MINOR SURGERY MANUAL



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Revised: Spring 2016

University of Western States
Portland, Oregon

Minor Surgery – CSC 8167

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Course Description
A systematic review of pertinent pathological conditions as minor surgical presentation, their resolution through minor surgical means, and aspects of minor surgical procedures. This course addresses the evaluation, diagnosis, and conservative management of minor surgical as well as proctologic presentations in a chiropractic office. Lecture will be strictly in an on-line format.

Purpose of Course
This lecture is taught to senior interns as an adjunct to the senior clinic experience. It provides an opportunity for the student to gain academic and practical insights into minor surgical and proctologic presentations and procedures for management. The course is designed to provide knowledge and practical skills for minor surgical procedures. In and of itself, this lecture is not sufficient to qualify participants as competent to perform any surgical intervention. This is an introductory level course and not intended to establish a level of proficiency that would qualify a participant to offer minor surgical procedures as part of a practice.

COURSE GOALS

When the student has completed this course, he/she should be able to:

1. Identify common dermatological and proctologic conditions appropriate for the scope of chiropractic minor surgery
2. Recognize high-risk procedures/ conditions and describe appropriate methods of referral.
3. Describe common minor surgery physiologic processes, pathologies, procedures and protocols.

LEARNING OBJECTIVES

1. Discuss the legal limitations of minor surgery as it pertains to the practice of chiropractic. (1)
2. Identify risk factors involved in patient selection. (1, 2)
3. Describe establishment of a sterile field for the physician, patient and the instruments. (3)
4. Identify and describe the appropriate applications of the various antiseptics. (3)
5. Students should be able to identify and describe the appropriate applications of the various anesthetics as well as their routes of delivery. (3)
6. Recognize the stages of wound healing and the factors involved in influencing healing. (3)
7. Identify types of wounds, infections, and appropriate interventions. (1, 2, 3)
8. Identify wound closures, suturing techniques, and instruments and materials used in suturing. (3)
9. Differentiate the various classifications of dermatological conditions that may be treated by a chiropractic minor surgeon in Oregon. (1, 3)
10. Identify the various types of malignant skin tumors. (1, 2)
11. Identify and apply various minor surgical options available for benign superficial lesions. (1, 3)
12. Select specific office procedures associated with the management of keloids, lipomas, cysts, growths, fibromas, local infections, nail removal, and other presentations amenable to surgical intervention. (3)
13. Identify the various causes of and presentations of burns and frostbite. (1, 2, 3)
14. Discuss and identify the pathophysiology and appropriate management of those anorectal disorders that require invasive minor surgical intervention. (1, 2, 3)

Materials List for Lab

1. Pair of Sterile Surgeon's Gloves
2. Needle holder
3. Tissue forceps
4. Suture removal scissors or iris scissors
5. 3-0 or 4-0 Braided silk suturing material
6. Beef tongue/ Pigs feet/ Cadaver

TABLE OF CONTENTS

Acknowledgments

1. Introduction and Definitions 1
2. Considerations of Minor Surgery 2
3. Patient Selection 4
4. Sterile Technique 7
5. Antiseptics 10
6. Wound Cleansing Solutions 15
7. Anesthesia 16
8. Toxic Effects of Local Anesthetics 22
9. Skin Anatomy 23
10. Wound Healing 25
11. Wound Care and Treatment 28
12. Wound Closure 32
13. Wound Dressing and Post-Operative Care 39
14. Wound Management 42
15. Tumor Diagnosis and Treatment 51
16. Malignant Skin Tumors 52
17. Benign Skin Tumors 54
18. Skin Lesion Treatments 59
19. Common Office Presentations and Procedures 62
20. Burns and Frostbite 68
21. Proctology 70

Appendix I - X 80

ACKNOWLEDGEMENT

"There is very little about this minor surgery manual that is novel or original thinking on the part of the "compilers." There is no reason to reinvent the wheel, and it was felt that what has been needed for a long time in the Minor Surgery class is a condensation of the most common minor surgical presentations finding their way into the chiropractor's office. This manual is made up of what is felt to be the salient and significant excerpts from various sources. The "compilers" wish it known that this manual be seen as nothing more than a condensation and compilation of others' works. It should be further stated that the only profit to be made from this manual be in the enrichment of one's education. This manual is therefore, donated!! I would like to acknowledge the following individuals and sources from whom we have "borrowed" generously. Frank Prideaux, D.C. - his notes and framework shape the heart of this manual, should anyone's name be affixed to this manual, it should be his. Many thanks are deserving of Lester Lamm, DC, whose enthusiasm in teaching this course for thirteen years are greatly appreciated. We cannot forget to mention the contribution of Ray Klier, DC and Richard Brouse, DC, DACBN whose teaching, encouragement and enthusiasm for the Minor Surgery Program at Western States Chiropractic College goes back over four decades. Also, special thanks to Drs. Steven Gardner and Steven Cranford for their clinical contributions to the specialty of chiropractic proctology. To those who wish to serve their patients in the broadest possible way, this manual is dedicated."- Dr. Lester Lamm

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Guide to Ambulatory Surgery, Roger C. Good, M.D.
Manual of Ambulatory Surgery, McKittrick, Kassity, Preston, M.D.s
Michael Carnes, D.C. for his expertise on snakes.

Special thanks goes out to Dr. Lester Lamm for his dedication to compiling the first origination of this manual with the team of supporters he listed above. Deep gratitude goes out to Drs. Delapp, Lamm & Tarnasky for their years of commitment to chiropractic minor surgery at the University of Western States and their mentorship. – Dr. Crupper

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Dermatologic Surgery Tips and Techniques. Stuart J. Salasche

I. Introduction

A. Definition of Minor Surgery - ORS 684.014 Minor Surgery means the use of electrical or other methods for the surgical repair and care incident thereto of tears, evulsions or cuts situated in the cutaneous and subcutaneous structures including the "tela subcutanea" of the human body, or to remove by surgical means any non-malignant tumors or pathological states such as foreign bodies or traumatic discontinuity causing loss of function of these same structures and to utilize any substance that will inhibit the growth and development of microorganisms that might have connection with the before mentioned pathological states and to administer localized anesthetic in connection therewith. (NOTE: All chiropractic students graduating after April 18, 1998 who wish to sit for the Oregon board must have 24 hours of lecture and 12 hours of lab on their transcripts.)

B. Definition of Appropriate Terminology

1. Surgery - (Dorland's) Surgery is that branch of medicine which treats disease, injuries, and deformities by manual or operative methods.
2. Laceration - (Dorland's) the act of tearing, b: a torn ragged, mangled wound.
3. Superficial - (Dorland's) pertaining to or situated near the surface (superficial facial.)
4. Abrasion - (Dorland's) the wearing away of a substance or structure through some unusual or abnormal mechanical process.
5. Benign - not malignant; not recurrent; favorable for recovery.
6. Lesion - (Dorland's) any pathological or traumatic discontinuity of tissue or loss of function of a part.
7. Foreign body - any material lodged in human tissue that is foreign (wood, glass, metal, etc.)
8. Excise - to cut off
9. Incise - to cut into
10. Ligate - to tie off
11. Sound - to probe deep with a blunt instrument
12. Debride - to clean away damaged or necrotic tissue
13. -tome - "to cut" as in episiotome
14. -ectomy - "to remove" cut out completely as in appendectomy.
15. Antiseptic - a substance that will inhibit the growth and development of microorganisms without necessarily destroying them.
16. Local anesthetic - an agent whose primary affect is to bring about a temporary loss of localized sensory nerve function.

II. General Considerations

A. Advantages to chiropractic office minor surgery

1. Cost
   a) In-office procedures eliminate the cost of going to a surgi-center or hospital. Average out-patient surgical fee at Adventist, $915; Surgi-center, $575; office of D.C., $260. This indicates a large savings to the patient.
   b) In-office minor surgery cases historically require less time loss from work. Hospitals frequently require pre and post "observation" time. There are frequently scheduling dilemmas for the attending physician and it is easier for them to monitor the patient in the confines of the hospital setting. This indicates a savings to both employer and employee.
   c) In-office procedures require fewer personnel. Usually the D.C. can perform without assistance or perhaps with one trained C.A.
2. Practicality
   a) Patients are less apprehensive about having a procedure done in a D.C.'s office as opposed to going to a hospital or surgi-center. There exists familiarity with the physician as well as non-hostile, comfortable and known surroundings. The number one complication to minor surgery is anxiety!
   b) It is comforting to the patient that they are able to return home immediately.
   c) Historically, most outpatient procedures recover quicker and experience fewer complications than in a hospital. Nosocomial Staph infections are often a problem in hospitals.

B. Disadvantages to Chiropractic Office Minor Surgery

1. Complications
   a) If not managed properly, even the simplest procedure can have serious or even lethal complications.
   b) A patient's anxiety level may bring about a crisis situation where the procedure is no longer possible to conduct.
   c) The patient may have a toxic reaction to the local anesthetic and go into anaphylactic shock.
   d) Unexpected operative and postoperative bleeding may occur.
2. Preoperative diagnosis must be extremely accurate
   a) D.C.'s cannot remove malignancies therefore they must be able to recognize what the lesion is.
   b) Knowing the lesion will eliminate unforeseen time consuming factors such as bleeders, subcutaneous restructuring, or multiple lesions.
3. Physician availability
   a) The DC performing minor surgery is always on call to his minor surgery patients.
   b) The DC minor surgeon must be willing to give up a few weekends. They cannot perform a minor surgical procedure on Friday and leave for the weekend. If the patient were to experience some complication, the DC must be available, if not, this constitutes abandonment, thus malpractice.
4. Post-operative scarring
   a) The patient must be made fully aware that there will be a scar as a result of the procedure.

b) Consider the location of the operative site and ascertain the amount of scarring. Procedures on the face are sometimes best left for the plastic surgeon. Consider what it will look like six months hence.

5. Cost to the physician
   a) Malpractice insurance is currently available to cover minor surgical practices and could potentially be very expensive.
   b) The physician must be willing to sacrifice a room for minor surgery procedures and keep it sterile.
   c) The initial cost for setting up a minor surgery theater can be very expensive depending on how elaborate the physician intends to be. Some of the more expensive items include: electro-cautery, operating table, operating lamp, sterilization equipment, oxygen supply, instrument stand, and the myriad of small equipment and supplies.
   d) Basic supplies and equipment list: (appendix I,II,III)

Mayo scissors	Dressing forceps
Iris scissors	Leurlock syringe
Towel clamps	Ambu bag
Tissue forceps	Airway set
Mosquito hemostats	Suturing material
Kelly hemostats	Masks
Needle Holders	Gloves
Suture scissors	Head covers
Blunt silver probe	Disposable syringes
Surgical soaps	Disposable scalpels
Antiseptics	Anesthetics
Syringe needles	Dressing

Plus all the items mentioned in (c) above.

   e) Cost effectiveness - the physician should consider the initial cost investment to the amount of cases encountered and potential income. This should be weighed against the time involved in procedures.
   f) The skilled physician will learn quickly that the key to a successfully run operation is establishing clear priorities. Most physicians involved in offering surgical procedures prioritize presentations into three general categories:
      (1) Emergency - action is needed NOW!
      (2) Urgent - action is needed sometime TODAY as soon as possible
      (3) Routine - action needed tomorrow or some convenient time.

      The chiropractor would rarely, if ever, need to address the "Emergency" surgical presentation, the chiropractor might see a few "Urgent" cases, but the vast majority of cases seen by a chiropractor are routine. Typical routine presentations would be: physical examinations, skin lesion biopsy, hemorrhoids (non-painful or bleeding), backache, nausea without vomiting and constipation.

III. Patient Selection - proper patient selection will eliminate a large percentage of potential problems if some common sense and defensive evaluation are used. Not everyone with a simple minor surgical presentation will make a good candidate for a procedure. Get used to screening your patients well. Anxiety is the number one complication to minor surgery.

A. General considerations

1. Age - the primary age groups for minor surgery that will make the best candidates are from 15 to 65. Those under the age of 15 are not well suited because they are difficult to control during surgery, especially with the very young (1 to 9 years). They do not follow instructions well nor do they understand the importance of postop care. They are frequently more active and run a higher risk of postoperative trauma to the surgical site. Those over the age of 65 are frequently in poorer general health, they may live alone, their memory often is less than optimum, there may be a compromise to general hygiene and there is frequent use of prescribed medications that may conflict with their minor surgery care and treatment.
2. Body type
   a) Ectomorph - tall, thin and fine boned patients who are usually hyperactive as a rule heal quicker without complication.
   b) Mesomorph - medium framed and average weight vary in pain sensitivity usually heal well and quickly.
   c) Endomorph - short, heavy, large boned, lethargic and frequently with elevated blood pressures are slower to heal and offer a slightly greater risk factor. This is not to say don't do a procedure, only consider this as one of the many factors to evaluate.
3. Patient health history
   a) Consider their general physical condition
   b) Perform either a written or an oral health history questionnaire. Consider the frequency that they catch a flu or cold. Consider all childhood diseases, hereditary diseases, and past surgeries.
4. Nutrition - consider the patient's diet as to whether or not the patient is eating a well-balanced variety of foods.
5. Medications - if a patient is taking any kind of medicine prescribed or over the counter, it is imperative that you familiarize yourself with that chemotherapeutic so as to adequately assess the potential impact on your procedure.
   a) Ask the patient what the medication is used for, refer to the PDR as per frequency, quantity, and effects.
   b) Ask about past medications and/or adverse reactions that are known.
   c) Ask about recreational drug usage: cocaine, Valium, Prozac, amphetamines, barbiturates, etc.
   d) Ask whether or not the patient has ever had a previous injection of local anesthetic. This could be from a previous procedure (frequently a wound needing sutures) or at the dentist office where novocaine was used. This will help screen for anesthetic toxic reaction.
   e) Ask specifically about over the counter medication usage. Heavy ingestions of aspirin have a direct impact on minor surgery procedures. They will increase the bleeding by prolonging the clotting time. Other common medications are diuretics. This will lower the blood pressure. Most commonly these are Dyazide or Lasix.

6. Check for the presence of systemic diseases.
   a) Diabetics are a very high risk. Their healing time is greatly increased; they are poor healers and are prone to secondary infections far more than the average patient.
   b) Patients with known blood dyscrasias are high-risk candidates. Patients with hemophilia are to be avoided for obvious reasons. Patients with leukemia or even simple anemia are a high risk.
   c) Patients with heart problems or a history of heart problems constitute an additional risk. Patients may be taking Coumadin or Heparin as a blood thinner which will increase the bleeding because the clotting ability is being compromised. Stroke victims, patients with arterial prosthesis, patients with a history of thrombophlebitis are all candidates for this kind of medication. Patients with pulmonary hypertension or congestive heart failure should be eliminated from minor surgery procedures. Patients with arrhythmias frequently are taking digoxin, Lanoxin, or digitalis. It is sometimes possible to identify the underlying systemic disease by the medication that is being taken.
   d) Patients with respiratory complaints constitute another high-risk group. Asthmatics, emphysemics or other patients with chronic obstructive pulmonary disease are at a risk because there is a decrease in oxygen uptake and resultant acidosis.
   e) Patients with nervous disorders are a risk group but perhaps not as high as those with frank systemic diseases. Manic-depressives, schizophrenics, neurotics, psychotics, anorexics, bulimics, and epileptics each carry their own inherent risks.

B. Patient Examination
   1. Routine physicals of potential minor surgery candidates should include height, weight, blood pressure (sitting and standing), pulses, respiration, reflexes, cranial nerves and funduscopic evaluation. It is a good idea to check the mouth for tooth or gum disease as well as the buccal mucosa where hemorrhaging, tearing or sloughing may occur. These manifestations may provide insight into the general health of the patient. Check the conjunctiva of the eyes and the sclera for color changes and clarity. Check the skin of the patient for oiliness or dryness as well as color and temperature.
   2. Any elective surgery must be preceded by a proper lab analysis. This must include a clotting time but should also include a CBC/UA and a prothrombin.
   3. Consider the patient's occupation and how the surgery will impact on his/her postoperative recovery. Is there an increased risk of infection or secondary trauma? Some high risk categories include: construction workers, carpenters, refuse workers, sewer workers, gardeners and landscapers, fisherman, butchers, janitors, and farmers. Consider the patient's activity level when screening for postoperative complications.

C. Examination of the Surgical Site
   1. Location - consider the site of the lesion or operative presentation. What structure does it lie in or is it adjacent to? Is it fixed or mobile? Is it attached deep or superficially? Will the size of the lesion change with the introduction of the anesthetic?
   2. Appearance - consider the color of the lesion and its vascularity. Will it readily bleed or are there adjacent vascular structures that offer some risks? What kind of scar will the operation leave? Which way do the skin lines run and does this offer any complications?

D. Patient Consultation - After evaluating the patient and the lesion and you have determined that the patient is not a high risk, explain in lay terminology to the patient what their lesion is and the pros and cons of surgery. Ultimately the decision is theirs, after you have provided them with all the pertinent information. Explain to them the kinds and duration of pain to be encountered both during and after the surgery. Tell them how long the surgery will take. It is always best to give an estimate of time longer than it will actually take in case you run into some time consuming complications. After the consultation, you must obtain the signature of the patient on an informed consent form and an authorization for surgery form. (appendix)

E. Patient Education - Half the postoperative complications can be avoided by properly educating your patient as to what to do, how to do it and when to do it. Some standards of postoperative care include:

1. Rest after surgery for at least 2-3 hours. The patient may experience some varying degrees of discomfort after the anesthetic wears off. Home treatment consists of aspirin, ice and/or elevation of the surgical site.
2. Postoperative bleeding - if the patient calls you from home complaining of bleeding, first of all assess the degree of bleeding (is the bandage completely soaked through?) If it appears that there is substantial bleeding, have the patient try direct pressure first and if this fails have the patient return to your office immediately; you may have a bleeder that must be controlled.
3. If in the ensuing days the wound site becomes painful, red and swollen, have the patient contact you immediately. You may have a secondary infection.
4. Instruct the patient to keep the wound site clean and dry. You should check on the patient within 24 hours of the surgical procedure so that you may evaluate the progress of wound healing, signs of secondary infection and to change the dressing. After that, if you feel comfortable with the patient's compliance, you may instruct the patient on how to change the bandages at home daily. Instruct the patient not to put anything on the wound that you do not authorize. This includes vitamin E, aloe vera or Grandma's famous poultice.

IV. Sterile Technique - your first line of defense against the invasion of secondary infections is the establishment of a proper sterile field for you, your instruments and your patient.

A. Instrument Sterilization

1. Steam autoclaving - this is one of the most effective means of instrument sterilization. It kills both bacteria and spores. This is accomplished by boiling water under pressure. Steam autoclaving kills all vegetative bacteria and most resistant dry spores in 13 minutes with a temperature of 120□C and a pressure of 750 mmHG (14.5 psi). One disadvantage to this method is that you cannot steam autoclave sharp instruments such as scissors; it dulls them.
2. Gas autoclaving - this is the most effective method of instrument sterilization but for our purposes is not cost effective and too dangerous. The gas used is ethylene oxide and it will also kill both bacteria and spores. The advantage with this method is that it does not dull instruments. However, the gas is deadly to humans when inhaled and necessitates special storage and handling.
3. Dry sterilization - It is possible to approach good general sterile coverage with dry heat such as in an oven at 170□C for 1 hour. This will effectively kill most but not all bacteria and it will not kill spores. This method can be used in emergency situations where the two methods of autoclaving are not available.
4. Cold sterilization - this is the least effective method of sterilization but necessary in some instances. An Iodine bath (Providyne, beta dyne) is used to immerse those instruments which cannot be autoclaved such as scissors and non-disposable scalpels. This method is not recommended for large scale routine instrument sterilization.
5. Instruments for sterilization are placed into sterile wraps for their protection against contamination after autoclaving. There are fabricated plastic bags with heat sensitive tape for individual instruments or you may choose to hand wrap (double wrap) your instruments. Hand wrapping should include the use of heat sensitive tape as well as an internal heat sensitive vile for verification of sterility.
6. Sterile instruments used in surgery are placed on a Mayo stand that has been properly draped with sterile coverings. Once the instruments are placed on the Mayo stand, it must be kept in mind that the sterile field also includes the air space immediately above the stand and nothing should be permitted to violate that air space or touch the stand except the gloved hands of the surgeon.

B. Patient Sterilization

1. Shaving of hairy areas of the body is no longer recommended, especially the eyebrows which may not grow back. It is felt that shaving a patient frequently causes nicking of the skin and provides a portal of entry for secondary infections. It is proper to cut back the hair with scissors (except for the eyebrows) but not to use a razor.
2. Preoperative skin preparation of the patient is conducted usually after the administration of the local anesthetic. The surgical site is first cleaned with green soap and water. One must be certain that considerably more area is cleansed than is involved in the surgical procedure. Remember, you can't be too clean or clean too much. After the area has been scrubbed with green soap and water, the area is thoroughly scrubbed five or more times with an effective antiseptic, preferably beta dyne. Final Preoperative skin disinfection is carried out by cleaning the surgical site proper with a tincture of Merthiolate on cotton tipped applicators. All three applications of skin cleaning are carried out by using ever expanding concentric circles which originate at the focus of the operative site. This will keep the contaminated debris moving out and away from the surgical site.
3. After the patient has been scrubbed thoroughly, the operative site is draped with sterile clothes or disposable sterile drapes. These drapes should be anchored securely so that they do not shift about during the surgery.
4. Humans are colonized with indigenous microflora that fall into 2 populations- resident or transient flora. (Bhatia, 2010)
    a) Resident flora has a stable population that is similar from person to person and participates in microbial antagonism against pathogenic organisms. The most common microorganism (90%)in this group is Staph Epidermis. The goal of preoperative skin cleansing is to decrease this flora to its lowest possible level.
    b) Transient flora is acquired via contact with people, fomites or the environment and may be removed by washing. The majority of postoperative infection are from this type of flora. Endogenous sources include the patient's nasopharynx or epidermis. Exogenous sources include surgical team, environment, instruments & materials. Most common flora is this group is Staph Aureus.
    c) The CDC defines as surgical site as being infected if it suppurates or produces pus within 30 day of a surgical procedure with one exception the suture abscess.

C. Sterile Field for the Physician

1. Depending upon whether or not the doctor has an assistant, the doctor will prepare him/herself for surgery by placing a covering over his/her hair and placing a surgical mask over the mouth. This is usually done before hand scrubbing on those occasions when the doctor is working without an assistant.
2. Hand scrubbing is of extreme importance because this is the part of the physician's body that comes into direct contact with the surgical site even though it is gloved. If for some reason the glove tears or is punctured, proper preoperative hand scrubbing may provide that extra layer of defense necessary to prevent contamination. The nails are cleaned with a nail file during the scrubbing operation and the hands are repeatedly cleansed from hand up to elbow always insuring that the contaminated debris is moved away from the fingers. When the hand scrubbing is complete the hands are held in an upright position to allow the excess water to drip off at the elbows. This position will prevent contaminants from being carried back to the hands by the water.
    a) When hand scrubbing is preformed correctly it reduced microbes by 90-99%.
    b) Ideally a broad spectrum, non-irritating, fast acting antiseptic agent should be used that has continuous antimicrobial action after hand scrubbing is complete. The most common agents used in the USA are povidone- iodine & chlorhexidine gluconate.
    c) There are new alcohol hand scrub solutions, Triseptin & N-duopropenide, that are becoming popular for their easy application. (Bhatia, 2010)
3. Gloving is the single most important technique that the physician must master. This is the material that will come in direct contact with the patient's tissue and every effort must be made to insure that the gloves are properly applied and never contaminated. It is equally important that the gloves fit snugly and are the correct size for the physician's hand. It is difficult and clumsy to attempt any surgical procedure with ill-fitting gloves.

V. Antiseptics

A. Introduction

1. Definition - an antiseptic is a drug or compound which is used to prevent the invasion of the body by bacteria. Antiseptics do not necessarily kill all the bacteria, but rather prevent the multiplication of bacteria. This is called bacteriostasis. If the antiseptic actually kills all the bacteria outright it is more accurately referred to as a germicidal.
2. The strength or effectiveness of an antiseptic is determined by the "phenol coefficient". The phenol coefficient is an arbitrary base line established by the effectiveness of phenol. All other antiseptics are compared to phenol and given their own respective coefficients. For example, an antiseptic having a phenol coefficient of 3X would be three times more powerful than the same amount of phenol.

B. Coal Tar Group of Antiseptics

1. Phenol - a very powerful antiseptic when in strengths exceeding 80%. It is very caustic in this concentration and would not be applied to a patient. Rather, it would be used in this concentration to scrub the counter tops or floors. Phenol is also called carbolic acid.
   a) Its antiseptic action is by precipitating the proteins in the coat of the bacteria.
   b) It has astringent properties and in dilute solutions acts as a very mild anesthetic.
   c) Camphorated phenol is a cream consisting of 30% phenol, 60% camphor and 10% liquid petroleum. It is frequently used as a chest rub in respiratory congestion.
   d) Phenolated lotion of calamine commonly referred to as calamine lotion is effective treatment for itching and burning of local dermatitis as would be found with poison oak or poison ivy. It is also effective for insect bites.
   e) Other less common uses of phenol are phenolated oil, phenol ointment, phenolated solution of Iodine (Boulton's solution for vaginal packs) and glycerite of phenol. The active ingredient of phenol solutions range in concentrations of 2% to 20% and are used for topical application where bacteriostasis is desired.
2. Cresol
   a) Cresol has a phenol coefficient of 3X. It is a brown liquid with a distinctive tarry odor. It is a direct coal tar derivative. In its heaviest concentrations it is used to impregnate telephone poles and railroad ties so as to prevent decay or infestation.
   b) The usual preparation of cresol is a 50% concentration in linseed oil soap which makes it more soluble. This solution is used to disinfect rooms and equipment.
   c) In very dilute solutions of .25% to .50% it can be used effectively as a vaginal douche. In hospitals this same dilute concentration can be used for bladder irrigation. Common name preparations containing cresol are: Creolin, Cresolin and Lysol.
3. Resorcinol
   a) Resorcinol is a colorless, odorless crystal that turns pink when exposed to light. It has a phenol coefficient of -1X. It is slightly less effective than phenol.
   b) It is very soluble in water, alcohol and glycerine.
   c) Its chief use is in an ointment of 5 to 10% concentration in the treatment of psoriasis, eczema and erysipelas.

4. Thymol
    a) Thymol is a colorless, slightly aromatic crystalline solid which is slightly soluble in water but very soluble in alcohol.
    b) Its primary use is as an additive to all mouth washes and astringent gargles. This is due mostly to its odor and taste.
    c) It is also a good antiseptic lotion or ointment for the treatment of diseases caused by fungi. It can also be used as an effective treatment for the management of hook worm.
5. Trinitrophenol
    a) Trinitrophenol is also known as picric acid. It is a yellow crystalline power with a bitter taste but no odor. It will, however, stain the skin. It is slightly soluble in water but more soluble in alcohol. It has a phenol coefficient of 7X. It is therefore used in very dilute concentrations.
    b) Its primary use is in the treatment of burns and superficial wounds. Dressings are soaked in this solution and applied directly to the burn or wound. It has its limits because of the caustic nature of the substance. It cannot be applied to large areas of the body (approximately 9% of the total body area or the equivalent of one full extremity).

C. Dye Group of Antiseptics

The dye group of antiseptics are those organic compounds some of which contain mercury, and are most effective in their use as an antiseptic and chemotherapeutic agent.

1. Proflavine dihydrochloride
    a) Though no longer commonly used, historically it has had frequent usage. It is used in a solution of isotonic saline in a 1:1000 concentration.
    b) Before the advent of antibiotics this solution was used to saturate gauze and pack wound cavities. It is effective even with small wound cavities as in those found with furunculosis and carbunculosis.
    c) This was the treatment of choice for conjunctival gonorrhea and otitis media before antibiotics.
2. Methylrosaniline
    a) Also known as gentian violet, this is a deep violet colored solution which is usually in 3% concentrations of water or alcohol.
    b) It is extremely effective against gram positive bacteria (staphylococci mainly). It can be used for the treatment of chronic cystitis, fungus, and burns when in jelly form. The most common usage today is the treatment of ringworm.
3. Methylthionine chloride
    a) Also known as methylene blue, it is a dark green powder which forms deep blue solutions.
    b) It is mainly used as a urinary antiseptic but can be used diagnostically to locate ano-vaginal fistulas or sinuses or cysto-vaginal fistulas.
4. Merthiolate
    a) Also known as thymerol or thymersol, this is an organic mercury compound containing up to 50% mercury.
    b) This is a very effective general antiseptic even against many spore-bearing bacteria. It is also an effective fungicide.

c) It is an excellent antiseptic for the treatment of lacerations and abrasions. It is the antiseptic of choice for the final scrub in preoperative skin preparation, in a 1:2000 concentration.

D. Halogen Containing Group of Antiseptics

This group of antiseptics contains one of the following halogens: chlorine, iodine or bromine.

1. Chlorine
   a) This is a yellowish irritant gas that when inhaled will cause death. It is the most widely used disinfectant for drinking water.
   b) The most common use of a chlorine solution in minor surgery is in a Dakin's Solution (Sodium Hypochlorite). It is a dilute chlorine solution containing .45 to .50% of sodium. This is a hypochlorite solution that must be freshly mixed and kept in a light resistant bottle for not more than 48 hours. After that it becomes too alkaline and caustic. It is a very effective and useful antiseptic for the treatment of open wounds of all sizes. The most significant attribute of this solution is that it dissolves bacteria, pus, and necrosed tissue without disturbing clots, therefore it won't reestablish hemorrhaging. It is, however, irritating to intact skin and one must coat the outer exposed skin with a petroleum jelly. The popularity of Dakin's solution use by chiropractors is most probably due to the inaccessibility of antibiotics. Current literature (Arch Surg - Vol 123, April 1988) recommends the abandonment of the use of Dakin's in the treatment of open wounds because of its toxicity to cells and the disadvantages outweigh the advantages.
2. Iodine
   a) This is a bluish-black crystal with a metallic luster and odor. It is slightly soluble in water but becomes more soluble with the addition of potassium iodide.
   b) It is a popular choice for surgical scrubs and skin preps. In very dilute solutions it is effective as a wound lavage. A degree of caution should be used when applying iodine based solutions because some patients are hypersensitive to it and may cause skin irritation.
   c) Beta dyne or povidyne in 10% concentrations are most frequently used for skin prep and cold sterilization. 7% solutions are called tinctures and used effectively on open wounds. 5% solutions can be applied to certain external mucosal linings such as for vaginal packs. This concentration for vaginal packs is called a Lugol's solution.

E. Miscellaneous Antiseptics
1. Silver nitrate
   a) In its solid form on the ends of wooden stick applicators, it is an effective treatment form for warts, excess tissue, ulcers, canker sores and cauterization of bleeders. It is very fast acting and must be applied with finesse, for it will burn any tissue it comes in contact with.
   b) Historically, it was used in concentrations of .25% to 1.0% in infection of mucous membranes, sinuses, throats, and was effective against conjunctival gonorrhea. More and more lately, this is being replaced with proper screening of pregnant females and erythromycin in order to avoid placing of burning drops of silver nitrate into the eyes of newborns. The treatment of silver nitrate in the eyes of newborns is called the Crede treatment.

c) Another silver containing antiseptic is Argyrol. It is not actually a silver nitrate solution, rather a silver protein precipitate. It is frequently used for the treatment of chronic and acute sinusitis. Cotton tipped applicators supersaturated with Argyrol are inserted into the nasal passages so that they lie as close to the sinus orifices as possible and left for one hour. The sinuses are allowed to drain freely into a catch receptacle. This treatment is usually repeated for three consecutive days with perhaps one day off between the second and third treatment.

2. Alcohol
   a) At best, alcohol should be considered a poor antiseptic. It is most commonly used in varying strengths ranging from 20% to 70%. The common form used is ethanol.
   b) When the concentration is greater than 80% it has a tendency to harden the protein coat of the bacteria and thus make it difficult to penetrate. With concentrations less than 80% it has a tendency to draw water out of the cells and thus dehydrate them.
   c) Alcohol in any form should not be used as a preoperative scrub or an instrument sterilization substance.
3. Formaldehyde
   a) The action of formaldehyde is oxidation of the proteins of bacteria. It is a gas that is soluble in water at 40% concentration. It is an extremely powerful antiseptic and is never to be applied to the patient.
   b) One function of formaldehyde is as an instrument sterilizing solution. It is very effective but once the instruments are removed from the formaldehyde bath for use they must first be flushed with a neutral substance such as sterile saline.
   c) The most common use of formaldehyde for the chiropractic minor surgeon is in 10% concentrations for the transfer of biopsy specimens. Its common name is Formalin.
4. Hydrogen peroxide
   a) H_2O_2 is a very weak antiseptic. Its action is to liberate oxygen. It disinfects by both chemical and mechanical means. When used in an open wound it literally "bubbles" debris to the surface.
   b) It is commonly dispensed in 3% concentrations and is used for washing/lavaging wounds and ulcers. It aids in debriding of tissue and removing dirt, foreign bodies and other debris. It cannot be used in a closed cavity because of the excessive oxygen production. Controversy exists as per its use in open wounds because it causes tissue damage disproportionate to its value as an antiseptic.
   c) H_2O_2 can be diluted to 1:5 parts of water and used as an effective mouth rinse for gingivitis.

F. Antiseptics Used Mainly as Astringents
1. Boric acid
   a) Boric acid is a mild antiseptic with soothing properties that tends to reduce swelling of mucous membrane.
   b) It is used in an ointment form of 10% concentrations for skin irritations. It is used in a 2% solution for the treatment of conjunctivitis. It is used in 2% to 4% concentrations for the irrigation of open wounds, burns and abscesses. It is also used in this concentration for vaginal packs in the treatment of vaginitis. It should be noted that this treatment should not exceed 5 days. After that it begins to irritate the vaginal mucosa

2. Potassium aluminum sulfate
    a) Commonly referred to as alum. It is frequently used in a lotion form for the treatment of skin irritations. In concentration of 0.5% to 1.0% it is used in a solid stick form to stop bleeding of small cuts. A common commercial product for men is the Septic pencil for shaving nicks.
3. Zinc
    a) This soluble salt is a very powerful astringent and can be caustic in strong concentrations.
    b) Zinc sulfate is less commonly used as a strong astringent and topical antiseptic.
    c) Zinc oxide is a more popular product with many uses. In an ointment form it is very effective for burns and almost any skin disease. It is most commonly seen on the noses of southern California sun seekers.
4. Antiseptics used for wound lavage
    a) Boric acid 2%, and hydrogen peroxide 3% and sterile saline are the most commonly used.
    b) Another very effective lavaging solution is Hydroxyquinoline sulfate. It comes in 1/4 grain tablets and is mixed one tablet per ounce of water. It is a good antiseptic and fungicidal. It can be used for cuts, abrasions, animal scratches, insect bites and athlete's foot. We use this solution extensively when irrigating ears.

G. General Purpose Antiseptics
1. Tea tree oil or Melaleuca alternifolia
    a) It is an antiseptic and fungicide in an oil form that must be diluted down with a neutral oil such as mineral oil. The pharmacological activity of tea tree oil is not completely understood but medical literature suggests that it is an effective treatment for various infections, primarily staph (Jour. Natl. Med. Assoc., Jan. 1960).
2. Bacitracin
    a) This is a topical antibiotic/antibacterial ointment of neomycin polymycin. It is an over the counter topical used as a postoperative or post-trauma dressing to aid in anti-infection processes.
3. Neosporin
    a) Another over the counter anti-infective antibiotic ointment containing the same constituents as bacitracin. It is probably the most frequently used topical post-operative ointment for minor surgery procedures.

VI. Wound Cleansing Solutions

A. Traumatic open wound presentations have a higher risk of infection than the elective procedures and thus need some different application of technique methods. This is due to contamination of the wound by a non-sterile environmental factor either pre or post trauma.

1. Povidone-iodine
   a) This is a complex of the potent bactericidal agent iodine with a carrier molecule, povidone. Upon contact with tissue, the carrier complex slowly releases free iodine. It is very effective against gram-negative and gram-positive bacteria as well as fungi and viruses. Adverse reactions are extremely rare but can be irritating to the eyes. It will not stain the skin but will stain clothing. It is marketed commercially under such brand names as Betadine, Operand, Acu-Dyne and Clonidine. It is manufactured as a solution by itself or in conjunction with an ionic detergent for scrub solutions. The scrub solution appears to be toxic to several tissues in open wounds and thus should not be used for purposes other than surgical hand scrubbing.
2. Chlorhexidine
   a) This solution is an effective gram-positive bactericidal. It is less effective against gram-negative bacteria than povidone-iodine and its action against viruses is uncertain. It is mostly used for hand scrubbing. Under normal use it has an exceedingly low toxicity level and can be employed around wound and pre-elective procedures. Like the povidone-iodine scrub it has an ionic detergent and direct contact with an open wound is discouraged. It is marketed under the names Hibiclens and STERIS tat.
3. Pluronic-F-68
   a) This is a new and potentially useful wound cleanser with a nonionic detergent. It has no demonstrable deleterious effects when used in wounds directly. The major drawback is that it has no antibacterial activity. It is most suited for wound cleansing of the face. It is marketed under the name Shur-Clens.
4. Hexachlorophene
   a) It is a bacteriostatic agent with good activity against gram-positive bacteria, but not very effective against gram-negative organisms. Though historically it has been widely used, it is falling from favor with the advent of povidone-iodine and chlorhexidine. In recent years, new discoveries of potential toxicity and teratogenicity have led to further decrease in its usefulness. Because hexachlorophene has a cumulative and protective buildup in the skin, it remains an alternative for hand scrubbing. It is marketed under the name PHisoHex. (Appendix IV)

VII. Anesthesia

A. Introduction to Local Anesthesia

1. Definition - the interruption of sensory nerve conduction without subjecting the patient to unconsciousness.
2. Background information - the choice of anesthetics and technique of application must be individualized for every patient. The type and extent of the wound or elective surgery, location, level of contamination, and estimated time for repair are variables which make each patient unique. Besides technical considerations, patients bring with them differing emotional characteristics and responses. Therefore, gentle handling and proper counseling of the patient during the procedures are required to achieve proper analgesia.

B. Pharmacology of Local Anesthetics

1. Upon injection, the local anesthetic infiltrates tissues and diffuses across neural sheaths and membranes. It acts by interfering with neural depolarization and transmission of impulses along axons. Fibers that carry stimuli from pain receptors in the skin have no myelin sheath and have the smallest diameter. The sensation of pressure and touch are transmitted by larger, myelinated fibers. The thin pain fibers are more rapidly and easily blocked by local anesthetic solutions. The significance of this fact in minor surgery is that an anesthetic solution of 1% can block stimuli of pain but leave the sensation of touch and pressure. Therefore an anxious patient may react to touch and pressure as if it were pain and ask why his wound is not completely numb. A higher concentration (2%) will in all likelihood abolish all stimuli, including touch and pressure, from the site.
2. There are three main pharmacologic properties that are important to consider in delivering local anesthesia. They are:
   (1) Onset of action
   (2) Effectiveness
   (3) Duration of anesthesia.

   They vary widely according to local vascularization, type and amount of anesthetic, concentration, technique of application, accuracy of injection and adjunctive use of epinephrine.
3. It should be noted that all injected local anesthetics are considered toxic even though the risk of reaction is extremely low. The higher the concentration of the anesthetic, the greater the risk. Although the chemical equation: 10cc of 1% anesthetic = 5 cc of 2% anesthetic, is balanced, the clinical reality is not. The side of the equation with the higher concentration (2%) carries a much higher risk of toxic reaction.
4. Even with lower concentrations, anesthetics are toxic and all restrictions to their application should be closely observed. One should never exceed the maximum allowable dose. A maximum dosage for those anesthetics most commonly used by chiropractors would not exceed 30cc for the average adult. This can vary as concentrations increase or decrease and as additives are mixed with the anesthetic solutions. The maximum allowable dose of 1% lidocaine with epinephrine is 50cc. Because of the potential risks to the fetus, pregnant females should not be given local anesthetics.

5. Summary of Local Anesthetics for Minor Wound Care

Agent	Concentration	Onset of Action	Duration of Block	Maximum Allowable Dose One Time
Lidocaine (Xylocaine)	1.0%	4-10 min	60-120 min	4.5 mg/kg of 1% (30 cc per average adult)
Mepivacaine (Carbocaine)	1.0%	6-10 min	90-180 min	5 mg/kg of 1% (35 cc per average adult)
Procaine (novocaine)	1.0%	5-10 min	60-120 min	4 mg/kg of 1% (25 cc per average adult)
Bupivacaine (Marcaine)	0.25%	8-12 min	240-280 min	3 mg/kg of 0.25% (80 cc per average adult)
TAC	*	5-10 min	Approx. 20 min	5 cc - 10 cc of mixture

*TAC is a combined mixture of 0.5% tetracaine, epinephrine 1:2000, and cocaine 11.8% and is applied topically with a 2 X 2 inch sponge.

C. Epinephrine as an Additive Mix

Epinephrine in concentration of either 1:100,000 or 1:200,000 is added to local anesthetics as a vasoconstrictor. It has both advantages and disadvantages.

1. Advantages
   a) Because of the vasoconstrictive properties of the epinephrine mix, less anesthetic is required because it is held at the surgical site longer and thus there is less toxic effect on the body. The toxicity lies in the local anesthetic and not in the epinephrine.
   b) The vasoconstrictive properties minimize the amount of bleeding at the operative site and allow the physician to operate in a relatively dry field unobstructed by the continual weeping of blood.
2. Disadvantages
   a) Under experimental conditions it has been shown that epinephrine potentiates wound infection.
   b) Epinephrine has limited usage because of the vasoconstrictive nature of the mix. It cannot be used in distal end organs because of the poor collateral blood circulation. Body parts such as fingers, nose, ears, penis and toes are areas where necrosis of tissue will occur with prolonged compromise to adequate blood supply. Therefore, one must not use local anesthetics with epinephrine in these areas.
      (1) Recent studies indicate that the risk of end organ damage (necrosis) may be unfounded and that the use of epinephrine with lidocaine in the fingers, nose, ears, penis and toes is beneficial to minor surgical procedures in these areas. Medical textbooks are still supporting the avoidance of epinephrine in end organ tissues making this a controversial topic. Until the controversy is resolved one might consider erring on the side of extreme caution.
   c) Because the anesthetic effect lasts longer at the operative site, there is an increased risk that a small bleeder may go unnoticed and there could be postoperative hemorrhaging.

D. Injection Procedures
   1. Equipment
      a) It is always prudent to select a disposable syringe that is the next size larger than the amount of anesthetic that you expect to use. For example: if you expect to use only 2 to 3 cc of an anesthetic, it is better to select a 5 cc syringe rather than a 3 cc syringe. This will avoid having to refill the syringe during the surgical procedure and risk violating the sterile field and utilizing valuable anesthetic time. Common syringe sizes are 3 cc, 5 cc, 10 cc, 20 cc and some larger syringes up to 50 cc which are used primarily for wound irrigation and lavage.
      b) Hypodermic needles come in a variety of sizes, both in length and diameter or caliber. The lengths range from 3/8 inch to 2 inches most commonly in 1/4 inch increments. The caliber or bore of the needle barrel also varies significantly. Local anesthetic is introduced using a 25, 26 or 27 gauge needle. A 21 gauge needle is used for venipunctures, and an 18 gauge needle is used for joint aspirations.
      c) The Patient's skin should always be cleaned with a disinfecting agent prior to inoculation with anesthetic. Although it has been common practice to use alcohol swabs as a pre injectable, it is much more prudent and effective to use either an iodine based substance such as povidone, Betadine solution or Merthiolate.
      d) If the surgical procedure allows, it is advantageous to use a topical skin refrigerant as a pre-injectable. The most common of these is Ethyl Chloride which comes in a pressurized bottle and can be easily applied to the patient by inverting the bottle and spraying the area of injection for approximately five or six seconds or until the skin begins to frost over. The anesthetic effect is neither prolonged (about 15-30 seconds) nor deep. It does, however, minimize the effect of an injection and the patient who has a fear of needles will appreciate any procedure which will decrease the amount of discomfort they will experience.
   2. Precautions
      a) A few simple rules in the application of local anesthetics will make the experience of trauma more tolerable to both the physician and the patient.
      b) Never inject a patient while they are in an upright position. They must be either supine or prone. Frequently patients become faint at either the sight of a needle or from the trauma of the injection.
      c) Extensive or multiple wounds likely to consume a large amount of time and/or a large volume of anesthetic are better left for the emergency room.
      d) Patients temperamentally unsuited should probably be referred. These include patients who do not have command of your spoken language, the patient who has an extreme fear of either needles or his/her own blood and those patients who by age are unmanageable and will not fully comprehend the consequences of the procedure to be rendered.
      e) After the needle has been inserted into the patient, pull back on the plunger of the syringe. If the needle happens to lie within an artery or vein the solution will turn pink within the barrel of the syringe and this would indicate that you should not introduce the anesthetic. You should withdraw the needle and try a different location.

f) If there appears to be no contraindications to proceeding forth with the introduction of the anesthetic, it is best to introduce the anesthetic "on the move". It is possible that you have gone completely through a vein so if the anesthesia is introduced while the needle is being withdrawn, there is little likelihood that any significant amount will be introduced directly into the vein. The advantage to injection on the move is that a larger area can be anesthetized and fewer inoculation or skin punctures performed.

g) Keep the syringe and needle hidden from the patient's sight for as long as possible. The less they see of the needle, the better for their anxiety level.

E. Conduction Anesthesia

1. Direct infiltration

a) This is a method of introducing a local anesthetic where a portal of entry has been created by trauma. A laceration is the most frequent presentation where this method is utilized. The skin is already broken and there is no need to pierce the skin a second time. The needle is introduced to the exposed edges of the wound.

b) The advantage to this method is that it bypasses the most painful aspect of anesthesia, i.e. the piercing of the sensory nerve rich epidermal layer.

c) The disadvantage to this method is that trauma has already changed the shape of the area and secondary inflammation processes further compromise the shape. With the introduction of an anesthetic, the shape is even further distorted and makes accurate approximation of the exposed edges more difficult.

2. Field block or parallel margin infiltration

a) This method is probably the most frequently used type of conduction anesthesia. This method would be a preferred alternative to direct infiltration where the wound is dirty or contaminated; it will decrease the risk of spreading any infection.

b) For both elective surgeries and dirty wounds, the object is to lay down a wall of anesthesia completely around the surgical site. The number of times it will be necessary to pierce the skin depends on the size of the wound or surgical site and the length of needle to be used.

c) For elective surgeries the introduction of the needle can be at any desirable point. It is introduced fully and the anesthetic injected on the move. When the needle is almost completely removed, the syringe and needle are swung around in an arch and the needle reintroduced on the opposite side of the wound. This will avoid having to pierce the skin a second time for that half of the surgical site. Again, the anesthetic is introduced on the move. At this time, approximately half the surgical site will be anesthetized. To obtain complete anesthesia of the site, the procedure is repeated starting at a new entry point 180 degrees from or opposite the original injection site.

(1) This technique is used for sebaceous cystectomy, lipomectomy, excisions, and foreign body removal.

3. Nerve blocks

a) This is a method of anesthesia whereby sensory nerves are anesthetized by injecting either directly into or immediately around a particular nerve or nerve plexus.

b) The advantage to this type of anesthesia is that it can produce the anesthetic effect for longer periods of time. It can additionally produce larger areas of anesthesia without increasing the amount of the anesthetic.

c) The disadvantage is that it requires considerably more skill and accuracy in its application than the other two forms of conduction anesthesia. It is possible to damage the neural tissue or fail to accomplish adequate anesthesia at the surgical site.

d) The most common nerve blocks are the digital or volar blocks. This technique is used with nail removal or when complete anesthesia of a digit is desired. The anesthetic is introduced along the medial and lateral aspects of the waist or midpoint of the proximal phalanx. The needle is inserted until it touches the bone and special care must be taken to avoid undue trauma resulting from too aggressive a maneuver. Approximately 1 cc is delivered per side. A complete block is usually achieved within 4 to 5 minutes. It must be kept in mind that epinephrine additive is contraindicated for volar nerve blocks.

e) Anesthesia of the face can be achieved by nerve blocks utilizing the supraorbital and infraorbital foramen and the mental foramen. These foramen can frequently be palpated. The supraorbital foramen (Trigeminal sensory branch I) supplies the medial 1/3 of the eyebrow, the medial 2/3 of the upper eyelid and those adjacent portions of the forehead and scalp. Anesthesia of the area can be accomplished by piercing the skin immediately adjacent to the foramen. The infraorbital, which supplies that half of the nose, lower eyelid and the upper lip and the mental, which supplies the lower lip and chin, can be anesthetized by either extraoral or intraoral procedures. Extraoral procedures are conducted as previously stated for the supraorbital, through direct piercing of the skin at the foramen site. The intraoral methods are those frequently used by the dentist. The upper lip is pulled up and away and the lower lip down and out. The needle is then inserted between the lip and the gum. As a landmark, the needle can be inserted at or slightly anterior to the sulcus of the first mandibular canine or maxillary canine tooth.

f) Though rarely needed, anesthesia of the ear can be obtained through nerve blocking of the greater auricular and lesser occipital nerves. Both are anesthetized by introducing the anesthetic along with inferior border of the mastoid process both anteriorly and posteriorly.

F. Anesthetic Solutions

1. Procaine (Novocaine)

a) This solution is used for all types of conduction anesthesia and comes with and without epinephrine. It is an ester base solution and thus is less desirable because of the slightly higher risk of toxic reaction, even though it remains very low. It is packaged in concentrations of 0.5%, 1.0%, 1.5% and 2.0%. For minor surgery purposes the highest concentration needed is 1.0%; higher concentrations carry an added risk of toxic reaction that is not necessary.

2. Tetracaine (Pontocaine)

a) This is a very potent and toxic anesthetic. It is ten times more potent than procaine. It has a much longer lasting effect but is limited to few procedures such as spinal blocks. It has no use for chiropractic minor surgery. It, like procaine, is an ester based solution.

3. Lidocaine (Xylocaine)

a) This is the most popular and frequently used local anesthetic. It comes in the same concentrations as procaine and with or without epinephrine. Its popularity is due primarily to its being an amide based solution rather than an ester and it has low toxicity, rapid diffusibility, topical activity and chemical stability. The onset of action is almost immediate. It readily penetrates nerve sheaths.

4. Mepivacaine (Carbocaine)
    a) This is also an amide based solution and is widely used in minor surgery. Its primary use is for those procedures where longer time frames are needed. It does not come with epinephrine and is in itself slightly vasoconstrictive and caution is indicated with its application into distal end organs.
5. Bupivacaine (Marcaine)
    a) This is a newer amide solution that is not widely used in
    b) Minor surgery but is increasing in frequency of use. The chief drawback is that it has a slow onset of action. The chief advantage is the duration of action which surpasses both lidocaine and Mepivacaine.
6. TAC
    a) This is a newer topical anesthetic with promising applications for simple lacerations and minor wound care, especially in pediatric patients. In equal parts mixture of tetracaine 0.5%, epinephrine 1:2000 concentration, and cocaine 11.8%, it can be applied directly to a wound via a saturated 2 X 2 gauze sponge. By leaving the sponge in direct contact for approximately 5-10 minutes, total analgesia can be achieved that compares with lidocaine in filtration. The chief advantage of TAC is that no needle stick is required. Because of its vasoconstrictive properties, it cannot be used in distal end organs. Additionally, TAC does not penetrate to sufficient depths to allow extensive debridement but suture placement is not a problem.
7. Ophthaine (Proparacaine hydrochloride)
    a) This is a 0.5% solution with glycerine for topical eye application. it is suitable for foreign body removal or ocular pressure testing. It is applied to the eye via an eye dropper. One drop of the solution will achieve complete anesthesia in approximately 13 seconds. The anesthetic effect will last 15 to 20 minutes. Its use is contraindicated in patients with known hypersensitivity reactions, numerous allergies, cardiac disease and hyperthyroidism. Prolonged use can cause corneal opacification and loss of vision.
8. Cetacaine (Rostra spray)
    a) This is another topical anesthetic effective on mucous membrane only but not the conjunctiva. It comes in a spray form and anesthesia is produced in approximately one minute. The anesthetic effect lasts 1 to 5 minutes depending on the amount used and the rate of absorption. It is effective for overriding the gag reflex or as a pre-injectable. This anesthetic contains small concentrations of tetracaine and benzocaine. Other local anesthetics that are used exclusively for topical application although infrequently by chiropractors are cocaine, Dyclonine and Dyclone.
9. Ethyl chloride
    a) A topical skin refrigerant that is highly flammable that is used primarily as a pre-injectable. It can also be used for lancing furuncles and carbuncles where inoculation has risks of introducing the infection into deeper adjacent tissues. The spray bottle is held approximately 12 inches away from the site and sprayed directly on the skin. The anesthetic effect is extremely short lived (15-30 seconds). (Appendix IX)

VIII. Toxic Effects of Local Anesthetics

A. Localized Effects - If a patient exhibits a localized toxic reaction to the introduction of a local anesthetic, it most frequently manifest with the appearance of redness, itching and swelling at the site of the inoculation. Usually there is no need to manage these patients and the condition will resolve with the absorption of the offending agent. There are those occasions, though extremely rare, when this condition will progress into a systemic reaction.

B. Systemic Effects

1. All known local anesthetics are systemically toxic. There are four main toxic reactions which can occur with the introduction of local anesthetic. These are (1) cardiovascular reactions, (2) excitatory central nervous system effects, (3) allergic responses, and (4) vasovagal syncope secondary to pain and anxiety.
   a) Cardiovascular reactions include hypotension and bradycardia and are due to a myocardial inhibitory effect of the anesthesia. Symptoms and signs range from those of mild cerebral hypoxia through complete unconsciousness and ultimately to cardiac standstill.
   b) Central nervous system reactions are caused by excitatory phenomena that ultimately can culminate in seizure activity. The phenomena can range from giddiness requiring no treatment to the startling and much feared generalized convulsions which end in respiratory failure.
   c) Allergic responses and vasovagal syncope are the least alarming, most frequent and most easily managed. The symptoms range from yawning, pallor, lightheadedness, wheezing, and hives to temporary loss of consciousness. Unless these conditions worsen or advance to more serious manifestations, the physician need only make the patient comfortable.
2. Causes of toxic reactions - All of the above mentioned manifestations are commonly due to inadvertent injection of a solution into a vessel directly. It is therefore extremely important that the plunger on the syringe be withdrawn prior to the inoculation once the needle has pierced the skin. If blood appears the needle must be moved in order to avoid tragic consequences. Two other contributing factors to toxic reactions are the (1) rapid absorption of the solution from a highly vascular area or (2) the use of excessive amounts of anesthetic by volume or concentration.
3. Prophylaxis - This is one area where the adage "An ounce of prevention is worth a pound of cure", is worth repeating. Proper screening of your patients will avoid many of the potential adverse reactions. Ask the patient if they have any known hypersensitivities to any substances but specifically medications or local anesthetics. Because dentists use local anesthetic more than any other single group, ask the patient about his/her trips to the dentist and whether or not they have ever been anesthetized.
   a) Included in this manual is a pamphlet, designed for ambulance drivers, describing toxic reactions and their management. (Appendix V)

IX. Skin Anatomy

A. Introduction - Before one can begin to surgically repair or electively intervene to remove a superficial lesion, the anatomical area in question must be thoroughly understood. The primary focus of minor surgery is the skin. It is a complex organ that provides a protective barrier against the hostile external environment as well as a functional organ through which body temperature is regulated and external stimuli are received. Most skin measures 1-2 mm in thickness, but can increase to 4 mm over the back. This variable will dictate the size and type of suturing material to be used in repair as well as the technique of closure. It is the layer arrangement that is most important for proper wound closure. The layers include the epidermis, dermis, superficial fascia (subcutaneous or subcuticular layer), and deep fascia. Regardless of the method of compromise to the skin, be it surgical intervention or traumatic insult, every attempt should be made to insure proper re approximation of the individual layers.

B. Epidermis

1. The epidermis is the outermost layer of the skin and is totally cellular and contains no organs, nerve endings, or vessels.
2. The primary function of the epidermis is to provide protection against the external environment and containment barrier for the human internal environment.
3. The epidermis consists of four microscopic layers only two of which are of concern in minor wound care.
    a) The stratum germinativum, or basal layer, is the parent layer for new cells. This layer provides the cells for new epidermis formation during wound healing.
    b) The stratum corneum is the keratinized, or horny layer that is derived from migrating and maturing basal cells. This layer is the most superficial and gives the skin its final cosmetic appearance.

C. Dermis

1. The dermis lies immediately beneath the epidermis. It is much thicker than the epidermis and primarily composed of connective tissue. The main cell types in the dermis are the fibroblasts, which elaborate collagen, and macrophages, mast cells, and lymphocytes which are all active during wound healing.
2. The dermis is composed of two layers, the papillary dermis and the reticular dermis. The richly vascular papillary dermis interdigitates with the epidermis and provides nutrients to that layer while the deeper reticular layer contains the bulk of adnexal structures of the skin, such as hair follicles, sebaceous glands, sweat glands, nerve fibers and vascular plexi.
3. The dermis is the key layer for achieving proper wound repair. Dermis is easily identifiable and provides the anchoring site for both superficial and deep sutures. Every effort must be made to cleanse, débride, and accurately approximate the dermal edges. This will insure optimal wound healing and minimize scarring.

D. Superficial Fascia

1. Deep to the dermis is the layer of very loose connective tissue that encloses a varying amount of fat. The primary function of this layer is to insulate against heat loss with some secondary protection against trauma.

2. Injury to the superficial fascia has the potential for creating dead space which may lead to the formation of a hematoma. Additionally, devitalized fat can promote bacterial growth and infection. Fortunately, the fat can be liberally débrided. In large complex wounds, this is the layer in which drains are placed to prevent excess blood and exudate accumulation.
3. The sensory nerve branches to the skin travel in the superficial fascia just deep to the dermis. When injecting an anesthetic, the needle should be directed along a plane between the dermis and superficial fascia. The anesthetic will spread quickly and easily in this area and abolish sensation to the skin.

E. Deep Fascia - The deep fascia is a dense, thin, discrete fibrous tissue layer that acts as an enclosure to muscle groups. The main function of the deep fascia is to support and protect soft tissue structures.

X. Wound Healing

A. Normal Wound Healing - this is a process that is allowed to proceed without undue interference from infection, excessive tissue devitalization, poor wound repair technique, underlying patient conditions and disease, and inhibitory drugs. Although wound healing is described as occurring in phases, it is in fact a continuum of overlapping events.

B. Wound Healing Phases

1. Immediate response to injury
   a) A traumatic insult will cause changes in skin architecture, tissue retraction and contraction, and compression of small arterioles and venules.
   b) Vessels undergo intense vasoconstriction for up to ten minutes while platelets aggregate in the lumens of the severed vessels and exposed wound surface.
   c) Clotting is activated by the tissue clotting factors, and within minutes, the wound begins to fill with a hemostatic coagulum.
   d) As hemostasis is secured, vasoactive amines are released into the wound region, leading to dilatation of uninjured capillaries and the initiation of wound exudation.
2. Inflammatory Phase
   a) After hemostasis has been achieved and exudation begins, the inflammatory response rapidly follows. Complement is activated and chemotactic factors are released that attract granulocytes to the wound area. These cells are followed shortly by lymphocytes. Peak numbers of the cells appear between 12 and 24 hours. The chief function of these cells is to control bacterial growth and suppress infection. This cell activity is aided by the immunoglobulins in the wound exudate. The granulocyte activity is markedly diminished by the third day.
   b) Macrophages can be detected in large numbers by 24 to 28 hours post trauma, and at day five they are the predominant inflammatory cell present in the wound area. Their primary responsibility appears to be phagocytosis and ingestion of wound debris. Macrophages appear to be important in stimulating fibroblast reproduction and neovascularization.
3. Epithelialization
   a) While the inflammatory response proceeds, epithelial cells at the stratum germinativum, or basal layer, of the epidermis undergo morphologic and functional changes. Within 12 hours intact cells at the wound edge begin to form pseudopod-like structures that facilitate cell migration. Replication takes place and movement of these cells over the wound surface begins. An advancing layer can be seen to travel over the damaged dermis, but under the hemostatic coagulum. Continued replication eventually reestablishes the normal layers of epidermis. Initial epithelialization can take place by 24 hours, but the architecture and thickness of this layer is modified over the months.
   b) It is important to understand that suture punctures are small wounds and epithelialization invade these small wounds and "plugs" can form in the healing process leaving a visible record. This can be avoided by removing the sutures at the earliest possible time.
4. Neovascularization
   a) New vessel formation is critical to wound repair. These new vessels bring oxygen and nutrients to the healing wound.
   b) Neovascularization is in evidence by day three and most active by day seven. This process is usually complete by the 21st day.

c) New vessels form loops of capillaries that are surrounded by fibroblasts. These two components on the wound surface give it the classic appearance referred to as granulation. Granulation tissue is most often seen in open wounds that are allowed to heal by secondary union.

5. Collagen synthesis
   a) With the establishment of a vascular supply and stimulation by macrophages, fibroblasts rapidly undergo mitosis. They begin to produce new collagen fibrils by the second day. Peak synthesis occurs between five to seven days, and the wound has its greatest collagen mass by the end of the third week.
   b) New collagen is laid down in a random, amorphous pattern. Over the months, this gel continually remodels, creating a basket weave pattern of collagen fibers. In order that the process go ahead without excess collagen formation collagen lysis takes place. This balancing act creates a vulnerable period for approximately seven to ten days after injury.
   c) The wound will have 5% of its original tensile strength at 2 weeks and 35% at 1 month. Final tensile strength is not achieved for at least 6-12 months.
6. Wound Contraction
   a) All wounds undergo some degree of wound contraction.
      (1) It is most pronounced in full thickness skin loss. The scar that forms gradually contracts centripetally over the wound defect through the action of specialized fibroblasts called myofibroblasts.
   b) A properly everted suture line will contract to a flat, cosmetically acceptable scar; whereas a wound closure with the edges already inverted will leave behind an unsightly depression in the epidermis that will stand out because of shadow formation from incident light.

C. Types of Wound Healing
1. Primary union
   a) Healing by first intention or primary union applies to relatively clean wounds with minimal tissue loss or devitalization. These wounds are most often created by shearing forces such as a knife.
   b) These wounds can be closed with sutures or skin tapes within 6 hours, the "Golden Period", without any subsequent complications.
2. Secondary union
   a) These wounds have significant tissue loss or devitalization, like avulsions, infarctions, ulcerations, and abscesses. They are better left to heal by secondary union or intention.
   b) These wounds are not closed by sutures and are allowed to heal by granulation and eventual reepithelialization. These wounds have a pronounced inflammatory response and are prone to significant wound contraction over time.
3. Tertiary union
   a) These wounds are those that can be closed by sutures after three to four days of observation. Closure by tertiary union is commonly referred to as delayed closure.
   b) Usually these wounds are too contaminated to close initially but have not suffered significant tissue loss or devitalization. Wounds in this category may be those more than 12 hours old, human or animal bites, or puncture wounds of considerable size.

c) Management includes thorough cleansing, irrigation, and debridement. Often antibiotic coverage is needed.

D. Alterations of Wound Healing

1. Several factors can alter the process and final outcome of wound healing. The following lists will provide considerations to management and expected results.
2. Technical factors
   a) Inadequate wound preparation
   b) Excessive suture tension
   c) Reactive suture material
   d) Local anesthetics
3. Anatomical factors
   a) Static skin tension
   b) Dynamic skin tension
   c) Pigmented skin
   d) Oily skin
   e) Body region
4. Associated conditions and diseases
   a) Advanced age
   b) Severe alcoholism
   c) Acute uremia
   d) Diabetes
   e) Ehlers Danlos syndrome
   f) Hypoxia
   g) Severe anemia
   h) Peripheral vascular disease
   i) Malnutrition
5. Drugs
   a) Corticosteroids
   b) Nonsteroidal anti inflammatories
   c) Penicillamine
   d) Colchicine
   e) Anticoagulants
   f) Antineoplastic agents
   g) Positive effects of Vitamin C, Vitamin A, zinc sulfate

XI. WOUND CARE AND TREATMENT

A. Types

1. For therapeutic and management purpose, wounds are classified as superficial or deep, simple or complex, and clean or dirty. It should be apparent from these descriptors that wound combinations occur; i.e. a superficial complex dirty wound.
2. Superficial wounds - these wounds involve the skin, subcutaneous tissue, fascia, and/or muscle without involvement of deep structures such as nerve, tendon, vasculature (arterioles or venules), bone or viscera.
3. Deep wounds - these wounds involve those structures excluded by definition from previous type. These wounds are often overlooked in a traumatic presentation where there appears to be superficial bleeding only. It cannot be overemphasized that all traumatic incidents should be pursued with a vigorous evaluation of the patient for other areas of involvement. Quite often fractures are missed because attention to bleeding at a distant site demands immediate attention and proper procedural evaluation is compromised. The management of deep wounds is beyond the scope of this practice and proper transport of these presentations should be carried out with all expedience.
4. Simple wounds - these wounds have interruption of tissue continuity but no significant loss or implantation of debris. Cuts, lacerations, punctures, and blunt trauma are wounds of this type.
5. Complex wounds - these wounds present with loss or damage of tissue or contain foreign matter. Lacerations, avulsions, abrasions, crush injuries and burns are wounds of this type.
6. Clean wounds - these wounds have little or no bacterial contamination and can be expected to heal without complication. Classification of this wound is not a simple task for the physician. Examination of the wound site is not sufficient to render an opinion as per the cleanliness of a wound. The physician must ascertain by inspection and conversation the factors involved in the injury. The physician must determine how much time has elapsed since the injury; he/she must consider the location of the wound; he/she must determine the causative agent; the physician must consider the local blood supply and general health of the patient.
7. Dirty wound - these wounds are those which by the judgment of the physician will most probably become infected if closed primarily. Again, the physician must gather the aforementioned information to determine the cause, location, time and other factors of compromise. In general, the delay of only a few hours will predispose an injury to bacterial infection. Wounds older than 5 hours should be considered a dirty wound and prone to infection. Other factors to consider in classification of dirty wounds are the contamination of the instrument of injury, impairment of local circulation and systemic conditions, such as diabetes, steroid therapy, and malnutrition.

B. Infection

1. Definition - the most common and serious complication to wound laceration repair is the secondary invasion of an infection causing bacteria. Virtually all accidentally induced wounds occur in an unsterile environment and should be considered contaminated. Even though the conditions of trauma are considered dirty by any standard, studies have shown that there remains a low percentage of post traumatic infection following intervention at an outpatient facility (4.5% to 6.3%). It is difficult to assess the presence of active infection post wound trauma because the processes of inflammation, a usual result of trauma, and infection are characteristically similar. Both have findings of warmth, redness, tenderness, and swelling. The primary difference between the two is that the infection has these signs to a greater degree, the patient reports subjective pain, and it is painful to palpation by an examiner. In most cases of infection the redness, warmth, and swelling extent beyond the immediate confines of the wound. For minor would lacerations that have been sutured, erythema that extends beyond 1 cm from the wound margin is suggestive of infection. The suspicion is further enhanced if this redness is accompanied by palpable induration greater than 0.5 cm. It is close to certain that an active infection is present when the patient exhibits purulent discharge, regional lymphangitis or wound dehiscence (splitting).
2. Microbiology of wound infection - the presence of bacteria does not in itself inevitably lead to the complication of infection. Studies have shown that the presence of 100,000 organisms per gram of tissue represents the critical mass necessary to cause infection. Factors that must be considered are: 1) type of injury, 2) time of injury, 3) size of inoculum, 4) virulence of pathogen, 5) resistance of the host, 6) presence of foreign matter, 7) and location of the injury.
   a) The most likely cause of infection of a minor laceration is by Staphylococcus aureus, (44%) in one study of post repair infections. Another study showed that S. aureus could be retrieved from 80% of all minor lacerations that became infected in the post repair period.
   b) Other frequently found infective organisms are Streptococci, Staphylococci epidermidis, (gram positive group), and E. coli, Proteus species, Enterobacter species, and Klebsiella pneumoniae from the gram negative group.
3. Factors that increase risk of wound infection:
   a) Wound characteristics:
      (1) Wounds greater than five hours old
      (2) Crushing mechanism wounds
      (3) Soil or foreign material
      (4) Lower extremity wounds
   b) Technical Elements:
      (1) Detergent scrub solutions
      (2) Anesthetics with epinephrine
      (3) Poor suturing technique
      (4) Excessive suture tension
      (5) Reactive suture material
      (6) Tincture of benzoin
   c) Patient condition:
      (1) Advanced age

(2) Diabetes
(3) Uremia
(4) Liver disease
(5) Malnutrition
(6) Corticosteroid therapy
(7) Patients who are health compromised or particularly prone to postoperative infections. As a patient's health deteriorates the likelihood of infection increases. This is most clearly demonstrated by the available statistical information. If a chronically diseased patient loses 20% of their weight, there will be a corresponding 3-fold increase in the postoperative infection rate. Many chronically diseased patients further their risk of infection by the way of the drugs they use to combat their disease. Four of the most notable pharmaceuticals that are associated with increased infection rates are: corticosteroids, immunosuppressive agents, cytotoxic drugs and prolonged antibiotic therapy.

d) The key to reducing the risk of wound infection is proper wound cleansing and preparation. Most of the aforementioned risk factors can be minimized if understood and appreciated. Minimizing suture tension and careful selection of materials can help decrease the odds of infection. Still, there are those clinical settings where antibiotic coverage is accepted protocol. Indications for prophylactic antibiotics are: 1) wounds greater than six hours old, 2) lower extremity wounds, 3) crushing mechanism wounds, 4) human and cat bites, 5) severely contaminated wounds, and 6) complicated hand wounds.

C. Antitetanus Prophylaxis

1. Any time a patient presents with a minor wound the physician must decide whether or not antitetanus shots should be administered. A significant number of seemingly trivial wounds have developed into cases of tetanus. Tetanus occurs almost exclusively in those patients who have not been immunized or completed a proper sequence of immunization. Most cases of tetanus occur in the age group over 50.
2. Guidelines for antitetanus prophylaxis
   a) Very tetanus prone - A wound exposed to a high level of bacterial contamination, a wound greater than 24 hours old, or a wound containing devitalized tissue that cannot be completely débrided. (Example sources: sewers, barnyards, penetration wounds of the colon.)
   b) Moderately tetanus prone - A wound exposed to moderate bacterial contamination, a wound over 6 hours old, stellate or crush wounds deeper than 1 cm, puncture wounds, or wounds that extend into muscle. (Example sources: pavement, wood, industrial sources, and human bites.)
   c) Not tetanus prone - clean wounds, less than 24 hours old, with no devitalized tissue. Any wound that does not fit in the previously mentioned categories.
   d) Fully immunized - for adults, they have received a minimum of three doses of tetanus toxoid: the first and second given at least one month apart, and the third given six months after the second. For children over six weeks but under 7 years, four doses have to be given; the first three at least one month apart and the fourth approximately one year later.

e) For those who have never been immunized and receive their first dose at the time of their wound repair, follow-up care is to include subsequent visits to a medical care facility to complete immunization. The second dose should follow 4-8 weeks after the first. The third dose should follow 6 months to a year after the second dose. Regardless of time or circumstances surrounding immunization, boosters should be given every 10 years after the last dose.

XII. Wound Closure

A. Definition of Terms

1. Bite - A bite is the amount of tissue taken when placing a suture needle in the skin or fascia. The farther away from the wound edge that the needle is introduced, the bigger the bite will be.
2. Throw - each knot of a suture consists of a series of throws. A square knot is fashioned with two or three throws. When using nylon, because of its tendency to unravel, several throws are necessary to secure the final knot. Throws pertain to the number of times the suture material is looped around in order to secure a knot.
3. Superficial suture - those sutures that are placed on the surface of the skin for final closure and are made of nonabsorbable material are called superficial sutures or skin closures.
4. Deep sutures - Sutures, usually made of absorbable material, placed in the superficial fascia (subcutaneous) or dermis with the knot buried in the wound are called deep sutures.
5. Interrupted sutures - Single sutures, tied separately, whether deep or superficial are interrupted sutures.
6. Continuous sutures - a wound closure effected by taking several bites the full length of the wound, without tying individual knots, is a continuous or running suture. Knots are only tied at the beginning and end of the closure to secure the suture material
7. Debridement - before actual suturing and knot tying, a wound must be made free of contaminants and dead or devitalized tissue. Devitalized tissue can be recognized by its shredded blue or blackish appearance. Tags or flaps of skin that will most probably necrose should also be trimmed from the wound site. The physician should use either a number 15 scalpel or straight iris scissors to remove excess tissue being cautious not to take too much tissue and remain as close to the wound edge as is reasonable. The wound edge is cut or excised at a slight angle so that the epidermal layer juts out slightly thus providing for natural eversion of the wound closure. (Append. VIII)
8. Hemostasis - Often wounds bleed actively, especially after debridement. Hemostasis must be obtained before wound closure can be successfully carried out. Should this not be the case there is an increased risk of the formation of a hematoma and subsequent reopening and debridement. The simplest method of hemostasis is with direct pressure with a 4 X 4 gauze sponge. Direct clamping with a hemostat is a last resort attempt to control the bleeding. It is usually only necessary to leave the hemostat in place for the remainder of the surgery up to closure. If when the hemostat is released and there continues to be profuse bleeding then it will be necessary to ligate the bleeder with absorbable material. Use of ligatures is discouraged because they irritate the wound site, increase the risk of infection and interfere with wound healing.

9. Deep Layer Closure - All layers of the wound must be repaired so that they are brought together in their normal alignment. This is important for functional, cosmetic and wound healing reasons. With any large gaping wound or deep incisional wound, it is important to decrease the amount of "dead space" or that space which is normally apposed but through the trauma has been laid open and exposed. Simple superficial sutures are not adequate to approximate the entirety of the wound and thus deep sutures are recommended. Sounding is recommended in all deep wounds to insure that deep structures such as muscle, nerve or tendon have not been severed or compromised. If this is the case, the wound should be closed with superficial sutures and the patient transported to the appropriate medical facility where the sutures can be removed and the deeper repairs made. In those cases where only the deep adipose tissue is involved or tissue down to the facial plane, deep sutures can be placed either horizontally or vertically depending on the needs as dictated by the wound. Buried interrupted sutures are distributed sparingly so as to affect apposition and aid in diminishing the amount of stress placed on the superficial sutures.

B. Accurate Skin Apposition - This is achieved by correctly creating an everted suture. An inverted suture will frequently leave an unsightly scar. The secret to obtaining skin eversion lies in taking right angle bites through the entire skin edge. On the face and scalp it is frequently necessary to undercut the skin edges to facilitate a right angle bite. The needle is placed in the needle holder halfway along the shaft, for if the needle is grasped too close to the shank it frequently bends or breaks. The needle is driven through at right angles. The opposite edge is then grasped and the needle brought out at a similar right angle. It is best to pass the needle through each edge separately rather than trying to catch both edges with one thrust. This will lead to bent needles, loss of right angulation, and frequently to poor apposition. Throws are then performed to create a knot that will draw up the tissue to close approximation with very slight eversion at the edges. (Append VI, e)

C. Suture Spacing and Tension - The wider the bite of skin edges, the fewer sutures that are required to obtain their correct apposition. However, the finest scar is obtained by using a large number of fine sutures, a technique which is used on the face. When there is gaping of the edges between the sutures, more sutures are required. When a large number of sutures are used, great care must be taken that each has not too wide a bite, for this may lead to marginal ischemia and necrosis of the skin edges. This is a common error in dealing with wounds on the skin of the fingers and leg. Suturing a wound under excessive tension, whether this is due to skin loss or to swelling of the tissues, is one of the major factors causing wound breakdown. Most wounds tend to gap, even when there is no skin loss. This means that there is a certain amount of normal tension in the skin surface which varies in different situations on the body. The tension permissible to close a wound with skin loss is largely a function of the vascularity, mobility and elasticity of the surrounding skin. In some areas, considerable tension can be used, but in others, none at all is permissible, otherwise necrosis of the skin edges will surely occur. (Appendix X)

1. Placement of deep sutures - One method of alleviating excessive tension in a wound closure is to place a few deep sutures. Not only will this close any dead space present, it will also provide deep structural stability so as to close superficially without compromise to correct apposition of the skin edges. This suture is accomplished by passing the suture needle initially through the lower aspect of the superficial fascia; the needle is then brought up through the dermis on the same side and out. The needle is then reintroduced into the dermis at the opposite matching point on the other side of the wound and passed down to the superficial fascia at a matching point opposite the initial introduction site. When the knot is tied, it will be buried deep and not interfere with the superficial external sutures or the healing process. The tails of the suture material are cut very close to the knot, leaving no more than a 3 mm tail. The less amount of suture material the body has to absorb, the less likelihood of problems.
2. Undermining - Another method of reducing wound tension is to undermine. This means to release the dermis and the superficial fascia from its deeper attachments, allowing the wound edges to be brought together with less force. Primary areas where undermining is recommended are the scalp, forehead, and lower leg, particularly over the tibia. Metzenbaum dissection scissors or iris scissors are used for undermining. As a rule, one should undermine as far back as a wound is long. In other words, if a laceration on the lower leg is 3 cm long, undermine 3 cm perpendicular back from the wound edges. Do not fail to include the wound ends.

D. Suturing Techniques

1. Simple interrupted suture - This suture is the most frequently used suture for a clean wound without complications such as deep involvement or multiple openings. This suture is usually used to close simple lacerations and uninvolved elective incisions. Sutures are tied individually beginning at one end of a wound and placing sutures sequentially toward the opposite end. Some physicians prefer to "halve" the wound by placing the initial suture at the midpoint of the wound and subsequently halving the subdivided openings until the wound is secure. The halving of wound suturing is best done after adequate undermining has been performed because frequently there will remain unwanted bunching of tissue between sutures. However, the end-to-end technique has its own set of difficulties. Frequently there will remain an extra tuft of skin called a "dog ear" at the end of the wound and this must be removed as excess tissue. This is accomplished by pulling the excess tissue tight over the wound and making a small 45 degree angle cut across the base of the dog ear and then dropping in a suture or two. As a rule, simple lacerations on the upper extremity or trunk can be closed with simple interrupted sutures of 1/4 in. bites placed 1/4 in. apart. Smaller and closer sutures are required at other locations such as the face.

2. Vertical mattress sutures - This suture should be used where the edges cannot be made to evert with a simple interrupted suture. This situation may arise in the following areas: 1) thin skin, 2) flexural creases, such as those of the fingers and palm, and 3) those areas of high stress where proper apposition of the skin edges is difficult. The essence of success in the use of this suture is to take the finest possible bite during the passage of the needle through the cuticular layer of skin. The bite should be so fine that the needle can be seen through the cuticular layer. Failure to take a fine enough bite leads to the raw edges of the wound being grossly everted to the exterior and results in secondary healing. A variation on this suture is the horizontal mattress suture. This suture closes the wound in an everted fashion and provides deep closure support. The suture is slightly more everted than the vertical mattress suture but this technique serves well for hand surgery where cosmesis is not as important and buried and deep sutures are contraindicated because of the foreign body effect. (Appendix VI)
3. Apical suture - Simple interrupted sutures cannot be used towards the triangulated end of a flap for they interfere with the circulation to the tip. The apical suture draws the tip into place, taking a bite through the deeper layer of the dermis of the tip, thus avoiding compromise of circulation. When the remaining sutures are inserted, it is best to take fine bites on the flap side towards the tip. (Append VI c,d)
4. Intradermal subcuticular "pull out" sutures - When an injury is necessarily closed under some tension because of tissue loss or there is a desire to avoid prominent suture marks, the most advantageous method of repair is the intradermal subcuticular pull out suture. Either nylon or fine monofilament material may be used and the free ends taped securely to the skin. This suture may be left in for two or three weeks to hold the edges together until the reparative process, delayed by tension, takes over; yet it will not cause ugly scarring that would inevitably accompany conventional skin sutures if left in place for that length of time. To obtain a straight scar, it is necessary that as the needle passes just beneath the dermis that its exit at the wound edge is oriented ever so slightly backwards with each bite. (Appendix VI a,b)

E. Suture Material

1. Criteria - Before placing sutures into a wound or operative site, one must consider a number of factors which will determine the kind of material to be used. The physician must consider the tensile strength of the material to insure that it is strong enough to hold the edges together without breaking. Knot security must be considered because some materials are predisposed to unraveling. Additionally one must consider the tissue reaction to the material as well as the material's ability to promote infection.
2. Absorbable sutures - Absorbable sutures are those which are placed for deep closure and not to be removed.
   a) Polyglycolic acid (PGA, Dexon) is currently the suture of choice for most physicians. It is a braided synthetic polymer which is less reactive and better able to resist infection from invading bacteria. It is excellent for knot security and holds half of its tensile strength for 25 days. It is, however, difficult to work with once it becomes wet. Its primary application is for deep closures of superficial and deep fascia and ligature of small bleeders.
   b) Polyglycan-910 (PG 910, Vicryl) is another synthetic polymer for deep closure that has excellent workability but not as good knot security as PGA. It has the greatest tensile strength and wound security and is thus preferred for deep support for prolonged periods.

c) Gut is the oldest form of absorbable suture material. It is manufactured from sheep intestines and can be used plain or treated with chromic salts (chromic oxide) to retard absorption. It has less tensile strength and wound security when compared to the synthetics and causes more tissue reaction.

3. Nonabsorbable sutures - These suture materials are used primarily for external closures where the sutures will be removed.
   a) Monofilament nylon (Ethilon, Dermalon) is the suture that is most commonly used for closures of minor wounds and lacerations. It is able to resist infections well and causes minimal tissue reaction. The tensile strength and wound security is very good for nylon.
      (1) The main disadvantage to using nylon is that it has poor knot security due to the "memory of monofilament"; it tends to unravel unless at least six throws are made per each knot.
   b) Another monofilament polymer is polypropylene (Prolene) which has significant advantages over other materials. It is the strongest and has the best wound security. It also causes the least skin irritation and it is at least as good at resisting infection as nylon. Like nylon, it has poor knot security because of its memory and is somewhat more difficult to work with than other nonabsorbable materials. It is best suited for subcuticular pullout sutures.
   c) Less commonly used today are the braided nonabsorbable sutures. These include silk, cotton, braided nylon (Nurulon), and multifilament dacron (Mersilene). Historically silk has been the mainstay for wound closures but with the advent of the newer synthetics it has fallen from favor. These materials have excellent workability and knot security but have a higher propensity for tissue reactivity and infection. Earlier removal of these sutures will minimize the adverse effects and make use of these materials preferred where maximal control and precision are required.

GUIDELINES FOR SUTURE MATERIAL AND SIZE FOR BODY AREA

(1) 5-0 and 6-0 braided silk - for fine suturing about the face and fingers.
(2) 3-0 and 4-0 braided silk - for heavy work about the scalp and limbs, especially in areas of high stress such as across a joint.
(3) 3-0 and 4-0 nylon (Ethilon, Dermalon) - minor wounds and lacerations about the scalp, trunk and extremities.
(4) 5-0 and 6-0 nylon (Ethilon, Dermalon) - for fine suturing about the face and hand.
(5) 5-0 plain catgut - for fine vessel ties and fine interrupted subcutaneous sutures of the face.
(6) 3-0 and 4-0 plain catgut - for larger vessel ties and interrupted subcutaneous sutures of the trunk and limbs.
(7) 4-0 polyglycolic acid (Dexon) - deep closures of the scalp, trunk and extremities.
(8) 5-0 polyglycolic acid (Dexon) - deep closures of the hand and face.
(9) 4-0, 5-0 and 6-0 polypropylene (Prolene) - for subcuticular "pull out" sutures.
(10) 4-0 chromic catgut - for repair of deeper structures where a longer period of time for security is desirable.

SUMMARY OF CHARACTERISTICS OF NONABSORBABLE SUTURES

Suture Type	Knot Security	Tensile Strength	Wound Security	Tissue Reaction	Workability
Nylon (Ethilon, Dermalon)	++	+++	+++	++	++
Polypropylene (Prolene)	+	++++	++++	+	+
Silk	++++	+	+	++++	++++
Multifilament Dacron (Mersilene)	++++	++	+++	+++	++++
Braided Nylon (Nurulon)	+++	++	++	+++	-

SUMMARY OF CHARACTERISTICS OF ABSORBABLE SUTURES

Suture Type	Knot Security	Tensile Strength	Wound Security	Tissue Reaction
Chromic Gut	++	++	10-14 days	+++
Polyglycolic acid (Dexon)	++++	++++	25 days	+
Polyglycan-910	+++	++++	30 days	+

SUTURE REMOVAL INTERVALS (Days)

Face	3-5
Eyelid	4
Ear	4-5
Leg	12-14

Nose	3-5
Scalp	7-10
Neck	5-7
Foot	10-12

Trunk	7-10
Arm	8-10
Hand	8-12
Extensor surface of joints	10-14

4. Needle types - There are a bewildering number and types of suture needles, but for use in minor surgery we can concern ourselves with a limited number and types. The curved needle comes in two basic configurations: the tapered and the cutting. For the majority of minor wound sutures we can further restrict our use to the cutting needle. This needle has a sharp edge on the convex portion of the needle which allows for ease of insertion into either the deep or superficial tissue because it cuts slightly as it goes. The tapered needle is more like a standard sewing needle that has been curved and essentially punctures the tissue. It is slightly more difficult to work with this needle because more pressure is required to insert the needle and this frequently leads to bent or broken needles. Needles come in different sizes for different areas of the body. For minor wound care the 3/8 or 1/2 circle are used with suturing material "wedged" or attached to the shank of the needle. Only those materials designated as cuticular, skin or plastics are recommended for minor wound care and they are coded C, CE, FS, P, or PS, depending on the manufacturer. Suture needle and wedged material are size designated by a number code followed by a zero. The size of the needle and material (diameter or caliber) becomes smaller as prefix number becomes larger. For example, 6-0 material is much smaller than 1-0 material. A chart is provided for guidelines of usage of the different materials.

F. Wound Taping - Increasingly, physicians are utilizing wound tape for suture repair. Tapes are easier to apply, they are non-invasive and require no anesthesia. The wound tension is more evenly distributed and for obvious reasons there are no lingering suture scars. Compared to standard suturing methods, wound taping is preferred for infection resistance. Experimental studies have shown that the tapes actually resist infection. There are however, several disadvantages.
   1. They are not recommended for wounds that have considerable tension, irregular shaped wounds or concave surfaces.
   2. They are not recommended for areas where moisture or oily skin would interfere with the adhesive quality of the tape. These areas are commonly the axilla, palms, or soles of the feet.

XIII. Wound Dressing and Post-Operative Care

A. Introduction - Wound dressings are varied and somewhat arbitrary as per physician's preference. Factors such as the location of the wound, the type of wound and the specific goals to be accomplished with the dressing are to be considered when selecting a dressing. The first decision a physician must make is whether to apply a dressing at all. Because the head & face are so vascular and resistant to infection, a physician frequently may leave the repaired wound undressed. There have been clinical trials that indicate that simple uncomplicated wounds heal as well and without complication regardless of the application or non-application of a dressing. A great number of wounds can be best served with the application of a simple Band-Aid or two. A dressing performs numerous functions and depending on the presentation, a dressing is designated by the function performed.

B. Dressing Functions

1. Wound protection - One of the main functions of a dressing is to protect the wound from further trauma and external contamination. Studies have shown that sutured wounds are vulnerable to bacterial infection up to 72 hours post application. If protection is foremost in the mind of the physician, it is best to initially apply a non-adherent covering such as a Telfa pad over the wound and then apply a measured and cut gauze sponge over the Telfa. These two dressings are anchored in places with sufficient skin tape to insure stability. This dressing is thick enough to provide protection from bacterial invasion and inadvertent accidental trauma.
2. Pressure - Regardless of whether the wound was traumatically introduced or electively performed, there is frequently the formation or accumulation of serous fluid or blood into the wound site. In cases such as these, the physician must be aware of the possibility of a hematoma or a seratoma formation. Should this be a possibility, the physician should select a dressing that applies sufficient downward pressure to insure that these formations are at least minimized. This dressing does not differ dramatically from the previously described dressing, except that rather than cutting the overlying gauze sponge to fit, it is better to take a 4 X 4 gauze sponge and fold it so that it packs up on top of the wound. If anchored securely to the underlying nonadherent Telfa pad, it will create sufficient pressure to discourage hematoma/seratoma formation.
3. Immobilization - Most commonly, the wounds occurring at the joints of the body frequently present the physician with an additional problem of dressing. Repair of wounds at joint spaces often need to be immobilized to prevent disruption of the healing process or accidental suture tearing. This is especially true if the wound is on an extensor surface. During flexion of that joint tremendous tension is applied to the extensor surface and risk of re injury is high. Immobilization can be achieved by splinting, as would be applicable with the digits, reinforcing tapes to anchor the dressing of the extensor surface, or if necessary, a temporary cast to insure complete immobilization. This is rarely necessary but an option to be considered if the wound site and wound extent dictate.

4. Absorption of exudates - Complicated wounds or wounds with potential for infection are likely to exude freely and copiously. Additionally, there are those wounds where formation of hematomas or seratoma cannot be avoided. The physician must take these factors into consideration when selecting a dressing. One option is to add several layers of gauze sponge over the Telfa pad to soak up the exudate. This technique is very effective but necessitates frequent dressing changes. In those cases where a hematoma or a seratoma is unavoidable, the physician should consider the use of a Penrose drain. This technique employs the use of a small section of surgical rubber or a small square of a surgical glove that can be rolled into the shape of a tube and inserted into the inferior most aspect of a wound during closure. Gauze sponges are placed under and over the exposed portion as it projects out from the suture site. The gauze sponges will soak up the exudate that is accumulating in the wound site and the Penrose acts as a conduit for its exit. The Penrose drain can be removed after two or three days or whenever there is no further risk of exudate accumulation.
5. Debridement - There are those rare occasions where debridement with a dressing is to be considered. In cases of burns or abrasions where foreign debris and extraneous matter has entered the wound site and cannot be débrided with cleansing effectively, the physician may place a gauze sponge immediately over the wound site with the intention of removing it in 24 to 36 hours. Though painful to the patient, when the gauze sponge is removed, fresh bleeding will occur and copious amounts of foreign matter can be removed from the wound site as it adheres to the dressing. The physician should exercise this option only if there is no other way to adequately remove the foreign material.
6. Comfort and Appearance - The physician must keep in mind that the dressing s/he places on a patient is his or her signature. A loose and sloppy application of a dressing will neither endear a patient to the physician nor will it inspire confidence in the physician's abilities. The physician should at all times keep in mind the needs of his patient when applying a dressing. The smallest, least bulky type of dressing is most preferred. The patient, with the exception of a child, does not want attention drawn to their injury or operation. Whenever and wherever possible, use the common Band-Aid. If this is not possible, use the next least obvious type of dressing. Keep in mind that the patient will not remain in a static position once they leave your office and the physician should consider the use and abuse that the dressing will receive. The dressing should be secure enough to perform the necessary task but not so tight as to restrict normal movement or compromise blood flow. Insure that the outer most edges of the dressing, the taped edges, are uniform and squared with each other. BE NEAT!!

C. Occlusive Wound Dressing - In recent years the traditional "bandage" type wound dressing has given way to the newer occlusive dressing. Because of the conflict between orthodox teachings to keep a wound dry, the occlusive dressing, which is essentially a "moist wound healing," has not completely caught on. Current literature suggests that the occlusive dressing is superior for both acute and chronic wounds (Arch. Dermatol. - Vol. 124, June 1988). There are four types of occlusive dressings; all designed to keep a wound moist and prevent crust formation.

1. Films - These are thin, transparent and adherent polyurethane's. They transmit water vapor, oxygen and carbon dioxide. They transmit water vapor, oxygen, and carbon dioxide. They are not absorbent. Examples of these dressings include Op-Site, Tegaderm, Bioclusive, Uniflex, Oproflex, Ensure-It, Thin Film Wound Dressing, and Blister Film. With most of them, the adherent material comes in direct contact with the wound. Initially, this poses no problem, since these dressings only stick to dry, unwounded tissue. However, once epithelialization begins, the potential is real for stripping away newly grown skin by the untimely removal of the dressing.
2. Foams - Examples of foam dressings include Synthaderm and Epilock, both made of nonadherent polyurethane material that is taped in place over the wound. The amount of wound fluid absorbed by these products is minimal.
3. Hydrocolloids - A partial list of hydrocolloids includes Duoderm, Comfeel, and Ulcer Dressing. In all of them, a water-impermeable polyurethane outer covering is separated from the wound by a hydrocolloid material whose composition varies with the particular dressing. They are opaque, gas impermeable, and absorbent. Eventually, the accumulation of wound fluid causes a gradual separation of the dressing from the wound, which is the only time a new dressing should be applied. Patients must be warned of the rather malodorous characteristic of the yellow-brown draining fluid under some of these dressings, or else they will discontinue therapy for fear of infection.
4. Hydrogels - The prototype of this kind of dressing is Vigilon, a polyethylene oxide membrane. To some it may be known as "Doctor Spenko's Second Skin." It is semitransparent, nonadhesive, and absorbent. Generally, only the inner, thin covering is removed to allow contact of the polyethylene with the wound.

XIV. Wound Management

A. Initial Assessment (Reproduced with permission from PATIENT CARE c 1998, May 30, 1988. Patient Care, Oradell, NJ All rights reserved.)

1. Presentation
   a) Type of wound
      (1) Blunt wounds are characterized by nonviable tissue, edema, and irregular wound edges. Estimate how much nonviable tissue may have to be removed.
      (2) Sharp object wounds may be deeper and bleed more than blunt wounds, have straight wound edges, and be accompanied by concealed injuries to blood vessels, tendons, and nerves. Damage to deeper structures calls for referral to an emergency department, general surgeon, or plastic surgeon. Abrasions are usually shallow, typically involving the epidermis and perhaps the dermis, they may contain foreign bodies and are likely to be contaminated.
      (3) Puncture wounds, often caused by animal or human bites, carry a high risk of infection because they are difficult to irrigate and debride (See "Mammalian bite wounds," Patient Care, August 15, 1987, page 157).

   b) Origin of wound
      (1) Consider the environment in which the injury occurred: Wounds from injuries in the home or office tend to be more pathogen-free than those from a factory, backyard, or roadway.
      (2) Sharp instruments produce lacerations that require relatively little debridement.
      (3) Occupational and vehicular accidents can produce contamination of wounds by difficult-to-locate, embedded particles.

   c) Location of wounds
      (1) Facial wounds - particularly if deep, conspicuous, or vertical to facial creases - may require the attention of a plastic surgeon because patients are especially concerned about cosmetic results; hand injuries may call for treatment by a hand surgeon to assure optimal function.
      (2) Wounds on the trunk, scalp, and extremities require less finesse in closure because they are usually less conspicuous.

   d) Delay in treatment
      (a) Wounds may have been inflicted hours before patients appear for treatment, and in most cases, prompt debridement, cleansing, and suturing are appropriate. Time of exposure to pathogens determines treatment in some cases, although repairs made up to six hours after injury are usually considered ideal. But in fact, studies of hand lacerations have shown little correlation between incidence of infection and treatment delays of as long as 18 hours. Facial repairs can be delayed, too, because of high vascularity of tissues.

2. Injury assessment
   a) History
      (1) Ask how the injury or injuries were inflicted, whether contaminants and foreign bodies may have been introduced into wounds, and how long the wound has been exposed to air and bacteria. Explore any complaints of pain.

(2) Probe for the reason behind an unusual fall that has caused injury, such as syncope, seizure, cardiac arrhythmias, or transient ischemic attack. Find out if the patient remembers falling.

(3) Ask about the patient's general health, systemic diseases such as diabetes, and medications. Use of corticosteroids, for example, may inhibit wound healing. Patients who may require special care are diabetics, the immunosuppressed, and the Immunodeficient, such as those with AIDS, Hodgkin's disease, and drug or alcohol addiction.

(4) Determine the patient's general health status, allergies to antibiotics and local anesthetics, and tetanus immunization status.

b) Physical examination

(1) Make a gross inspection of the wound - gently. Assess bleeding at the skin surface and deep within the wound where pressure or clotting may have stopped hemorrhage. Most wound bleeding can be controlled by pressure and elevation; bleeders generally should not be clamped. Small bleeders often respond to epinephrine, 1 mL of 1:1,000 in 4-5 mL of saline, on a gauze pad held against the injured areas (not an FDA-approved route of administration), but epinephrine should not be used in areas of end arteriole supply (digits, hands, feet, nose, ears, and penis). For children, it should be used in greater dilution.

(2) If you see much bleeding, assume that it is arterial. Try to find a distal pulse, although the distal pulse may persist even with vascular damage. If in doubt, consider angiography.

(3) Look for related injuries at other sites.

(4) Evaluate nerve function distal to the wound - especially if it is on the hand, over a joint, or on the face - before anesthetizing the site. A needle will do, but the sight of a needle may frighten the patient. Instead, consider touching the patient's skin with a wisp of cotton pulled out a bit from a swab to see if the patient feels it and to see if it is like that of an analogous area; for example, compare an injured finger with an uninjured finger. Test two-point discrimination with the ends of a paper cup spread 3-4 mm apart. For the trunk, spread the points 1.5 cm apart. Test for gross motor function.

c) Anesthesia

(1) Infiltrate the wound area with local anesthetic, using a 27- to 30-gauge needle; inject subdermally and slowly through wound margins to minimize the pain of injection. Inject 0.5% or 1.0% lidocaine HCl (Xylocaine HCl) alone, with a maximum of 4.5 mg/kg, for end arteriole structures where vascular compromise is a concern. Combine lidocaine with epinephrine, with a maximum of 7 mg/kg, for a longer-acting effect on scalp, face, and possibly trunk. A long-lasting alternative to 0.25% bupivacaine HCl (Marcaine HCl, Sensorcaine); it is four times more potent than lidocaine, so 0.25% bupivacaine is equal to 1.0% lidocaine in numbing power. Warning: The stronger the anesthetic solution, the more deleterious the effect on wound healing. Anesthetics reduce the tensile strength of wounds, and the addition of epinephrine intensifies this effect.

(2) Consider diphenhydramine HCl (Benadryl) for a patient allergic to lidocaine; dilute half and half with normal saline solution in a syringe and then inject 2-3 mL (unlabeled use).

(3) Topical application is appropriate for children 2 years of age upward; moisten a cotton ball with TAC solution (0.5% tetracaine HCl, 1:2,000 Adrenalin Chloride, and 11.3% cocaine HCl), and press against the skin for at least 10 minutes, except on end arteriole structures and mucous membranes (not an FDA-approved indication for tetracaine HCl and cocaine HCl), the assistant or parent who holds the cotton ball should wear a glove so that fingertip circulation is not affected. This activity keeps a parent usefully occupied. A very young child may require immobilization by a sheet or "papoose board" or by having an anesthesiologist administer general anesthesia. In some cases, sedation may have to precede anesthesia. Warning: Though rare, seizures have been reported in children anesthetized by large doses of lidocaine and TAC.

(4) Regional, spinal, or general anesthesia may be desirable for major wounds.

(5) For abrasions, anesthetize the skin with a field block, apply a gauze pad moistened with a 4% lidocaine solution, or apply 2% lidocaine jelly (unlabeled use), in modest amounts. Also consider nitrous oxide already mixed half and half with oxygen, if available.

d) Closer examination

(1) Explore the wound more thoroughly for possible damage to vessels, nerves, tendons, muscles, and joints. Bone fractures in the hand are especially easy to overlook. Function may possibly be retained in a tendon with as much as 95% transection, but a transected tendon that breaks later may be extremely difficult for even a specialist to repair.

(2) Consider referral if damage is extensive, requires a high level of skill to repair, or if follow-up will be extensive. Consider closing the wound to protect it until a specialist and operating room can be scheduled.

(3) Use a small retractor or skin hook to separate wound edges. A skin hook can be improvised by bending the tip of a 19-, 20-, or 22-gauge syringe needle with a needle holder; hold it with a cotton swab inserted in the barrel or grasp it with a hemostat or needle holder.

(4) Search for foreign bodies embedded in or under the skin by sight and touch. A probe or mosquito hemostat may reveal splinters or particles. Consider X-ray studies.

e) X-rays, other imaging

(1) Use X-ray studies to confirm fractures, especially of the small bones of the hand or foot.

(2) Conventional X-rays, xeroradiographs, or fluoroscopy may be necessary to locate small foreign bodies; even glass particles down to 0.5 mm tend to show up on X-rays. To avoid concealment by bone, order oblique and tangential X-ray studies.

f) Grams' stain and cultures
   (1) For wounds that are fresh and uninfected, you need not order stains and cultures; they will not reliably indicate which wounds will become infected and what the infecting organism will be.
   (2) For older, obviously infected wounds, it may sometimes be useful to obtain stains and cultures to identify the pathogen, especially if the patient is at risk from underlying disease or if a course of broad-spectrum antibiotic therapy has failed.

g) Indications for hospitalization
   (1) Major blunt injuries.
   (2) Severe wounds requiring IV antibiotics or surgical debridement or repair.
   (3) Massive blood loss or developing shock.
   (4) Signs of systemic sepsis.
   (5) Compound fractures and wounds penetrating joint spaces.
   (6) Infected hand wounds.
   (7) Serious local infections such as tenosynovitis.
   (8) In children and infants, face, head, or neck wounds that have penetrated the cranium or other vital deep structures.
   (9) Infected wounds in the presence of severe preexisting infection or compromised immunity (such as diabetes, liver disorders, cancer chemotherapy, or asplenia).

B. Initial Treatment

1. Antiseptics

a) Use antiseptics only to decontaminate the skin; they generally should not be used in wounds, especially at full strength.

b) Povidone-iodine solution (Betadine) has a bactericidal effect on skin and appears to have a similar effect in wounds if diluted to a 1-5% solution, although some controversy exists as to the value of using it in wounds even if highly diluted. If a patient is allergic to povidone-iodine, consider the use of benzalkonium chloride (Zephiran) 1:750 solution.

c) Detergents and soaps, among them povidone-iodine skin cleanser and surgical scrub mixtures, are suitable for skin cleansing but should never be used in wounds because they cause injury to tissues. Other effective, commonly used surface cleansers are hexachlorophene (pHisoHex) and poloxamer 188LF. The latter can be used in wounds, particularly if they are contaminated, is appropriate for use around the eyes because it does not sting.

d) Clean abrasions with povidone-iodine, saline, hexachlorophene, or poloxamer 188LF solutions.

e) Hydrogen peroxide should not be applied to open wounds: It causes tissue damage disproportionate to its value as an antiseptic.

f) Tinctures of iodine and merbromin (Mercurochrome), often used by patients, are of little value as antiseptics.

2. Irrigation

a) Jet irrigation with a pulsatile flow device, such as a Water Pik or a 19-gauge needle attached to a 20- or 50-mL syringe, removes particles efficiently.

b) Lactated Ringer's, normal saline, diluted povidone-iodine, and antibiotic solutions are good choices. One part povidone-iodine in 10 parts saline is said to provide antibacterial action while preventing tissue damage. Among the antibiotics used to reduce wound infection are 5% penicillin G sodium or cefazolin sodium (Ancef, Kefzol), 1 mg/mL of normal saline. As much as 2,000 mL of solution may be needed for extensive irrigation.

3. Mechanical removal of particles
   a) Use a mosquito hemostat or splinter forceps to remove particles; attract small ferrous pieces with a sterile pointed bar magnet. A loupe (convex lens) with 2X magnification aids visualization.
   b) If you find many small, hard-to-remove particles, some may be inadvertently left behind to become fibrosed; they do not constitute a problem, but be sure to tell the patient even if you only suspect that foreign bodies remain in the wound.
   c) In abrasions, a gauze pad or the sponge side of a surgical scrub brush helps remove small particles. Unremoved particles create scars or "tattoos."
   d) If you have a great deal of trouble finding or grasping metal fragments that you know are there, consider referring the patient. The sub specialist may have fluoroscopy to help locate foreign bodies.
4. Debridement
   a) The ideal in debridement and suturing is to put normal skin to normal skin, making sure it is anatomically aligned. If the wound edges are irregular, severely bruised, or embedded with dirt, trim them to be smooth, perpendicular to the surface, and of equal depth; this will avoid a depression when closure is made. Cut away devitalized tissue in crush wounds and animal bites.
   b) If the wound is small or has been produced by a sharp object, debridement is frequently unnecessary. For large wounds with severely damaged tissues, a consultation is in order.
   c) If skin viability is questionable, cut into the dermis to see whether it bleeds.
   d) Use a No. 10 or 15 scalpel to excise tissue; an alternative is a sharp iris scissors (see Figure 1). A sterile pen is useful for marking the skin, and a skin hook or forceps helps to hold skin taut for cutting.
   e) Exercise care in debriding an injury on the face. Even slight distortions in the skin on healing can produce a suboptimal cosmetic result. Facial injuries generally require significantly less debridement than lacerations elsewhere because the skin is highly vascularized and tends to heal well.
   f) Do not shave off an eyebrow. Consider shaving the head only minimally.

5. Closure
   a) Suture materials
      (1) Absorbable sutures include natural gut and synthetic materials, principally polyglycolic acid (Dexon, Dexon Plus, Dexon-S), and polyglactin 910 (Vicryl, Coated Vicryl). Synthetic absorbable suture are superior to gut counterparts on most counts: Synthetics produce less tissue reaction, more secure knots, fewer infections, less dehiscence, and greater tensile strength. The synthetics are generally used SC to sew muscle and fascia but are suitable for the dermis, too. Relatively new synthetics are polyglyconate monofilament suture material (Maxon) and polydioxanone monofilament (PDS); their long-lasting tensile strength makes them good choices for patients such as diabetics whose wounds heal more slowly.
      (2) Nonabsorbable synthetic monofilament sutures are generally superior to the multifilament type and also to natural sutures like silk and cotton in preventing wound infection. Silk and braided polyester (Dacron, Mersilen) provide knot security important around eyes and orifices, but they also have less tensile strength and increase the risk of infection. Nylon (Dermalon, Ethilon, Nurolon, etc.), polypropylene (Prolene, Surgilene), and braided, polybutilate-coated polyester (Ethibond) provide less knot security. Nylon may require five or six knots, but is nonetheless a good choice for suturing the epidermis.
   b) Needles and other closing devices
      (1) A curved reverse cutting needle, triangular in cross-section, is suitable for all layers of skin. Smaller needles are preferred for finer repairs, as on the face. So-called plastic needles - steel needles intended for plastic surgery - are more finely honed and more expensive than cuticular needles.
      (2) Staples, implanted by a disposable stapler, and clips make closure faster, and reduce the rates of wound infection.
      (3) Wound closing tapes (Clear on Skin Closures, Ethistrip, Steri-Strips) are useful when sutures are unnecessary or when wound margins must be held together after sutures are removed. Special preparation solutions or gums do not improve long-term adhesion of tapes.
   c) Closure techniques
      (1) Avoid leaving dead space, which can increase the risk of hematoma and infection.
      (2) Repair deep structures first, such as muscle and fascia, with absorbable synthetic sutures of the smallest size that will do the job. A good choice is 4/0 or, rarely 3/0.
      (3) Do not attempt to close the fatty layer of skin. The stitches have no strength and increase the risk of infection.
      (4) Align the wound edges. Close the dermis with absorbable synthetic sutures, as fine as 6/0 or 7/0 on the face, 5/0 on the hands or extremities, and 4/0 on the scalp, trunk, or bottom of the foot. Use a size smaller on the skin underneath the skin. Make the base wide enough that skin edges are not inverted when the loop is drawn tight (see figure 2).
      (5) Skin that is sewn flat will invert as it heals and cause a scar. You can avoid this outcome by everting the edges lightly on suturing so that the skin flattens out as it contracts during healing.

(6) Use a fine nylon suture, 6/0 or 5/0, in the epidermis close to the skin edge; this closure is intended to close the wound, not to provide strength.

(7) For most wounds, use interrupted sutures. Among their advantages: They can be individually removed or replaced if tension is too great at certain points, if infection is found in only one area of the wound, or if a knot becomes untied. Running stitches, if skillfully placed, can save considerable time, however.

(8) Horizontal and vertical mattress stitches are basic to wound closure and should be placed according to the size and shape of each wound.

d) Delayed primary closure

(1) You may decide against primary closure because of suspected infection, diabetes, human or animal bites, immunosuppression, chronic disease, malnutrition, obesity, and malignancy.

(2) Leave the wound open, and cover it with a dressing wet with normal saline or diluted povidone-iodine solution for 2-3 days; the wound is cleaned and inspected for infection daily. If no infection develops, the wound may be closed.

(3) Alternatively, stitches may be placed but not tied, and sterile gauze soaked in a solution is placed in the wound. If no infection develops, the sutures are tied four days after the first treatment, with the patient locally anesthetized or sedated.

(4) Be cautious about suturing wounds more than 6-8 hours old unless they are clean and uncomplicated. Also be cautious about wounds with severe contamination, damaged deeper structures, substantial tissue loss, large flaps, difficult-to-repair avulsions, full thickness (or greater) abrasions, and sole-of-foot injuries acquired outdoors. On the face, extensive or irregular wounds and those of the eye, eyelid, nose, ear, or lip may be difficult to repair. Consider referring patients with these problems to emergency-medicine specialists, general surgeons, plastic surgeons, or other surgical sub specialists.

e) Antibiotics

(1) Topical antibiotics

(a) Apply topical antibiotics after suturing and before dressing. Be aware that some may also accelerate and some may inhibit wound healing.

(b) Appropriate agents are bacitracin ointment (Baciguent); polymyxin B sulfate/zinc bacitracin/neomycin sulfate ointment (Neosporin), silver sulfadiazine (Silvadene) (unlabeled use); and nitro-furazone (Furacin) (not an FDA-recognized indication for nitrofurazone).

(2) Systemic antibiotics

(a) Such medications may be indicated for diabetics with an extremity injury, patients with bite wounds, and those with severely contaminated wounds. There is controversy over the value of prophylactic antibiotics, however, and some studies show no improvement in infection rates.

(b) Recommended antibiotics include cefadroxil (Duricef, Ultracef), 1 g to start and 500 mg bid; dixloxacillin sodium (Dycill, Dynapen, Pathocil, etc.), 500 mg qid - all for 3-5 days depending on the condition of the wound and the patient. Another appropriate cephalosporin is cephalexin (Keflet, Keflex), 250 mg q6h. For human and animal bites, amoxicillin with potassium clavulanate (Augmentin), 125 mg q8h (based on potassium clavulanate component) is effective

(c) Recommended antibiotics for abscess <5 cm (less than) post incision and drainage is Clindamycin. This is most beneficial in MRSA + patients and significantly decreases the risk of new infection at 1 month.

f) Dressings

(1) Plain gauze pads

(a) Gauze pads can be applied over antibiotic ointment, soak up exudate appearing in the first 24 hours, and are inexpensive.

(b) These pads may shed particles into the wound and may stick to the wound.

(2) Occlusive dressings

(a) Occlusive dressings (Bioclusive, DuoDerm, OpSite, Tegaderm) consist of transparent plastic film designed to keep foreign matter and bacteria out of wounds.

(b) These dressings adhere to wounds, keep them moist, and promote healing in abrasions and wounds with tissue loss; they are also easily removed.

(3) Petrolatum-coated dressings

(a) Petrolatum dressings (Vaseline, Xeroform), although most commonly used for burns and skin grafts, can be applied to wounds.

(b) The dressings have some bacteriostatic action and can be readily removed, especially after soaking with water.

g) Tetanus prophylaxis

(1) In clean minor wounds

(a) Patients who require a tetanus or tetanus-diphtheria (Td) booster immunization: (1) those who have had fewer than three tetanus doses in their lives; (2) those who have had three or more doses but none for 10 years. Administer 0.5 mL IM.

(b) Patients do not require tetanus immune globulin (Homo-Tet, Hu-Tet, Hyper-Tet).

(2) In all other wounds

(a) Patients who require a Td booster: (1) those who have had fewer than three tetanus doses; (2) those who have had no more than two doses and whose wounds are more than 24 hours old. The dose is 250 U IM for wounds of average severity and 500 U IM for severe or neglected wounds.

(b) If both are given, use separate syringes and inject at separate sites; the tetanus toxoid must be in the absorbed, not fluid form.

h) CAM support

(1) Bromelain (Blonstein, 1960) (Pavan, 2012)

(a) MOA- healing acceleration, edema reduction, debridement, antiinflammatory, antithrombotic, pain reduction

(b) Disadvantages, precautions or CI- pts on blood thinners, latex allergy

(c) Dosing-

(i) PO-

(a) 3000 mcu tid x 3 d then 2000 mcu tid

(b) 1000 mg tid

(ii) Topical- cream 35%

(2) Comfrey (Staiger, 1946)

(a) MOA- antiinflammatory

(b) Disadvantages, precautions or CI- Deep puncture wounds

(c) Dosing- creams 10-30%

(3) Aloe Vera (Takzaree, 2016) (Hajhashemi, 2012) (Davis RH, 1989)

(a) MOA- activation of transforming growth factor beta (TGF-B) epithelialization & angiogenesis, collagen synthesis, inhibition of thromboxane A2 (TxA2), antiinflammatory

(b) Dosing-

(i) Topical-

(a) 100% raw gel 2.5-5 mg/kg

(b) gel 95% extract BID

(4) (Manuka) Honey (Jull AB, 2015) (Oryan A. A., 2016)

(a) MOA- antibacterial, tissue regeneration, antimicrobial, antiinflammatory, antioxidant, pain reduction

(b) Dosing-

(i) Topically qd 15-30 ml

(5) Calendula (Kalvatchev Z, 1997) (Christoph Nicolaus, 94-103) (Dinda M, 2015) (Okuma CH., 2015)

(a) MOA- antiinflammatory, collagen formation, fibroblastic activity

(b) Disadvantages, precautions or CI- daisy or aster family allergy

(c) Dosing-

(i) Topically- tid-qid

(a) Ointment PRN

(i) 5 g herb in 100 g ointment

(b) 1:1 tincture 40% alcohol

(c) Compress

(i) 1:5 Tincture 90% alcohol diluted to 1:3 with boiled H20

(ii) 5ml of tincture to 100 ml distilled water BID-TID

(6) Vitamin C (Traikovich, 1999)

(a) MOA- collagen synthesis

(b) Disadvantages, precautions or CI- mild GI upset usually with values PO > 30,000 mg

(c) Dosing-

(i) PO 200-500 mg

(ii) Topically 0.5 ml asorbic acid solution with H2O qd x 3 m

(7) Propolis (Oryan, 2018)

(a) MOA- antibacterial, antifungal, prevention of biofilm formation

(8) Curcumin aka Tumeric (Akbik, 2014) (Mohanty C, 2017) (Yang Z1, 2018)

(a) MOA- antiinflammatory, inhibition of TNF-a and IL-1, reduction in oxidative stress, supports proliferation, immune- mediated tissue regeneration

(b) Disadvantages, precautions or CI- oral rare diarrhea, rash, h/a; CI in clotting disorders, gout, gall stones, kidney stones

(c) Dosing-

(i) PO-2 g qd x 3 wks

WHEN TREATING WOUNDS

DO . . .

(a) Ask about cause and age of injury, contaminants, foreign bodies, and pain.
(b) Probe for the reason if a fall caused the injury.
(c) Ask about the patient's general health, current diseases, and prescribed medications.
(d) Try to control bleeding first with pressure and elevation.
(e) Explore damage to nerves, tendons, and bones of deeper levels before cleansing, debriding, and suturing the wound.
(f) Avoid strong anesthetic solutions that may slow wound healing.
(g) Be cautious about anesthetizing infants and children.

(h) Search assiduously for foreign bodies both visually and radiographically.
(i) Irrigate wounds thoroughly with lactated Ringer's, normal saline, diluted povidone-iodine, or antibiotic solutions.
(j) Debride and suture to align normal skin with normal skin.
(k) Evert wound edges slightly when suturing to avoid inversion and scarring later.
(l) Use interrupted stitches generally for wound closure.
(m) Remove sutures promptly from healed wounds.

DON'T . . .

(a) Give anesthesia before testing for nerve and tendon damage.
(b) Apply topical TAC solution or any other vasoconstricting anesthetic to an end arteriole structure.
(c) Use detergents, soaps, full-strength povidone-iodine solution, or hydrogen peroxide inside wounds.
(d) Forget to inform the patient if you think you may have left small particles in the wound.
(e) Debride too much tissue in facial wounds, which may heal successfully even when irregular.
(f) Suture in the fatty layer of the skin.
(g) Fail to provide tetanus immunization when necessary.

XV. Tumor Diagnosis and Treatment

A. Definition - A tumor is a morbid enlargement of tissue; it is new growth of tissue in which multiplication of cells is uncontrolled and progressive, therefore, it is considered a neo-plasm.

B. Classifications

1. Hyperplasia - this is controlled cell proliferation to a limited sense. It is a method whereby cells adapt to stress. This is the simplest non-involved type of tumor. Examples of this type of growth are hyperkeritization or calluses.
2. Metaplasia
   a) This class of tumor is essentially an adaptive substitution of one type of fully differentiated adult cell for another type of adult cell. It represents the replacement, under conditions of stress, of a more delicate or vulnerable type of cell by another cell type more suitable or capable of meeting the stress of the local situation but less specific functionally.
   b) Metaplasia tends to occur in the direction of more specialized to less specialized cell types. This is particularly true of the excretory ducts of any gland of the body where there is chronic irritation or inflammation i.e., tracheal mucous membrane, bronchiolar tissue, endocervical glands, sweat glands, etc.
3. Dysplasia - this classification is the most severe and potentially dangerous. It represents the loss of regularity of individual cells as well as loss of their architectural orientation. Dysplastic cells exhibit "pleomorphism". They vary in size, shape, and possess large irregular nuclei. It is this stage that precedes neoplastic transformation.

C. Differentiation of benign and malignant tumors

1. Benign tumors
   a) These tumors are cytologically and characteristically considered relatively innocent.
   b) They are slow growing, but have the potential to reach enormous sizes and risk compromise of adjacent tissue structures by crushing or displacement.
   c) They remain localized to the site of origin and do not spread to distant sites.
   d) Those benign lesions that are palpable are usually nontender, unless in an inflamed state, and are quite mobile encapsulations.
2. Malignant Tumors
   a) Collectively these types of tumors are referred to as "cancerous" lesions.
   b) They are usually faster growing tissues and have the ability to spread to distant sites (metastasis).
   c) They also have the ability to invade adjacent tissue even if that tissue is a different type.
   d) These lesions have a much higher metabolic state and increased vascularity and capillary fragility.

XVI. Malignant skin tumors

A. Basal cell carcinoma

1. This is the most frequent type of skin cancer and the most easily treatable and is the least life threatening of the skin malignancies.
2. The etiology of this presentation is far better understood today than it was just decades ago. There is an extremely high correlation to sun exposure and onset of this disease. Additionally, there is evidence to indicate that chronic micro-trauma will also cause tissue changes. This trauma can also incorporate chemical irritation.
3. There is a much higher incidence of this occurrence with light skinned people but dark skinned people are not exempt.
4. The initial onset does not usually occur until after the fourth decade and it occurs in those areas most heavily subjected to sunlight; the face, neck, and dorsum of the hands and arms.
5. The growth of this type of malignancy is usually quite slow in comparison to other types of skin cancer. It usually takes approximately one to two years for a lesion to reach 1 cm in. diameter.
6. Basal cell carcinoma rarely penetrates the base membrane and less than one tenth of 1% metastasize. Those lesions that progress without treatment have raised rolled borders and an ulcerated or necrotic center.
7. Treatment of choice: refer to an oncologist or a dermatologist. Chiropractors are prohibited from knowingly treating cancerous lesions.

B. Squamous Cell Carcinoma

1. This type of skin cancer is less common than basal cell type but they have the same etiology: sun exposure.
2. Squamous cell carcinoma arises from the epidermis as nodular growth of squamous epithelial cells. It has the appearance of peels on the skin or as a nonhealing skin ulcer.
3. It is most commonly manifest on the vermillion border of the upper lip, the paranasal folds, ears, cheeks, or the axillary region. It can arise from advanced stages of actinic keratosis.
4. The growth rate is more rapid than that of basal cell carcinoma and it readily metastasizes.
5. The treatment of choice is referral for excision and biopsy.

C. Melanoma

1. This type of skin cancer is the most dangerous but least frequent of the skin cancers. Should this type of cancer metastasize it will most likely be lethal.
2. The shape of the melanoma is like that of any nevus. It differs in that it is jet black in coloration and occasionally will have visible vascularization in or adjacent to the lesion. Frequently in later stages of advancement this nevi will ulcerate or bleed with micro-trauma.
3. The melanoma can arise from any skin pigmentation or in an area of new growth. Its occurrence is much higher in light skinned caucasians but can be seen in dark skinned individuals as well.
4. The onset is rapid and the lesion will change shape and coloration significantly. Should this occur with any skin lesion, the patient should be referred out immediately to an oncologist or dermatologist for excision and biopsy. Investigative literature on this subject shows that the depth or thickness of invasion of melanoma has a relationship to the prognosis. (See Clark's levels of invasion chart in appendix.)

D. It is interesting to note that regardless of the type: basal cell, squamous, melanoma or any non-skin cancer, the prudent physician will not overlook the opportunity to examine the oral cavity of his or her patients. Seventy-five percent of all head and neck cancers begin in the oral cavity.
   1. For the general public, the American Cancer Society has publicized seen warning signs, using the acronym CAUTION. Certainly, every physician should be more familiar with these:
      (1) Change in bowel or bladder habits
      (2) A sore that does not heal
      (3) Unusual bleeding or discharge
      (4) Thickening or lump in breast or elsewhere
      (5) Indigestion or difficulty swallowing
      (6) Obvious change in size or color of a wart of mole
      (7) Nagging cough or hoarseness
   2. It has been estimated that 80% of the most common cancers could be found early by a simple thorough physician examination.

XVII. Benign Skin Tumors

A. Keloids

1. Keloids - these tumors are bulging structures resulting from excessive formation of collagen in the healing stages of a wound.
2. The etiology is unknown. There is an extremely high rate of occurrence in black people where trauma is involved (acne, insect bites, cuts, incisions, etc.) Those patients who are predisposed to keloids are poor candidates for scar reductions and should they need minor surgery, they should be fully informed of the risks of excessive scar formation.
3. Inadvertent keloid formation can be the result of improper management of a wound. The best way to avoid keloid formation is to incise along the tension lines that naturally occur on the body, be sure to accurately approximate the wound edges, and limit the number of sutures whenever possible to minimize the inflammation process.

B. Lipomas - These benign tumors consist of encapsulated fat tissue arising from the subcutaneous fascia.

1. For those patients having multiple manifestations of lipomata, there is every likelihood that there is familial predisposition. Should the lesion be solitary in its presentation, it is most likely the result of blunt trauma.
2. Visually there may be no findings or if any, only a slight uplifting or bulging of the skin over the site of the lipoma. They palpate as soft and quite mobile concentrations of tissue ranging in size from grapes to golf balls (flattened). Because they arise from the subcutaneous fascia, they frequently have a root like attachment deep to the lipoma that fixes it in place, thus allowing the overlying skin to move freely over the superior portion of the lipoma. The lipoma is frequently multilobular and has a venous drainage and arterial supply through the attachment at the base.
3. Because of their capacity to reach extreme sizes, lipomata are usually removed so as not to compromise adjacent tissue structures. Mainly they are removed for cosmetic reasons. Occasionally they undergo dysplastic changes and become liposarcomas.
4. Lipomas are most frequently found on the body areas of increased fat, the flanks, back, chest, upper arms and legs.
5. The treatment of choice is surgical removal and biopsy. A linear incision is made over the center of the lipoma following the skin lines. After the incision is made, it is best to proceed from this point with blunt dissection using only blunt dissection scissors, a hemostat or the back side of a surgical blade. Because the stalk contains vascular elements extreme care should be used while teasing loose the anchoring stalk. After the lipoma has been removed, it is imperative that the open wound area be probed, preferably with the surgeon's finger, to insure that there are no remaining lobes or small seedling lipomas. It is usually necessary to use a couple of deep sutures to close the dead space before doing a superficial closure.

C. Sebaceous Cyst (Wen) - these tumor like structures are caused by the blockage of the duct of a sebaceous gland located adjacent to the hair follicle. The tumor develops because the sebaceous material continues to be produced by the gland but has no portal of exit and thus becomes well encapsulated and enlarged. These tumors can also range in size from grapes to golf balls.

1. These tumors can be differentiated from lipoma visually by the existence of a small central well at the middle of a raised "lump" of skin. This is the compromised duct to the sebaceous gland and is markedly larger than surrounding pores. Palpably, the sebaceous cyst differs from the lipoma in that it is affixed to the overlying skin and not at the base, thus the skin and tumor move freely over the underlying tissue.
2. The contents of the sebaceous cyst is sterile coagulated sebum. It is essentially a rancified oil and has a most offensive odor when extruded or ruptured from the encapsulation. One is hard pressed to describe how foul an odor it is.
3. Sebaceous cysts most frequently occur on the scalp, back of the neck, shoulders, scrotal areas, arm, and behind the ear.
4. The cysts are frequently removed for cosmetic reasons, but are also removed because they become infected and extremely painful. The treatment of choice is to remove the entire cyst, insuring that no portion of the gland is left. If a portion of the gland is left behind it will continue to function in producing sebaceous material and a new cyst will form.
5. The surgical procedure differs only slightly from that for the lipoma. Once the central well, is identified indicating the duct of the gland is isolated, an elliptical incision is made on each side of it. Once the incisions have been made and superficial bleeding controlled, blunt dissection is recommended. Undercutting of the overlying skin may be necessary to promote adequate removal of the cyst by separation of the cyst from the attached adhesions. The portion of skin created by the two elliptical incisions is grasped securely with a hemostat and retracted upward while blunt dissection is being conducted. Every attempt should be made to remove the saccule in its entirety without rupturing the contents. This is not always possible and if the saccule should rupture, wipe away the exudate and continue to retract the empty saccule and blunt dissect until it is removed. Again, it is quite possible that a couple of deep sutures will be necessary to close dead space but this is usually only necessary if the sebaceous cyst has reached considerable size. It is not always necessary to send a sebaceous cyst out for a biopsy. They can be easily identified by the contents and odor. Should the sebaceous cyst present with unusual vascularity or any other alarming component, it should be biopsied.
6. Update- the term WEN is typically associated with a trichilemmal/pilar cyst filled with keratin found on the scalp that may be indistinguishable from a sebaceous cysts

D. Inclusion, Implantation, or Foreign Body Cyst - as a group, these tumors exist as the result of the body's recognition of extraneous matter in an area where it is not normally found. It can be the result of blunt trauma or introduction of a foreign body. The traumatically induced cyst occurs when epithelial tissue is forced to a deeper level and is interpreted by the body as an invasion of foreign matter. The epithelial tissue will continue to grow and replicate and enlarge. The body's natural defense mechanisms attempt to wall off the invading tissue with connective tissue and eventually forms a cyst. The same process occurs with the introduction of a foreign body, splinter, glass shard, metal filing, thorn, or any other foreign matter.
   1. These cysts occur most frequently in the hands and feet where trauma more commonly occurs. The cysts palpate as very hard, non-tender, mobile nodules that lie just beneath the skin. The skin can be displaced or elevated but not reddened or edematous. These cysts rarely achieve any significant size and a large manifestation would be pea sized.

2. These cysts are usually removed for cosmetic reasons but occasionally will compress on a nerve of the hand or foot and must be removed. A small single incision is made directly over the nodule and the lesion blunt dissected. There is a remarkable absence of adhesions or fibrotic anchors with these lesions and are thus very easy to remove. Following the incision, they all but fall out of the body. The removed cyst has a remarkable likeness to a pearl in coloration, palpation and appearance. Once extracted, the cyst can be halved with a scalpel and the foreign object examined. Barring any unforeseen surprise lesions, there is no need to biopsy this specimen if it appears as has been described.

E. Verrucae Vulgaris (warts) - these are benign epithelial growths formed by hypertrophy of the papillae. They may occur at any location on the cutaneous or mucous membrane surfaces. They are caused by a papovavirus. They are autoinoculable and can be transferred from one person to another, but not from toads to people.
   1. This lesion is seen more frequently in children than in adults. They occur most commonly on the hands and feet and most frequently on the digits. As single or multiple lesions, they are relatively asymptomatic except for disfigurement.
   2. Verrucae can spontaneously remiss or disappear with relatively simple treatment. However, they can also defy any method of treatment.
   3. There are about as many variations in manifestations.
      a) A resin from the roots and rhizome of the Podophyllum peltatum (podophyllin) is frequently used as a caustic agent to erode the lesion. Caution must be used so as not to compromise vital tissue.
      b) A pedunculated form of the verrucae can be clipped off at the base with scissors after the administration of a local anesthetic and left to heal by secondary intention or with superficial electrodesiccation.
      c) Surgical excision of these common warts is an excellent method of treatment and probably the most rapid and surest method.
      d) Many dermatologists depend upon electrodesiccation for removing warts. They use either a monopolar or bipolar unit. The bipolar unit is inserted into the base of the wart and current applied. The wart will dehydrate and can be removed then with scissors or a scalpel. The monopolar unit utilizes an arching spark that burns and sears the lesion to a crust which is then allowed to slough. Both of these methods may necessitate more than one treatment at weekly intervals.
      e) Various topicals can be applied to the verrucae to resolve them. Fuming nitric acid has long been a favorite. More recently, bichloracetic acid has been used in the same way. A petroleum salve is applied to the vital skin around the wart to protect it and the acids applied directly to the wart.
      f) Cryotherapy, using either liquid nitrogen or solid carbon dioxide is another effective method of treatment. Both are applied until a white frost completely covers the wart and begins to invade adjacent tissue. Again, multiple treatments may be necessary.

g) Lastly, a combined method of treatment has been used successfully at WSCC. The wart is isolated with a doughnut shaped pad that fits snuggly around the wart and the center filled with Mosco ointment. Any ointment designed to dissolve warts can be applied but Mosco has a consistency that renders it slightly more suitable. The doughnut shaped pad is covered with an anchoring adhesive and left for four or five days. Each day the "hole" of the doughnut is refilled with fresh Mosco. By the fifth day, the wart is markedly necrosed and scraped away with a scalpel. There remains only a small pearly structure at the center of the exposed lesion, which represents the heart of the verrucae. One need only arch a spark from a monopolar desiccation unit to the central seed to eliminate it. Rarely do they return.

F. Papillomas - these are small growths occurring on the skin in many areas. These lesions consist of a layer of skin covering a central stalk of fibrous tissue, which contains a nutrient artery and vein.
   1. These tumors appear most frequently on the back and in the axilla and on the neck. They are frequently referred to as "skin tags".
   2. They are asymptomatic unless traumatized, at which time they become edematous and somewhat painful.
   3. There are three simple methods for dealing with these lesions.
      a) A papilloma can be removed by a ligature placed at the base of the lesion. A silk thread can be used and tied securely enough to insure that the blood supply is cut off. Denied its blood supply and nutrients, the papilloma will necrose and fall off in 7 to 10 days.
      b) Another method of treatment is with electrodesiccation. The base is injected with a small amount of anesthetic and the papilloma retracted away from the skin with a forceps or hemostat.
      c) Occasionally papillomas will reach such size that surgical excision is recommended. Following introduction of a local anesthetic, the lesion is retracted and excised with a scalpel. It is usually necessary to close with only a solitary suture.

G. Cutaneous horns - These lesions are hard, hornlike projections extending above the level of the skin; they develop due to a marked keratosis of the horny layer of skin, which fails to be discarded. As time goes by, these lesions grow to considerable size.
   1. They can occur anywhere on the body, but most frequently appear on the head, back, and extremities. They most frequently occur in older people and should be regarded as a type of senile keratosis.
   2. There lies a danger in these lesions which cannot be over emphasized. There is a 12% likelihood that these lesions will become malignant. They can be easily removed by surgical excision under local anesthetic. All should be submitted for histologic examination.

H. Fibromas - these tumors are hard, rounded, moveable, slow growing, noninflammatory lesions. They are found usually in adults, in the skin or the subcutaneous tissue almost anywhere on the body. On section, they are composed of bundles of connective tissue which are almost cartilaginous in their hardness.
   1. Fibromas usually cause no symptoms, except disfigurement or, occasionally, slight pain due to trauma. On palpation they are sometimes very similar to sebaceous cysts and must be distinguished from them. The sebaceous cyst will move freely with the skin over underlying tissue whereas the fibroma which has neither attachments to the skin or underlying tissue, moves quite freely as if sandwiched between layers.

2. Fibromas almost never undergo malignant degeneration and are removed for cosmetic reasons primarily. Like the inclusion cyst, they can be simply extracted by creating a small linear incision over the fibroma and grasping the tumor with a hemostat and teasing it loose from any attachments.

I. Ganglia - ganglion may be defined as a cystic swelling surrounded by a fibrous tissue wall and occurring in the vicinity of joint capsules and tendon sheaths. The cause of the appearance of a ganglion has never been absolutely determined, however, there are suggestions that they are the result of a traumatic event involving the tendon sheath. There is also wide acceptance of the theory that ganglia arise as a result of a degenerative process in the mesoblastic tissue surrounding joints and tendon sheaths.

1. Ganglia appear more commonly in women than men and most commonly on the exterior surface of the wrist, although they commonly occur along any tendon course.
2. The most constant and prominent symptom is the presence of a mass that is visible and palpable. The mass becomes more pronounced with flexion or extension away from the site of the lesion. There may also be some slight compromise to normal range of motion and feeling of stiffness. Pain is frequently a symptom which increases with pressure on the lesion. They palpate as hard fixed smooth lesions that can be identified as tendon by contracture of the involved muscle.
3. There are numerous treatment approaches to the ganglion but it should be noted that the Oregon Board of Chiropractic Examiners have determined that this particular lesion lies outside the scope of practice and cannot be surgically treated by a chiropractor.
    a) Rupture - Although in the past, rupture of a ganglion by striking it with a heavy book or sharp finger pressure was dramatic, the permanent cure rate is quite low, and this technique is no longer recommended.
    b) Aspiration - this treatment method has been disappointing. The jellylike consistency of the contents does not lend itself to complete resolution. When it is felt that a ganglion is newly formed and aspiration potentially more successful, a 14 gauge one inch needle is employed.
    c) Excision - this method has been the most successful but demands the fine skill of an orthopedist specializing in extremity procedures. The capsule containing the gelatinous material must be meticulously dissected out. A firm compression bandage is applied post-surgery to insure that infiltration back into the wound site does not occur.
    d) Hydrocortisone - hydrocortisone in saline solution, 25 mg. per ml, is injected in amounts from 0.3 to 0.5 ml. directly into the swelling, without anesthesia or aspiration. A single treatment is usually successful, but 2 or 3 injections at weekly intervals may be necessary.

XVIII. Skin Lesion Treatments

Methods available to chiropractic minor surgeons for the treatment of skin lesions – cryosurgery, electrocautery, hyfrecation, radio-surgery and laser

Characteristic	Cryosurgery	Cautery	Hyfrecator	Radio Surgery	Scalpel	Laser
Cutting	No	Yes	No	Yes	Yes	Yes
Control of bleeding	No	Yes	Yes	Yes	No	Yes
Ability to obtain biopsies	Yes	Yes	No	Yes	Yes	Yes
Self-sterilizing	No	Yes	No	Yes	No	Yes
Production of sterilized cut	No	Yes	No	Yes	No	Yes
Healing time	Same	Same	Same	Same	Same	Same
Production of scar tissue	No	Yes	Little	No	Yes	No
Ability to plane soft tissue	No	No	No	Yes	Yes	Yes
Portability	Yes	Yes	Yes	Yes	Yes	Yes
Initial costs	++	++	+++	++++	+	+++++
Ongoing costs	++	+	+	++	+	++
Need for local anesthesia	No	Yes	Yes	Yes	Yes	Yes

A. Cryosurgery. Liquid nitrogen will treat most superficial skin lesions including viral warts freezing the tissue to –196 degrees centigrade.. Results are good, cryobiopsies can be obtained for histology, there is minimal scarring and most treatments are given without prior anesthesia. More than one treatment may need to be given and supplies of liquid nitrogen need to be available easily. Maintenance costs are minimal and running costs are just the cost of the liquid nitrogen.

B. Electrocautery – The small, hand-held cordless disposable cautery is an ideal instrument to start minor surgery. It can both cut and coagulate, is immediately available and can be used for the removal of most skin lesions, either alone or with a curette or scalpel. Local anesthesia is necessary for many lesions. Maintenance costs are minimal. It produces thermal damage to delicate tissues with some degree of scarring. Histological specimens may be obtained in most cases. It is very portable and may be taken to the patients home. Burners are self-sterilizing. One disadvantage is the smell of burning. A vacuum exhaust or fan is advisable.

C. Hyfrecator – (Fulguration) This instrument is ideal for treating all superficial skin lesions, including keratoses, angioma, warts, molluscum and papillomas. Local anesthesia is necessary. Thermal damage occurs with consequent scarring. The electrodes are not self-sterilizing. It is excellent for vascular lesions and for hemostasis and obliteration. The disadvantages include difficulty in obtaining specimens for histology and the smell of burning. A vacuum pickup or extractor fan is advisable. Maintenance and running costs are minimal. Portability is an advantage.

D. Radio-Surgery – This radio frequency generator combines both cutting and coagulation. There is minimal thermal damage to tissue and excellent cosmetic results with minimal scarring. Lesions may be ‘planed’ down to skin level. There is minimal postoperative pain with rapid healing. Local anesthesia is needed for most lesions. Specimens may be obtained for biopsy. Electrodes are self-sterilizing. Maintenance costs are minimal – mainly the cost of replacing wire electrodes and flexible cables. Running costs are minimal. The smell of burning is more pronounced than with electrocautery so a good vacuum extractor unit is necessary. It is semi-portable.

E. Laser –The term "laser" is an acronym for Light Amplification by Stimulated Emission of Radiation. Lasers are instruments which can convert electrical energy into light which can be used for a variety of purposes. Lasers have come to occupy unique and important roles in surgery. Lasers are the brightest known source of light, and can have extremely powerful effects on the human skin. The uniqueness of lasers derives from a number of special properties. Among these are extreme high intensity, coherence, which permits focusing on a very small spot size, and provides the capacity for delivered in very brief pulses. The greatest disadvantage of lasers in chiropractic minor surgery is cost. Specialized training is provided by laser manufacturers.

    (1) Dermatologists have used lasers since the 1960's for the treatment of skin lesions, although generalized acceptance of laser therapy has occurred only in the last few years. Most recently, revolutionary technological advances have improved lasers to the point where they now offer significant advantages over standard techniques used for the treatment of skin blemishes, tumors, tattoos, birthmarks and facial aging changes. Specific lasers are chosen based on the condition one wishes to treat.

Comparison of various minor surgery therapies in the treatment of different skin lesions

Uses	Cryosurgery	Cautery	Hyfrecator	Radio-surgery	Scalpel	Laser
Intradermal Nevi	Yes	Yes	Yes	Yes	No	Yes
Spider veins	No	Yes	Yes	Yes	no	Yes
Viral warts	Yes	Yes	Yes	Yes	Rarely	Yes
Ingrown toenails	Some	No	Some	Yes	Yes	Yes
Keratoses	Yes	Yes	Yes	Yes	Yes	Yes
Basal cell carcinoma	Yes	Yes	Yes	Yes	Yes	Yes
Skin tags	Some	Yes	Some	Yes	Yes	Yes
Kerato-acanthoma	Yes	Yes	Yes	Yes	Yes	Yes
Molluscum contagiosum	Yes	Yes	Yes	Yes	No	Yes
Pyogenic granuloma	Some	Yes	Yes	Yes	No	Yes
Seborrheic warts	Yes	Yes	Yes	Yes	Yes	Yes
Cervical erosions	Yes	Yes	Yes	Yes	No	Yes

XIX. Common Office Presentation and Procedures

A. Furuncles and Carbuncles

1. Furuncles and carbuncles are the names applied to local staphylococcal infections of the skin and the subcutaneous tissue. Each begins as an infection of a hair follicle or of a sebaceous gland and progresses to produce a small area of induration with central necrosis known as a pustule. The central necrosis is surrounded by a well formed area of redness. When singular in formation, it is referred to as a boil (furuncle). In areas in which there are dense fibrous septa extending from the skin to the underlying fascia, the infection may extend from one area of subcutaneous tissue to another without effective walling off of the process, thus attaining considerable size. This lesion is known as a carbuncle.
2. Predisposing factors - in many instances the recognition and the appropriate management of predisposing factors may be as important as the administration of specific measures. The following short list of predisposing factors will aid in not only assessing the fulminating lesion, but provide insight into preventive measures.
   a) Trauma of any form, which includes exposure to irritants, deodorants, and defatting agents.
   b) Poor hygiene. Easily the most significant predisposing factor.
   c) Local causes of pruritis, such as insect bites and pediculosis capitis.
   d) Excessive sweating, especially of intertriginous sites, hands, and feet.
   e) Climatic factors, primarily hot humid areas.
   f) Diabetes and blood dyscrasias.
3. These lesion occur on any part of the body, but most frequently on the face, the back of the neck, the axillae, the groin, the buttocks, the arms, and the proximal phalanges of the fingers. The fully manifested furuncle/carbuncle is exquisitely painful especially with movement of the involved area. It commonly takes 4 to 6 days for the lesion to become fully "ripe", complete with central core of necrosis. Once the central core is established, the lesion can spontaneously rupture and pain relief occurs. In the carbuncular type of infection, the walling off process cannot keep pace with the spread of infection. As a result, the encircling inflammatory wall of induration is frequently quite wide in diameter, and "pointing" or central core formation occurs at multiple sites. An elevated temperature and evident "toxemia" as a result of absorption from the area of infection usually occurs with this manifestation when untreated. Should this occur the outcome can be extremely serious and even life threatening.

4. Treatment of established local staphylococcal infections still rests chiefly on the surgical principles of rest, elevation, heat, and drainage when pus has formed. Scrupulous cleanliness is the first principle of management. For the small or singular furuncle, the central core of the necrosis can be lifted out with a needle or forceps. Local anesthetics cannot be used because of the added risk of inoculating the infection into deeper adjacent tissues. If the furuncle is so painful that any contact with the lesion is difficult, one can use a topical skin refrigerant, ethyl chloride, to momentarily freeze the area and provide enough decreased sensitivity to remove the central core. The treated furuncle is dressed with Neosporin or neomycin antibiotic ointment. This dressing must be changed daily and any new pus removed until such time that the induration and redness remiss and the healing process well established. Without constant monitoring, there is every likelihood that the lesion will reoccur. The more involved or lobulated lesion common with carbuncles presents a different set of circumstances that must be attended with considerably more caution. Given the increased size of these lesions and the presence of copious amounts of pus, it is advisable that if the option to intervene is exercised, the débrided lesion should be packed with an iodine impregnated gauze which acts as a wick to soak up excess exudate as well as an anti-infectious agent. It is ill advised to address these lesions without access to systemic antibiotics. Although incision and drainage has for a long time been the recommended treatment, this should not be done without antibiotic coverage.

B. Paronychia
   1. Paronychia is probably the simplest type of infection that involves the distal phalanx. It appears along the nail near the base. It is usually the result of a Staphylococcus aureus invasion following some type of trauma or the biting off of a hangnail. The result is an exquisitely painful and swollen soft tissue along the nail bed and edge.
   2. The treatment of choice is to induce drainage at the earliest opportunity. This is accomplished by raising the nail edge with a scalpel at the site of the swelling and provide an exit for the accumulating pus. The escaping pus will provide immediate relief. The knife can be drawn along the nail to separate the skin over the tiny abscess sufficiently to provide adequate drainage. This can be followed with 24 hours of hot wet compresses to encourage drainage. A simple dressing with topical antibiotics is then placed around the finger for 3 or 4 days.
   3. If the infection has extended beneath the eponychium at the base of the nail and into the subungual space, it is usually necessary to make an incision through the eponychium parallel to the lateral edges of the nail. This incision is carried downward to permit the eponychium to be turned back to expose the nail bed. As much of the nail bed as is undermined with pus is excised, the scalpel or scissors is used.

C. Nail removal
   1. Not infrequently, due to infection, trauma, or fungal invasion, it is necessary to remove an existing nail and allow formation of a new nail. This is an uncomplicated procedure when done properly.
   2. There are two methods by which anesthesia can be achieved. Both are effective but different levels of skill in application are required.
      a) Nerve block - this method demands the most skill but is usually the most effective in acquiring total anesthesia. (See nerve blocks in section on conduction anesthesia)
         (1) Best option for complete avulsion.

b) The other method necessitates less skill but may be more painful to the patient. Injection sites are selected just lateral and proximal to the nail bed root and local infiltration through the field block method instituted. This will result in complete anesthesia of the nail bed and half the nail. It is necessary to inject additionally through the distal most aspect of the digit just beneath the nail bed. Allow as much time after the proximal injections as possible. The distal injection is quite painful because of the profusion of sensory nerves. Best option for partial avulsion.

c) Keep in mind that one cannot use epinephrine additive to control bleeding.

3. Complete Avulsion- Once complete anesthesia is obtained, a spatulated flat blade is inserted between the nail and nail bed from the distal end. One simply moves the blade from side to side and separates the nail from the bed. Once the nail has been separated from the bed, a hemostat is used to grasp and elevate the nail away from the digit and the physician pushes the remaining anchoring tissue away from the nail.
4. Partial Avulsion- Prepare toe with povidone iodine. Use anesthetic without epinephrine in digital nerve block. Apply short duration use of tourniquet for hemostasis. Identify 20-25% of toenail for partial avulsion. Use nail elevator to separate from nailbed then use nail splitter to cut beneath the nail fold. Grasp avulsed nail with hemostat, twist toward lateral nail fold and remove by pulling straight out. Confirm lack of fragments to avoid nail spicule & recurrence. After hemostasis remove tourniquet and perform matrix destruction
   a) Matricectom- Options include chemical, electrocautery, radiofrequency, CO2 laser ablation
      (1) Chemical uses 80-88% phenol applied topically to matrix for 30 seconds times 3 rounds followed by neutralization of phenol by topically application of 70% isopropyl alcohol
         (a) Caution- if tissues other than matrix affected during application of phenol post-surgical oozing may occur for 6-8 wks
         (b) Contraindicated if patient, surgeon or assistant are pregnant
5. The digit is dressed with a non-stick bandage saturated with a topical antibiotic ointment. The dressing should be changed daily for approximately one week. A thin healing crust will rapidly granulate in over the exposed nail bed and the dressing can be removed permanently.

D. Fishhook trauma

1. Not infrequently in this region, a patient will present with a fish hook imbedded somewhere in his/her body. Attempts to remove the fish hook by the patient are usually unsuccessful due to the presence of a "barb" near the point of the hook which will not allow for the hook to be "backed out".
2. The physician need only inject a small amount of local anesthetic near the projected exit point of the hook. Following anesthesia, the hook is grasped firmly with a plier or needle holder and pushed on through the skin to its natural point of exit. Once the point is pushed through and the part exposed, the physician clips off the point and barb with wire cutter and backs the remaining portion of the hook out. Encourage bleeding of the wound and bandage it with a simple dressing and a topical antibiotic ointment. Care should be taken to monitor this wound because hooks are frequently dirty and there is a good chance for secondary infection.

E. Ring Removal
   1. Occasionally a patient will present with trauma to a finger that has a ring on it. The patient will complain that the swelling is causing lots of pain and there appears the possibility of strangulation of the finger unless the ring is removed.
   2. To avoid having the ring cut off, one should first attempt the following technique. Push the ring as proximally as possible and thread the end of a piece of 2-0 suturing material between the ring and the finger. Starting at a point as far from the ring as possible, begin to make looping turns tightly around the finger with the suture material moving ever proximally. The great knuckle and the accumulated serous fluid is pushed away. An ointment is then applied to the suture material and the ring slides off the finger. This entire action must be done rapidly because there is total compromise of the vasculature during this process. Once the ring is removed, the suture material is unwound.

F. Bites - 90% of all bites are from dogs, 5% from cats, and 5% from other animals. Most bites harbor a gram negative bacillus - Pasteurella multocida.
   1. Animal bites - most of these bites are limited to minor abrasions but can be more involved tears. All complicated tears should be referred out immediately. Simple lacerations or puncture bites can be maintained with careful cleansing of the involved area and covered with a protective bandage swabbed with an antibiotic ointment. All animal bites should be treated as if rabies were present: animal control personnel should be contacted so as to quarantine the biting animal. Suturing of animal bites should not be done; they are dirty wounds and the introduction of micro-organisms contraindicate closure of these types of wounds.
   2. Human bites - The vast majority of these types of bites occur over the metacarpophalangeal joint on the dorsum of the hand, where a clenched fist would normally come in contact with the teeth of a combative opponent. Anaerobic and aerobic cocci, fusiform bacilli, and spirochetes present in the mouth are thus transferred to broken areas of the skin. Anaerobic streptococci seem to be the most important of these microorganisms. The organism most frequently associated with human bites is Eikenella corrodens. Infected lesions include soft-tissue necrosis, cellulitis, abscess formation, tenosynovitis, thenar and palmar space infections, and dorsal subcutaneous and sub-aponeurotic space infections. These are extremely dangerous injuries, especially when ignored or treated incorrectly. Proper treatment of these hand wounds begins with cleansing the part for at least 10 minutes with soap and water or some detergent. Strong antiseptic solutions are never used. Debridement is carried out under good anesthesia but suturing is to be avoided as well as tightly packed post treatment dressing. The hand should be splinted loosely and the patient should seek penicillin therapy.
   3. Snake bites - There are probably more old wives tales about snake bites and snake bite remedies than any other medical emergency. The following information comes from the Handbook of Snakes, Vol. II, by Wright and Wright. This is the most comprehensive and one of the most widely respected treatises on North American snakes in publication.
      a) Coral Snake (Elapidae - genus Micrurus). Though thought to be extremely venomous, these snakes are entirely inoffensive in behavior and rarely bite when handled. There is still much doubt in some quarters, despite recorded fatalities, that the bite of the coral snake is very serious.

b) Copperhead (Crotalidae - genus Ancistrodon). Few adults die from the bite of copperheads, though many have been bitten with severe consequences. It is reasonable to believe that a 30 inch copperhead might inflict a rapidly fatal bite on a child 8 years old or younger. Copperheads are usually mild, but one should not be careless or foolhardy with them. Its venom is less virulent than the rattlesnake.

c) Water Moccasin (Crotalidae - genus Ancistrodon). The following record of moccasin bites in Florida was compiled from newspaper accounts and from records of the Bureau of Vital Statistics. Beginning in 1934, there were 8 cases of bites resulting in 3 fatalities. From that date to 1944, there were no fatalities in 60 reported bites.

d) Rattle Snakes - (Crotalidae - genus Crotalus). There are somewhere around 30 species of rattle snake in North America. Adult sizes vary considerably in length and the amount of toxicity of their venom as well as their temperament can vary widely depending on species. According to a Mr. Blatchley, "people are bitten by rattlesnakes in some part of Florida almost every year. Three have been bitten since I have had my winter home here, and two of them died within a few hours." According to Allen (1945), "the mortality rate from the bite of this snake is about 30%." According to Wright and Wright, the Western Diamondback is our largest, with the largest fangs, injects the most venom (though less toxic drop for drop compared to some other rattlesnakes) and is our most dangerous snake. Enough people die from its bite to warrant advising outdoor people to always be on the alert. Fortunately, the before-mentioned snakes are not endemic to Oregon. The only poisonous snake found in Oregon is Crotalus viridis oreganus. It can be found east of the Cascades in both Northern and Southern Oregon. Its more popular names include Pacific Rattler, Western Rattler, Oregon Rattler, and California Rattler. For a period from 1927 to 1934 there were 134 bites of C. V. oreganus with 9 deaths. Treatment protocol is covered in Emergency First Aid.

e) The treatment of snake bites by laymen has historically been worse than the snakebite. There are three commonly accepted procedures that should be discontinued in light of recent literature. 1) Cryotherapy or application of ice is contraindicated. 2) Incision and suction, the popular "cut and suck" technique actually facilitates envenomation and compounds the problem. 3) Tourniquets, ligatures or other constrictive bands should be avoided and replaced with an immobilization splint at heart level.

4. Spider Bites - All spider bites are venomous. There are two groups of poisonous spiders in the U.S. The Latrodectus (widow spiders) and the Loxosceles (brown spiders) are found in all states. The bites of the widow spider carry a venom that is histolytic and systemic. There have been thousands of clinical cases and many deaths. Lyovac is the commonly used antivenin for the black widow spider. The widow spider is identified by the red hourglass on the underside of the body. The brown recluse sports a dark fiddle-shaped configuration on the dorsal cephalothorax. The major symptoms of the widow spider bite are severe pain, cramps, and muscle spasm that eventually affect the whole body. Pain and discomfort usually persist for 24 hours and then decrease by the next day. Symptoms exhibited by the brown recluse are anorexia, apathy, and dehydration during the first 8 hours post bite. The bite site becomes erythematous and then forms a blister surrounded by a halo of ischemia. In a week or so, the central area becomes depressed and necrosed. The necrosis spreads and forms an ulceration. Systemic reactions consist of chills, fever, nausea, vomiting, arthralgia, and petechial eruption within 24 hours post bite.

5. Hymenoptera - This order includes bees, wasps, hornets, ants and other stinging insects of which the venomers are the females. The venom is expelled via an ovipositor which has the dual purpose of injecting poison and depositing eggs. Responses to these stings range from histamine wheal to fatal anaphylactic shock. The interval between envenomation and death is usually rapid - less than one hour. If allergic systemic symptoms ensue, the venom's hemolytic and neurotoxic effects appear, with the development of petechial hemorrhages, malaise, weakness, nausea, vomiting, abdominal cramps, dyspnea, vascular collapse, and death. Treatment for this is like any anaphylactic reaction. (See Toxic Effects of Anesthetics).
6. Tick Bites - Ticks do not actually bite, rather, they attach themselves to a host by embedding their heads in a burrowing action into the skin. Tick attachments are quite common in Oregon, especially in the eastern portion of the state and in the mountainous areas. The most commonly infected areas are the scalp, axilla, back of the neck, and trunk. It requires 5-6 days of attachment for a tick to inject enough toxic regurgitation to induce paralysis. The Rocky Mountain Spotted Fever variety of tick is not found in Oregon. Again, there are many "home cures" for tick attachment. They range from burning them out with a lit cigarette to unscrewing them counter clockwise, neither of which is very effective. If one tries to forcibly remove the tick by pulling or tugging on them, there is every likelihood that the body will detach from the head and leave the head buried beneath the skin. Another reported method of treating tick attachment is to use a petroleum based product like kerosene or Vick's Vapor Rub or turpentine. It is generously applied to the exposed trunk of the tick. The application is toxic to the tick and interferes with the respiration cycle. The tick is therefore forced to let go and seek a safer haven. Current literature does not support any of these approaches to tick removal. The most acceptable treatment is to grasp the tick's exposed body and apply gentle retraction. The tick eventually will release its grasp. After the tick has been removed, clean the attachment area thoroughly with soap and water and finish with an application of iodine.

XX. Burns and Frostbite

A. Frostbite - this is a form of peripheral vascular disease due to exposure to cold.

1. Predisposing factors
   a) Increased heat loss due to wet clothing or contact with metal (Conduction).
   b) Increased heat loss due to high wind velocity commonly referred to as wind chill factor (Convection).
   c) Difference in temperature gradients between the body and surrounding environment. The greater the difference, the greater the heat loss (Radiation).
   d) Existing impaired circulation as is found in diabetics, peripheral vascular disease, and arteriosclerosis.
   e) Other factors that will predispose a person are drunkenness, unconsciousness, exhaustion, hunger, and age (the very old and the very young).
2. Symptoms - After exposure to the cold, a patient notices a stinging, burning sensation in the exposed part and then a definite numbness or anesthesia. The exposed area becomes wax-white in color. If the patient seeks warmth at this time, they may experience itching and tingling and redness of the involved area. Chilblains may form, which are nodular swellings surrounded by a reddened area of hyperemia or cyanotic flat swellings in the exposed area. Chilblains cause symptoms long after the exposure to cold is over. They are characterized by painful, tingling sensations, which are aggravated when the part becomes warm. If exposure to cold is continued beyond the numbness phase, more marked changes occur. Vesicles or blebs form over the exposed area with marked soft tissue swelling accompanied by painful burning sensations. Prolonged exposure produces death of the tissue and gangrene.
3. Treatment - It has been accepted for years that rubbing snow on the area of frostbite will help. This has not been shown to be correct. The most accepted method of treatment today is internal and external rewarming. External rewarming should be with dry warmth. Internal rewarming can be with any warm liquid. Should vesicles or blebs appear, the patient should be transported to a hospital or emergency facility.

B. Burns - Burn treatment and classification are covered in the Emergency First Aid Class. However, a brief review for emphasis is included here.

1. Severity - Burn severity is determined by the following factors:
   a) Extent - how much of the total body area is involved. Burns involving more than 10% of the body surface in children and 15% of the body surface in adults are considered serious and hospitalization necessary.
   b) Depth - how deep does the burn go.
   c) Location - where on the body does the burn appear.
   d) Patient's age - the very old and the very young have special needs in treating burns as well as potential complications.
   e) Patient health - a person in ill health will not respond to treatment as well as a healthy patient.
   f) Cause or agent - severity is greatly determined by the source of the burn i.e., fire, acid, liquid gases, radiation (sun and nuclear) and boiling liquids. Each demands its own set of unique treatment protocols.

2. Degree of Burn
   a) First degree burns involve the epidermis only and manifest as an erythematic reaction, usually a sun burn. There are no blisters or systemic effects except in those rare occasions when a patient experiences some nausea, headache, or malaise. Patients usually recover within 24 to 48 hours. Treatment of this burn is accomplished with the application of any one of the over-the-counter antiseptic/anesthetic ointments.
   b) In second degree burns there is more marked local tissue disturbance, with capillary wall destruction resulting in edema and bleb formation. These burns are by far the most frequent in number. The best results for treatment of these burns is obtained by:
      (1) Wash the area with white soap and water.
      (2) Do not break blisters or debride the wound.
      (3) Cover with fine mesh gauze impregnated with petroleum or Sulfamylon cream.
      (4) Apply over this a firm dressing bulky enough to keep dirt away from the injury.
   c) Third degree burns involve destruction and tissue loss with subsequent scarring. Any patient presenting with a third degree burn should be referred out to a hospital or emergency care facility for treatment.

XXI. Proctology

A. Anatomy of Rectum and Anal Canal

1. The rectum is arbitrarily described as beginning at the level of S3 vertebrae, descending along the curvature of the sacrum and coccyx, and ending at the upper aspect of the pelvic diaphragm. It measures 12 to 15 cm in length.
2. The anal canal is the terminal portion of the intestinal tract. It begins at the anorectal junction, is 3 to 4 cm in length, and terminates at the anal verge. It is surrounded by strong muscles, and due to the tonic contraction of these muscles it is completely collapsed and represents an antero-posterior slit. The musculature of the anorectal region may be regarded as two tubes, one surrounding the other. The inner tube, being visceral, is smooth muscle and innervated by the autonomic nervous system while the outer, funnel-shaped tube is skeletal muscle and has somatic innervation.
3. This short segment of the intestinal tract is of paramount importance because it is essential to the mechanism of continence and is prone to many diseases.
4. The lining of the anal canal consists of epithelium of different types at different levels. At approximately the midpoint of anal canal there is an undulating demarcation referred to as the dentate line. This line is approximately 2 cm from the anal verge. Because the rectum narrows into the anal canal, the tissue above the dentate line takes on a pleated appearance. These longitudinal folds, of which there are 6 to 14, are known as the columns of Morgagni. Between adjacent columns, at the lower end, there is a small pocket or crypt. The crypts are of surgical significance in that foreign material may lodge in them, obstructing the ducts of the anal glands, which results in abscesses. The mucosa of the upper anal canal is lined by columnar epithelium. The change, however, is not abrupt. For a distance of 6 to 12 mm above the dentate line there is a gradual transition.

B. Muscles

1. Internal sphincter: The downward continuation of the circular smooth muscle of the rectum becomes thick and rounded at its lower end and is referred to as the internal sphincter. Its lowest portion is just above the lowest portion of the external sphincter and is 1.0 to 1.5 cm below the dentate line. It is an involuntary muscle innervated by both the sympathetics and parasympathetics. The sympathetic is motor, and parasympathetic inhibitory to the sphincter.
2. Conjoined Longitudinal Muscle: At the level of the anorectal ring, the longitudinal muscle coat of the rectum is joined by fibers of the levator ani and puborectalis muscles. The conjoined longitudinal muscle so formed, descends between the internal and external anal sphincters. It has been suggested that the role of the conjoined longitudinal muscle is to affix the anal canal and to evert the anus during defecation.
3. External Sphincter: An elliptical cylinder of skeletal voluntary muscle which surrounds the anal canal has been described as consisting of the subcutaneous, the superficial, and the deep portions. The lowest portion of this muscle occupies a position below and slightly lateral to the internal sphincter. A palpable groove at this level has been referred to as the intersphincteric groove. The external sphincter is supplied by the inferior rectal nerve and a perineal branch of the fourth sacral nerve.
4. Levator Ani Muscles: The levator ani muscle is a broad, thin muscle which forms the greater part of the floor of the pelvic cavity, and is innervated by the fourth sacral nerve.

5. Puborectalis: This muscle arises from the back of the symphysis pubis and the superior fascia of the urogenital diaphragm, runs backward alongside the anorectal junction, and joins its fellow muscle of the other side immediately behind the rectum where they form a U-shaped loop which slings the rectum to the pubes.

C. Blood Supply of the Rectum and Anal Canal

1. Superior Rectal Artery: is the continuation of the inferior mesenteric artery which, after crossing the left common iliac artery, changes its name to superior rectal artery. Further branching pierce the muscular coat, and in the submucosal plane reach the anal columns, where they terminate above the anal valves as a capillary plexus. This vascular distribution may account for the prominence of hemorrhoids in the three major positions (right anterolateral, left anterolateral, and left lateral).
2. Middle Rectal Arteries: arise from the anterior divisions of the internal iliac arteries and reach the lower portion of the rectum anterolaterally at the level of the levator ani muscle.
3. Inferior Rectal Arteries: arise from the internal pudendal arteries which in turn arise from the internal iliac. They traverse the ischiorectal fossa supplying the anal sphincter muscles.
4. Middle Sacral Artery: arises from the back of the aorta, 1.5 cm above its bifurcation, descends over the last two lumbar vertebrae, sacrum, and coccyx, and behind the left common iliac vein, the presacral nerve, and the superior rectal vessels to supply the lower portion of the rectum.

D. Nerve Supply

1. The large intestine, including the rectum, is innervated by the sympathetic and parasympathetic systems. The external anal sphincter and the lining of the anal canal, below the dentate line, are supplied by somatic nerves.

E. Examination Orientation

1. The standard position of reference when discussing anorectal disease and treatment is the left lateral Sims position.

XXII. Disease Conditions of the Anorectal Canal: The differential diagnosis of an anorectal condition can frequently be made by the accurate delineation of the type of bleeding experienced by the patient. One must determine whether the patient is passing clots, or it is true melena. Whether the blood is mixed with the stool, or separate from the stool, whether the blood appears on the toilet tissue, or it drips into the toilet bowel. Blood which drips into the toilet bowl, and is bright red in nature, and free and separate from stool, is frequently associated with bleeding internal hemorrhoids. Blood which is on the tissue tends to be associated with anal fissures or an abrasion of the anal canal. Melena, obviously, can be caused by any pathological process higher up in the gastrointestinal tract. The association of blood and mucus usually is seen with a low lying carcinoma or, more frequently, with an inflammatory condition such as ulcerative colitis or Crohn's disease. The passage of blood clots is usually associated with a sources of colonic origin.

A. Skin Tags: Areas of hypertrophied cutaneous tissue located adjacent to the anus. They are usually more common in the postero-lateral quadrants of the anus and there is evidence of previous external hemorrhoidal disease whether thrombosed or non-thrombosed. Newer tags have some degree of blood content, have a normal flesh color and feel spongy when palpated. Older tags have little blood content and appear off-white in color and feel indurated when palpated. Aside from old external hemorrhoidal disease, other etiological factors associated with skin tags include;
    a) Anal Fissure or Fistula
    b) Crohn's Disease
    c) Condyloma Acuminata
    d) Anal Neoplasia - Bowen's Disease
    e) Pruritus Ani
    f) Previous anorectal surgery

    1. If the tag is small, it is usually asymptomatic, apart from occasional itching and difficulty in maintaining anal hygiene. If tags are large enough to be symptomatic, they are characterized by periodic swelling, itching, irritation, crawling sensation, and poor anal hygiene. If tags become inflamed, they may ulcerate and cause considerable burning and intense pain.
    2. If Symptomatic, palliative treatment consists of anesthetic ointments, topical ointments, and hot sitz baths. If persistently irritating, and related to anorectal disease, the disease causing the tags must be addressed, and usually includes removal of the skin tag. The type of surgery may vary: cryosurgery, laser surgery, or electrosurgery.

B. Pruritis Ani: is an unpleasant cutaneous sensation characterized by varying degrees of perianal itching. Men are affected over women in a ratio of four to one. The perianal skin becomes thin, friable, tender, blistered, ulcerated and weeping. In later stages the skin is raw, red and oozing, or pale and thickened (lichenified).

    1. Most commonly, pruritus ani occurs in patients who have loose stools, and are unable to cleanse properly (Stroke, MS, Arthritis) or may be associated with the healing phase of an anal condition. Fifty percent of pruritus ani is due to other diseases.
    2. One must always question the patient regarding the use of antibiotics since they may be the cause of pruritus ani. The overuse of topical steroids is a particular problem resulting in "steroid skin." The perianal skin develops marked striae. Overgrowth with candida is common, but can be prevented by limiting the duration and strength of the steroid ointment used.

3. Diet may also be the cause of pruritus ani. Such things as coffee, chocolate, tomatoes, spicy foods, and citrus fruits are irritating
4. Always treat the underlying cause as complications from perfumed or colored toilet tissue can be enough to cause pruritus.
5. Idiopathic pruritus is labeled after a comprehensive work-up fails to identify a specific cause. Try to keep the area dry.

C. Hemorrhoids

1. Within the anal canal there exists highly vascular "cushions" consisting of discrete masses of thick submucosa which contain blood vessels, smooth muscle, and elastic connective tissue. Hemorrhoids are a sliding downward of this part of the anal canal lining. These cushions are located in the left lateral, right anterolateral, and right posterolateral sites. The presence of even very large cushions, in the absence of symptoms, is no cause for alarm, and is certainly not an indication for treatment. At least 5 to 15 percent of the general population suffers from symptoms referable to hemorrhoids, although it is unusual under the age of 30 years except in pregnant and post-partum women. The incidence increases with age, and it seems likely that at least 50 and as high as 70 percent of people over the age of 50 have some degree of hemorrhoid formation. Men seem to be affected at least twice as frequently as women.
   a) Causes: Many factors have been implicated in the causation of hemorrhoidal disease
      (1) Heredity appears to be a factor as anatomical variations with circulation or sacro-coccygeal angle
      (2) Our erect posture directs gravitational forces to produce or aggravate hemorrhoids
      (3) The notable absence of valves in the hemorrhoidal plexus
      (4) The notable absence of adequate draining veins into the portal plexus
      (5) Obstruction of venous return due to raised intra-abdominal pressure
      (6) Diarrhea states predispose hemorrhoid formation or irritation
      (7) Hyperfunction of the internal sphincter along with continued straining may be the most responsible factor
2. Classification
   a) External skin tags: are discrete folds of skin arising from the anal verge. Such tags may be the end result of thrombosed external hemorrhoids, or may be a complication of inflammatory bowel disease independent of any hemorrhoidal problem.
   b) External hemorrhoids: are the dilated venules of the inferior hemorrhoidal plexus which is located below the dentate line and covered by squamous epithelium. Usually quite painful especially if there is thrombosis. If non-thrombotic, they are usually characterized by itching, irritation, swelling and pain
   c) Internal hemorrhoids: are the symptomatic, swollen submucosal vascular tissue located above the dentate line, and covered by transitional and columnar epithelium. Classification of internal hemorrhoids include:
      (1) First degree - no protrusion but bulge into lumen of rectal canal;
      (2) Second degree - protrude at stool and reduce spontaneously;
      (3) Third degree - protrude at stool but must be manually reduced;
      (4) Fourth degree - protrude at stool and cannot be reduced.

(a) In the diagnosis of internal hemorrhoids, several symptoms may be present. Bleeding is classically bright red and painless and occurs the end of defecation. Blood usually drips or squirts into the toilet bowl and accounts for 75% of all frank bleeding from the bowel. Prolapse of the hemorrhoids to below the dentate line usually occurs at the time of straining at defecation and spontaneously reduces.

d) Mixed hemorrhoids: are those in which elements of internal and external hemorrhoids are present.

e) Strangulated hemorrhoids: occur in circumstances where the prolapsed hemorrhoids, due to the spasm of the sphincter, have their blood supply cut off. Strangulated hemorrhoids will result in gangrenous hemorrhoids

3. Examination
   a) General patient assessment to ascertain the general health status, and in particular to exclude associated disease, notably bleeding disorders and liver disease with portal hypertension.
   b) Inspection and digital examination will exclude low-lying rectal and anal neoplasms and asses sphincter tone.
   c) Anoscopy is the definitive examination. Proctosigmoidoscopy must be performed in all cases in order to visualize the rectum and lower colon so that con-existing conditions may be excluded, in particular, carcinoma and inflammatory bowel disease.
4. Treatment
   a) Dietary manipulation and education is all that is required in patients with first degree hemorrhoids with occasional symptoms of painless bleeding. Also stool softeners (vegetables and cereal fiber), suppositories, and hot sitz baths.
   b) For patients with first degree hemorrhoids not relieved by dietary means, rubber band ligation is simple, quick and effective. The ligated tissue sloughs off in about 7 to 10 days decreasing the size of the hemorrhoids and causing submucosal scarring and partial atrophy of the venous plexus. Rubber band ligation can only be used on internal hemorrhoids.
   c) Sclerotherapy, a solution such as 5% phenol in vegetable oil, is injected submucosally above the internal hemorrhoids. Like rubber banding, it is indicated in patients with first degree or second degree hemorrhoids unrelieved by simpler means.
   d) Manual dilation of the anus is sometimes used to overcome anal obstruction due to constricting bands, or anal sphincter dysfunction. This is done under anesthesia then followed with a daily home routine using a special grooved anal dilator. Patient self-dilation is performed daily for two weeks, and at regular intervals for as long as six months. Manual dilation was the accepted treatment for hemorrhoids at the Royal Academy of Surgeons in London.
   e) A partial internal sphincterotomy is widely used for the management of patients with anal fissures where it is though that the underlying problem is one of “hyperfunction” of the internal anal sphincter. It is though that similar dysfunction accounts for the occurrence of hemorrhoidal disease. Minor incontinence occurs in 25% of patients.

f) Cryotherapy is the application of liquid nitrogen to the hemorrhoid. The main problem encountered is that of profuse foul discharge which can continue for two weeks until the necrosed tissue sloughs off. This therapy is not in wide use due to the many problems and hazards.

g) Closed hemorrhoidectomy should be reserved for patients having unrelenting symptoms of prolapse, pain or bleeding, or in whom large hemorrhoids are found to be associated with other anorectal pathology requiring operative management.

h) Non-surgical Negative Galvanic (Keesay Technique) is indicated for internal hemorrhoids and simple prolapse. It is the historic Chiropractic treatment for internal hemorrhoids. The hemorrhoid is injected with 1cc xylocaine and 12 to 18 mA of negative galvanic current is applied across the hemorrhoid. The treatment is repeated daily until reduction is complete. Extensive internal hemorrhoidal disease may require 10 to 20 treatments. Immediate application of ice with for 5 minutes and each hour for 4 hours greatly reduces patient discomfort. Contraindications to this treatment include certain drug use (coumadin, anti-inflammatories, insulin, anti-hypertensives) and certain disease states (diabetes, hypertension, heart disease, ulcerative colitis, Crohn's, pregnancy and infectious disease such as STD's). A complication of bleeding may arise after 5 to 10 days as the necrotized tissue sloughs off.

i) Thrombosed external hemorrhoids, if diagnosed within 4 days, can be excised under local anesthetic to relieve the pain. After 4 days it is best to treat conservatively with hot sitz baths, suppositories and stool softeners.

D. Fissure In Ano: may be defined as a painful linear ulcer situated in the anal canal and extending from just below the dentate line to the margin of the anus. It is very common.

1. Symptoms
   a) Pain for ½ to several hours after defecation
   b) Frank bleeding
   c) Constipation
   d) Dysuria
2. Affects both sexes equally
   a) Located mid-line posterior in 99% of men
   b) Located mid-line posterior in 90 % of women with 10% in women located anteriorly.
3. A lateral fissure can be indicative of severe systemic disease.
4. Most fissures heal readily, however, if it persists secondary changes develop. Swelling at the lower end of the fissure, forming a "sentinel pile" and swelling and fibrosis at the proximal end in the anal valves causes a condition referred to as a hypertrophied anal papilla.
5. Causes include
   a) Trauma to the anal canal, usually from large, hard fecal bolus
   b) Anatomical anal abnormality
   c) Inflammatory bowel disease
   d) Previous anal surgery
   e) Childbirth
   f) Laxative abuse

6. Recent studies have demonstrated that following the initiation of a tear in the anal canal, the chronicity is probably perpetuated by an increase in the tone of the internal anal sphincter and an abnormal reflex sphincter spasm following distention
7. Treatment
   a) Avoiding constipation can break the cycle of hard stool-pain-reflex spasm
   b) Bulking agents
   c) Stool softeners
   d) Warm sitz baths
   e) Anesthetic ointments with 5% xylocaine
   f) Anal dilators
   g) Suppositories
   h) Surgical repair is indicated for fissure-in-ano if there is
      (1) persistent pain and bleeding,
      (2) exposure of the internal sphincter muscle,
      (3) induration of the fissure edges
      (4) the development of a large "sentinel pile"
      (5) a hypertrophied anal papilla
      (6) lack of response to conservative management
   i) Operative treatment of fissures includes
      (1) Fissurectomy - excision of fissure along with a broad triangle of skin
      (2) V-Y Anoplasty - a method employing the use of excision of the fissure combined with an advancement flap of anoderm
      (3) Anal Stretch - manual dilation of the anus, involves the forceful stretching of the anal sphincter with as many as 6 or 8 fingers. Goal is to break up sphincter spasm.
      (4) Partial Internal Sphincterotomy - division of the lower half of the internal sphincter in the posterior mid-line through the fissure itself. The wound takes longer to heal and may be complicated by incontinence.

E. Inflammatory Conditions of the Anorectum

1. Diarrhea: Any condition in which diarrhea is part of the problem will produce anorectal inflammation of a nonspecific type. Perianal excoriations, pruritus ani, and acute superficial anal fissures are very common. Treatment of these problems is directed towards correcting the underlying disease which produces the diarrhea. Supportive care, especially nutrition and fluid and electrolyte balance is important.
2. Crohn's Disease: This is a disease of unknown etiology which can afflict any portion of the alimentary tract. The anus and perianal areas are no exception. In 25% of patients with small bowel involvement, anal lesions will be in evidence at some stage during the patient's illness. One of the main intestinal disturbances brought about the disease is diarrhea with perianal excoriations and pruritus ani. Direct involvement of the perianal skin produces a classical discoloration consisting of a blue cyanotic hue which, once seen, characterizes the disease. Most patients with perianal problems related to the diarrhea of Crohn's disease can obtain relief when the diarrhea is controlled.

3. Irradiation Proctitis: Irradiation proctitis is an iatrogenic condition which may affect patients undergoing irradiation therapy for disease afflicting organs in close proximity to the rectum. The most common problem so treated is cancer of the cervix. The pathogenesis of the disease is ischemia. In the acute phase this is the result of nonspecific inflammation generated by direct radiation damage. Symptoms consist of rectal bleeding, diarrhea, and mucous discharge often associated with rectal pain and tenesmus. Late phases of the disease are characterized by ongoing proctitis often complicated by fibrotic rectal strictures and fistulae into the bladder or vagina. Treatment of patients with minimal involvement and symptoms, all which is required is reassurance as most cases are self-limiting with complete spontaneous resolution. Patients with more severe symptoms may benefit from a short course of corticosteroid retention enemas or suppositories for seven days.
4. Tuberculosis: TB affecting the anorectum as a primary disease is extremely rare even in areas where the disease is common. It usually presents as an anal fissure or ulcer. This is classically large, eccentric and atypical. These patients invariably have coexisting gastrointestinal or pulmonary TB. Diagnosis is confirmed by demonstrating caseating granulomata and acid-fast bacilli in the lesion. Treatment involves drainage of the abscesses and commencement of specific antituberculosis chemotherapy.
5. Schistosomiasis: can mimic any condition affecting the anorectum hence can be confused with common lesions, notably cancer and Crohn's disease.
6. Amebiasis: rarely involves the anorectum in isolation. It should always be excluded in all cases presenting as a proctocolitis by biopsy and histology rather than stool culture. Classically, the disease produces macroscopic ulcers with undermined erythematous edges seen on proctoscopy.

F. Sexually Transmitted Diseases of the Anorectum

1. Condylomata Acuminata: is the most commonly seen sexually transmitted disease of the anorectum. The causative agent is believed to be a papilloma virus which is auto-inoculable, filterable, and transmittable. The incubation period is usually from one to six months but may be longer. They occur with greatest frequency in male homosexual patients. Condylomata are found in the perianal region and anal canal, as well as other parts of the perineum, vulva, vagina, and cauliflower-like masses and are often soft and friable therefore, bleed easily. Other than bleeding, pruritus ani may be the only other symptom. Because of the free association of numerous diseases, and the frequency of Condylomata acuminata, other sexually transmitted diseases must be excluded. Included in the differential diagnosis are Condylomata lata, the lesions of secondary syphilis. A definitive diagnosis is made by the dark field examination which will demonstrate the spirochetes. There are numerous treatments for Condylomata acuminata - including Podophyllin, surgical excision, electro-desiccation, cryotherapy, and ultrasound. With the provision that condoms are used prophylactically, sexual activity may be resumed when the patient so desires. Without the use of condoms, sexual intercourse may probably be safely resumed after a three month disease-free period has elapsed.

G. Neoplasms of the Anorectal Canal

1. Neoplasms of the anal canal include Squamous cell carcinoma, Basal cell carcinoma, Bowen's disease, and Perianal Paget's disease. Squamous Cell Carcinoma is the most common and resembles those occurring in skin elsewhere in the body. Macroscopically, they typically have rolled, everted edges with central ulceration. Any chronic unhealed ulcer should be considered as a potential squamous cell carcinoma until proven otherwise by biopsy. They are found 4 times more commonly in men than in women and occur at an average age of 63 years.

H. Anorectal Abscess and Fistula-In-Ano

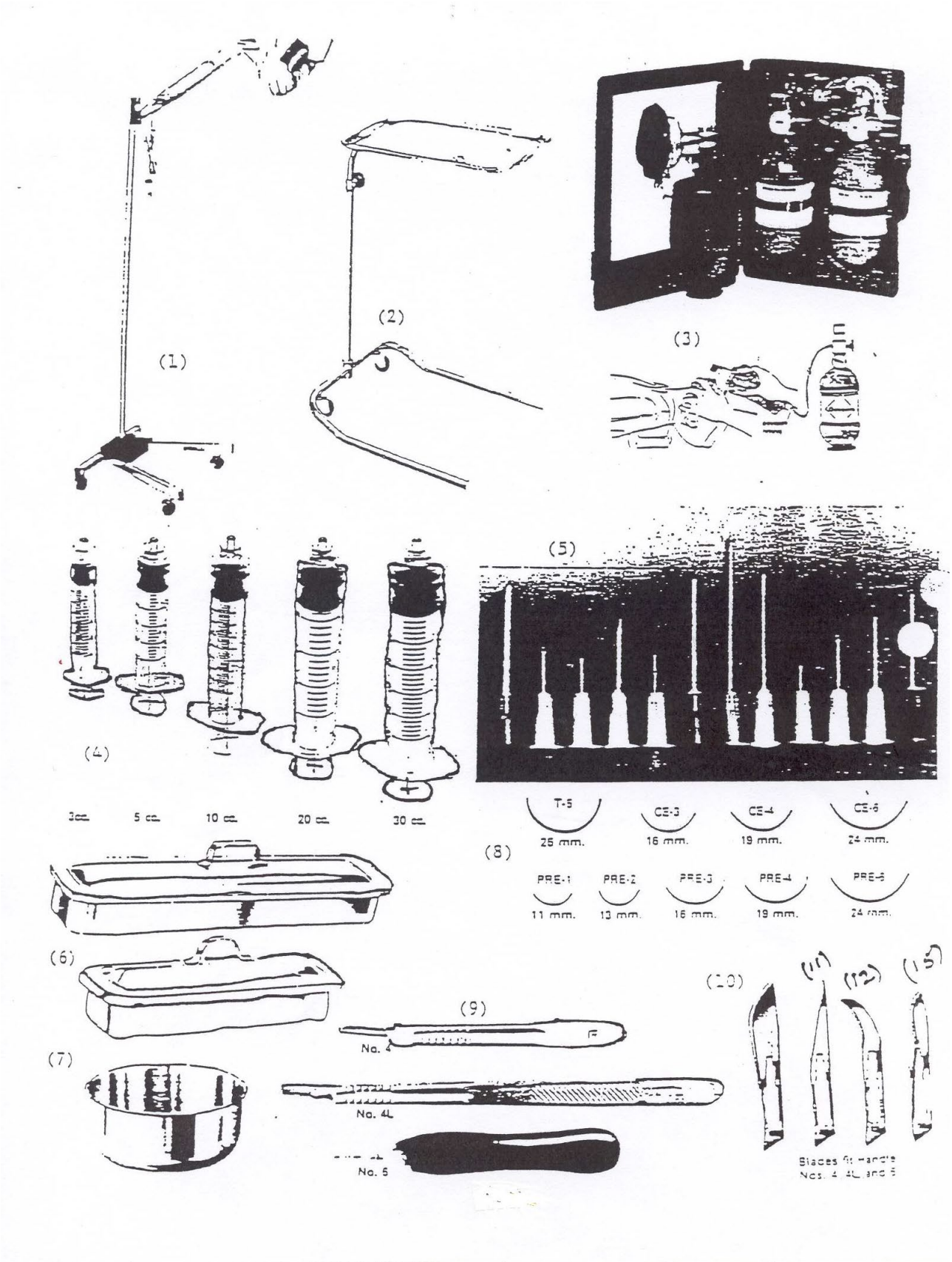
1. A fistula is an abnormal communication between any two epithelial-lined surfaces, thus fistula-in-ano is an abnormal communication between the anal canal and the perianal skin. Approximately 90% originate in the crypts of Morgagni, and the greatest concentration of crypts are located in the posterior aspect of the anal canal. Fistulas usually begin as infections of the anal glands located at the dentate line. Obstruction of the ducts of the anal glands can be by fecal material, foreign bodies, of by trauma. The most common course for a fistula to pursue is from the mid-anal canal downward in the intersphincteric plane to the anal verge but they may also tract upward or circumferentially around the anus (horseshoe fistula).
2. Goodsall/Salmon rule - any opening posterior to the coronal plane the fistula probably originates from the dorsal midline crypt and an opening anterior to the coronal plane indicates that the tract of the fistula runs to the nearest crypt.
3. The further the distance the external opening is from the anal margin (5-6cm) the greater probability of upward extension of the fistula into the intersphincteric plane.
4. The abscess is an acute manifestation while the fistula is a chronic situation. The patient with an abscess presents with acute pain and swelling in the anal region. Pain occurs with sitting or movement and is usually aggravated by defecation and even coughing or sneezing. The clinical history may reveal a preceding bout of diarrhea. General symptomology includes malaise and pyrexia.
5. In the chronic state, the patient will give a history of either an abscess which burst spontaneously or required drainage. The patient will notice a mall discharging sinus or discharge may cause skin excoriation and pruritus. There may be pain with defecation as well as bleeding due to granulation tissue in the region of the internal opening.
6. A list of differential diagnoses includes; Bartholin gland abscess, Sebaceous cyst, Tuberculosis, Osteomyelitis of the boy pelvis, Fissure, Urethroperineal fistula, Carcinoma, penetrating injuries, Pilonidal sinus, retrorectal cyst, Folliculitis of the perianal skin, and Pruritus ani.
7. Presence of symptomatic fistula-in-ano is indication for surgery as neglected fistula may result in repeated abscesses. Usually the "lay-open and tract excision" technique is the surgery of choice. Sometimes severity may mandate incision of sphincter muscles causing some degree of incontinence. Urinary retention (25%), hemorrhage, acute thrombosed hemorrhoids, fecal impacting, and recurrent fistulae are also complications.
8. The Seton technique is the utilization of a nonabsorbable suture placed through the tract t encircle the sphincter muscle below. Hanley recommends an elastic seton, tightened at 2-3 week intervals until it transects the muscle. This slow division and scarring ensures preservation of sphincter function.

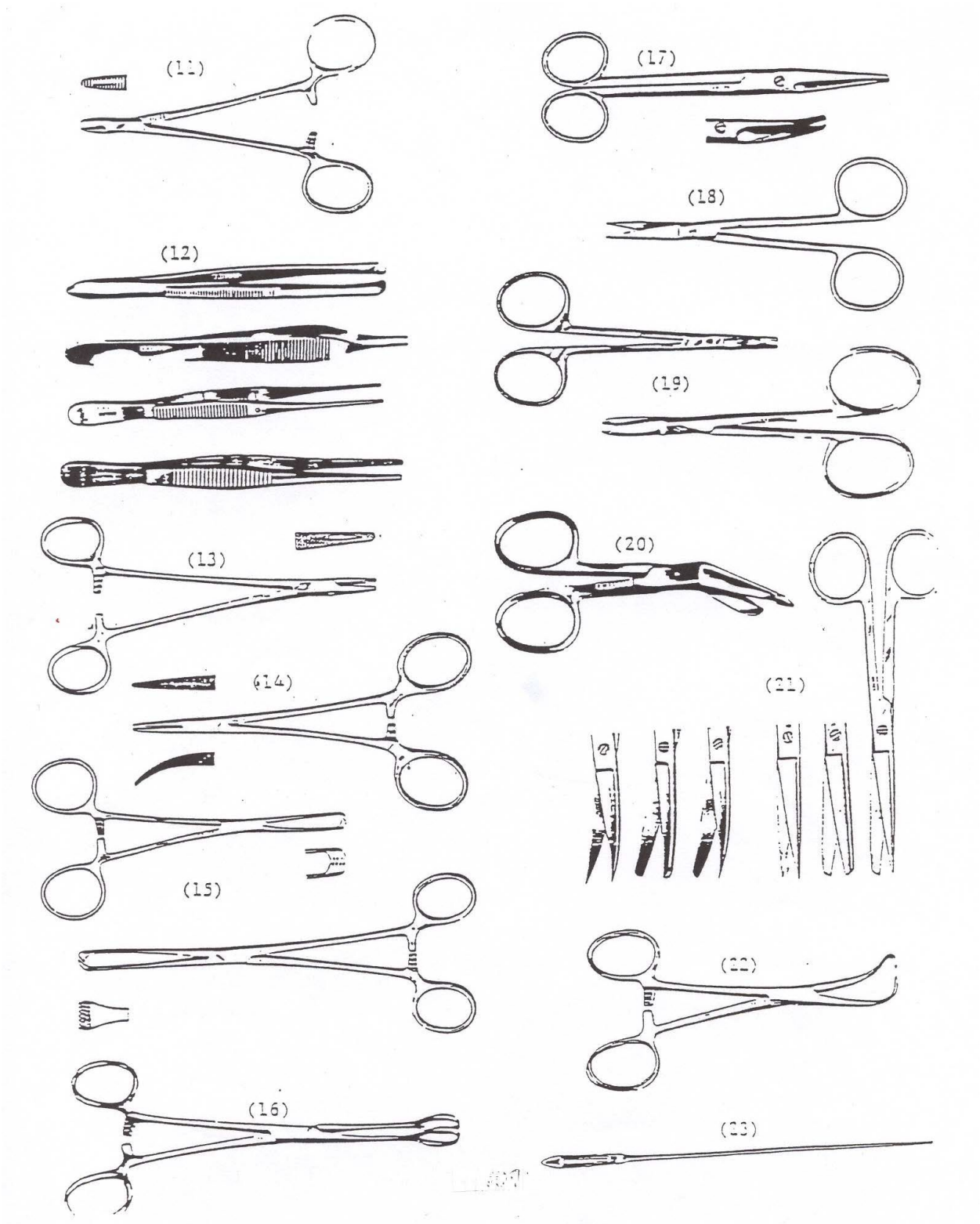
9. The most common benign condition of the large bowel are polyps. They may be pedunculated, sessile or villous. It is well known that neoplastic polyps are found in association with carcinoma. The malignancy rate for tubular adenoma is 5%, and for villous adenomas approximately 40%. The symptoms produced by polyps (bleeding, diarrhea, prolapse, mucous discharge, and interference with defecation) are rarely severe and in many cases absent, or unrecognized. The treatment of choice is total excisional biopsy.

APPENDIX I

MINOR SURGICAL THEATER EQUIPMENT AND INSTRUMENTS

1. Operating Lamp
2. Mayo Instrument Stand and Tray
3. Oxygen Supply and Ambu-bag
4. Disposable Syringes
5. Disposable Syringe Needles
6. Cold Sterilization Trays
7. Autoclavable Solution Bowl
8. Suture Needles
9. Surgical Knife Handles
10. Disposable Surgical Blades
11. Needle Holder
12. Tissue Forceps (thumb, dressing, tissue, splinter)
13. Needle Holder
14. Halsted Mosquito Forceps (curved or straight "hemostat")
15. Allis and Thoms-Allis Tissue Forceps (4x5 teeth and 6x7 teeth)
16. Sponge Forceps
17. Dissection Scissors
18. Iris Scissors (fine)
19. Suture Removal Scissors
20. Bandage Scissors
21. Operating Scissors (curved and straight - blunt and pointed)
22. Towel Clamp
23. Blunt Probe


(1)
(2)
(3)
(4)
3cc
5 cc
10 cc
20 cc
30 cc
(5)
(6)
(7)
(8)
T-5
25 mm.
CE-3
16 mm.
CE-4
19 mm.
CE-6
24 mm.
PRE-1
11 mm.
PRE-2
13 mm.
PRE-3
16 mm.
PRE-4
19 mm.
PRE-6
24 mm.
(9)
No. 4
No. 4L
No. 5
(10)
(11)
(12)
(13)
Blades fit Handle
Nos. 4 4L and 5


(11)
(12)
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(23)

APPENDIX IV

SUMMARY OF WOUND CLEANSING AGENTS

SKIN CLEANSER	ANTIBACTERIAL ACTIVITY	TISSUE TOXICITY	SYSTEMIC TOXICITY	POTENTIAL USES
Povidone-iodine surgical scrub	Strongly bactericidal against gram (+) and gram (-) bacteria	Detergent can be toxic to wound tissue	Painful to open wounds. Other reactions extremely rare.	Wound periphery cleanser and hand cleanser
Povidone-iodine solution without detergent	Same as povidone-iodine scrub	Not toxic to tissue.	Extremely rare	Wound periphery cleanser
Chlorhexidine	Strongly bactericidal against gram (+) organisms, less strong against gram (-) bacteria.	Detergent can be toxic to wound tissue.	Extremely rare	Hand cleanser alternative wound cleanser.
Pluronic-F-68	No antibacterial activity	None known	None known	Wound cleanser (particularly useful on the face).
Hexachlorophene	Bacteriostatic against gram (+) but poor against gram (-) bacteria.	Detergent can be toxic to wound tissues.	Teratogenic with repeated use.	Alternative hand cleanser.

SUMMARY OF LOCAL ANESTHETICS FOR MINOR WOUND CARE

AGENT	CONCENTRATION	ONSET OF ACTION		Duration of Action	Maximum Allowable Dose One time
		Infiltration	Block		
Lidocaine* (Xylocaine)	1.0%	Immediate	4-10 min.	60-120 min. (for block)	4.5 mg/kg of 1.0% 30cc per average adult
Mepivacaine (Carbocaine)	1.0%	Immediate	6-10 min.	90-180 min. (for blocks)	5.0 mg/kg of 1.0% 35cc per average adult
Bupivacaine (Marcaine)	0.25%	Slower	8-12 min.	240-480 min. (for blocks)	3.0 mg/kg of 0.25% 80cc per average adult
TAC	**	5-10 min	-	Approximate 20 min.	5cc - 10cc of mixture

The relative values for Lidocaine may also be applied to Procaine (Novocaine)

** TAC is a combined mixture of 0.5% tetracaine, epinephrine 1:2000, and cocaine 11.8% in equal parts and applied topically with a 2x2 inch sponge.

(V, 2013) (Finsen, 2013)

APPENDIX V

I. ANAPHYLAXIS

A. SPECIFIC INFORMATION NEEDED

1. Present history: Exposure (orally, IM or IV) during past few hours to allergenic substances: drugs (antibiotics, allergy shots); insect bites; toxic substances; unusual foods (nuts, fish and fruit most common).

2. Past history: Known allergies, prior allergic reactions.

3. Symptoms: Itching, difficulty breathing, chest tightness, nausea, abdominal cramps, subjective airway impairment or swelling, numbness and tingling.

B. SPECIFIC PHYSICAL FINDINGS

1. Vital signs, level of consciousness.

2. Respiratory: Wheezing, hoarseness, upper airway noises.

3. Skin: Generalized itching or flushing, hives.

4. Edema: Generalized or local, particularly of lips, tongue, uvula, face.

5. Vomiting or diarrhea.

C. TREATMENT

1. Protect airway; suction as needed. Cricothyrotomy may be required if unable to intubate or ventilate by bag mask after epinephrine has been administered.

2. Remove injection mechanism is still present.

3. Patient should be supine with legs elevated unless respiratory distress predominates.

4. IV: Balanced salt solution, large bore. Not indicated if only hives and itching present.

5. Monitor cardiac rhythm.

6. If patient has signs of progressive anaphylaxis, including hypotension and/or significant respiratory distress:

(1) Epinephrine
   (a) with BP > 80mm Hg administered epinephrine 0.3cc 1:1000 s.q.
   (b) for total cardiovascular collapse administer IV or S.L. 3 ml of 1:10,000 S.L. in adult.

(2) 250 ml IV fluid challenge, as indicated by presence of shock syndrome.

(3) If no improvement noted, repeat epinephrine, 1:1000 0.2 mg s.q. or S.L. every 5-10 minutes or 2cc 1:10,000 IV.

(4) Pediatric dose: 0.01 mg/kg or epinephrine s.q. or sublingually.

7. O_2 high flow, by reservoir mask and obtain vital signs.

II. SPECIFIC PRECAUTIONS

A. Epinephrine induces vomiting in children; it increases cardiac work and may precipitate angina or MI in susceptible individuals. Common side effects include anxiety, tremor, palpitations, tachycardia and headache, particularly with IV administration.

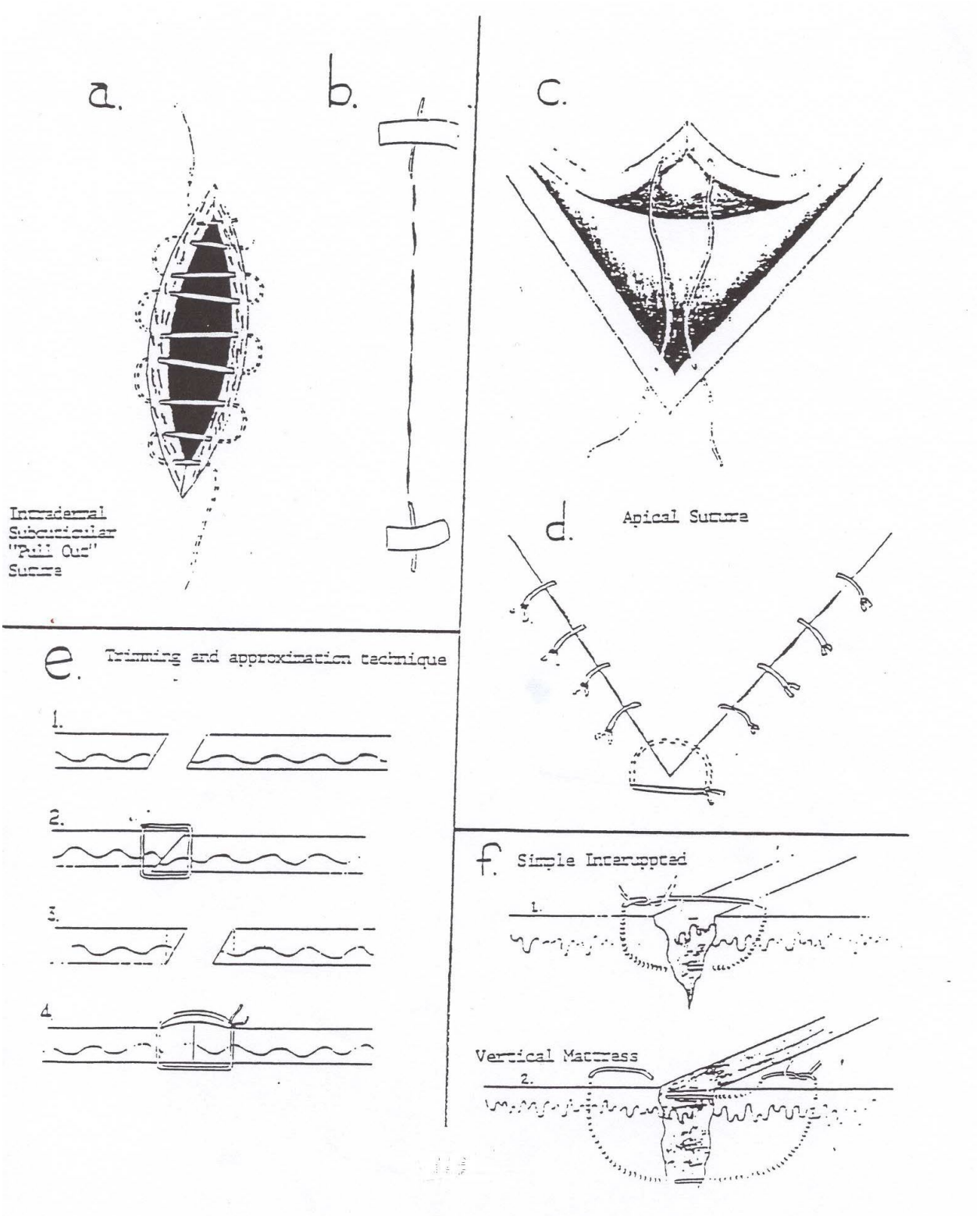
B. Two forms of epinephrine are available; 1:1000 dilution appropriate for SQ or IM injection and 1:10,000 dilution for IV administration.

   BE SURE TO GIVE THE PROPER DILUTION TO YOUR PATIENT.

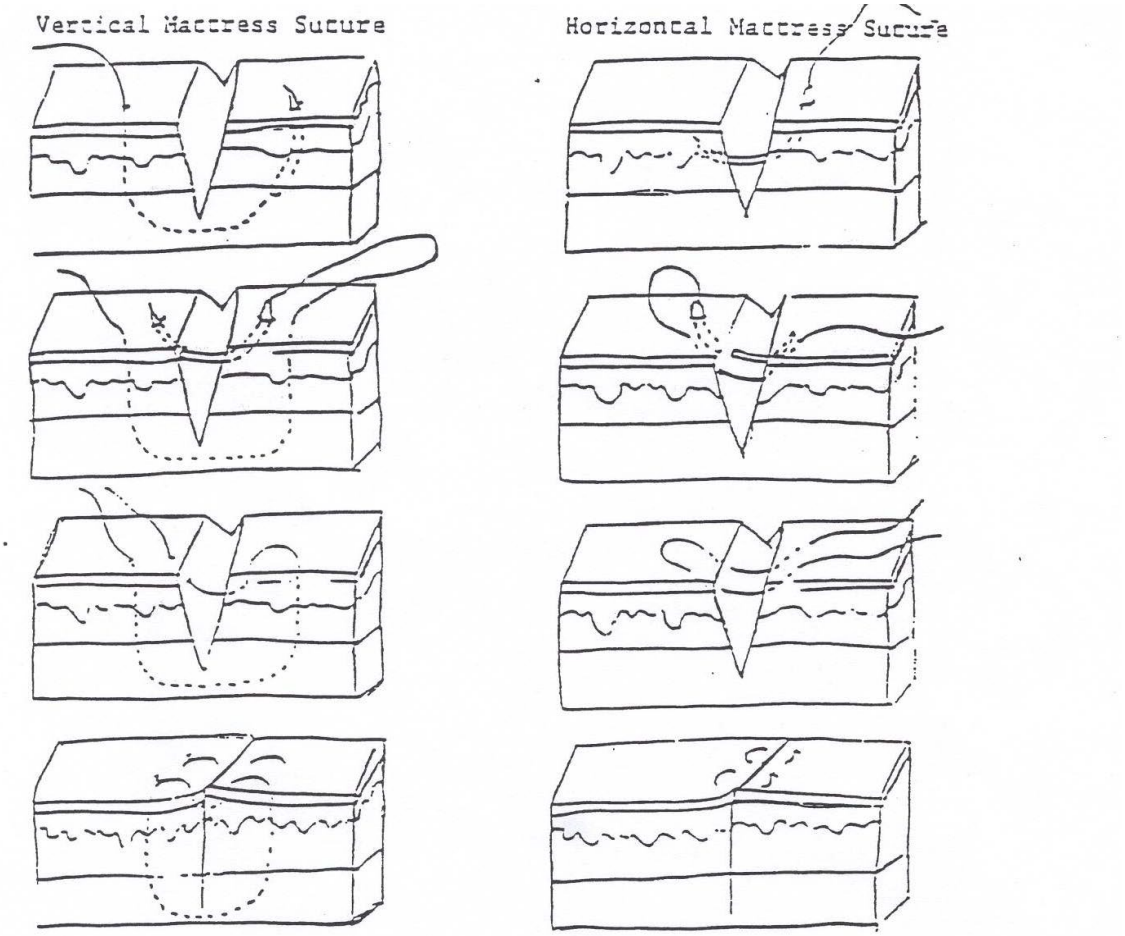
C. Epinephrine should not be given without signs as well as symptoms of cardiovascular collapse and/or significant respiratory distress. Do not rely on history alone.

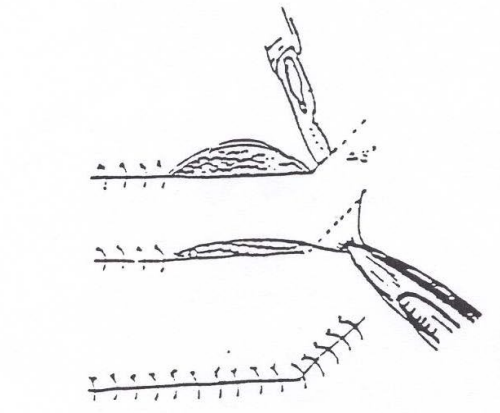
D. If anaphylaxis has been precipitated by an injection either of medication or insect toxin, half of epinephrine dose may be given SQ by the injection site, the rest in another extremity. Do not let treatment of the injection site distract you from IV treatment of life-threatening anaphylaxis. Do not inject epinephrine into an end organ (penis, digits, tip of nose).

APPENDIX VI

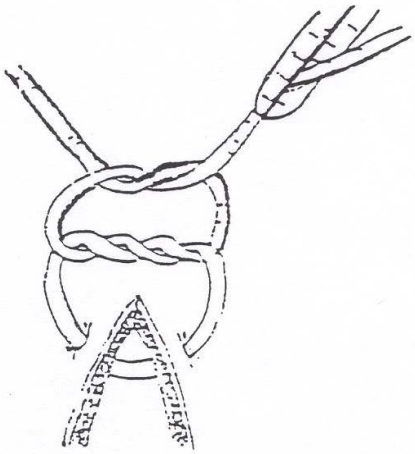

a.
b.
c.
Intradermal
Subcuticular
"Pull Out"
Suture
d.
Apical Suture
e.
Trimming and approximation technique
1.
2.
3.
4.
f.
Simple Interuppted
1.
Vertical Mattress
2.

APPENDIX VII



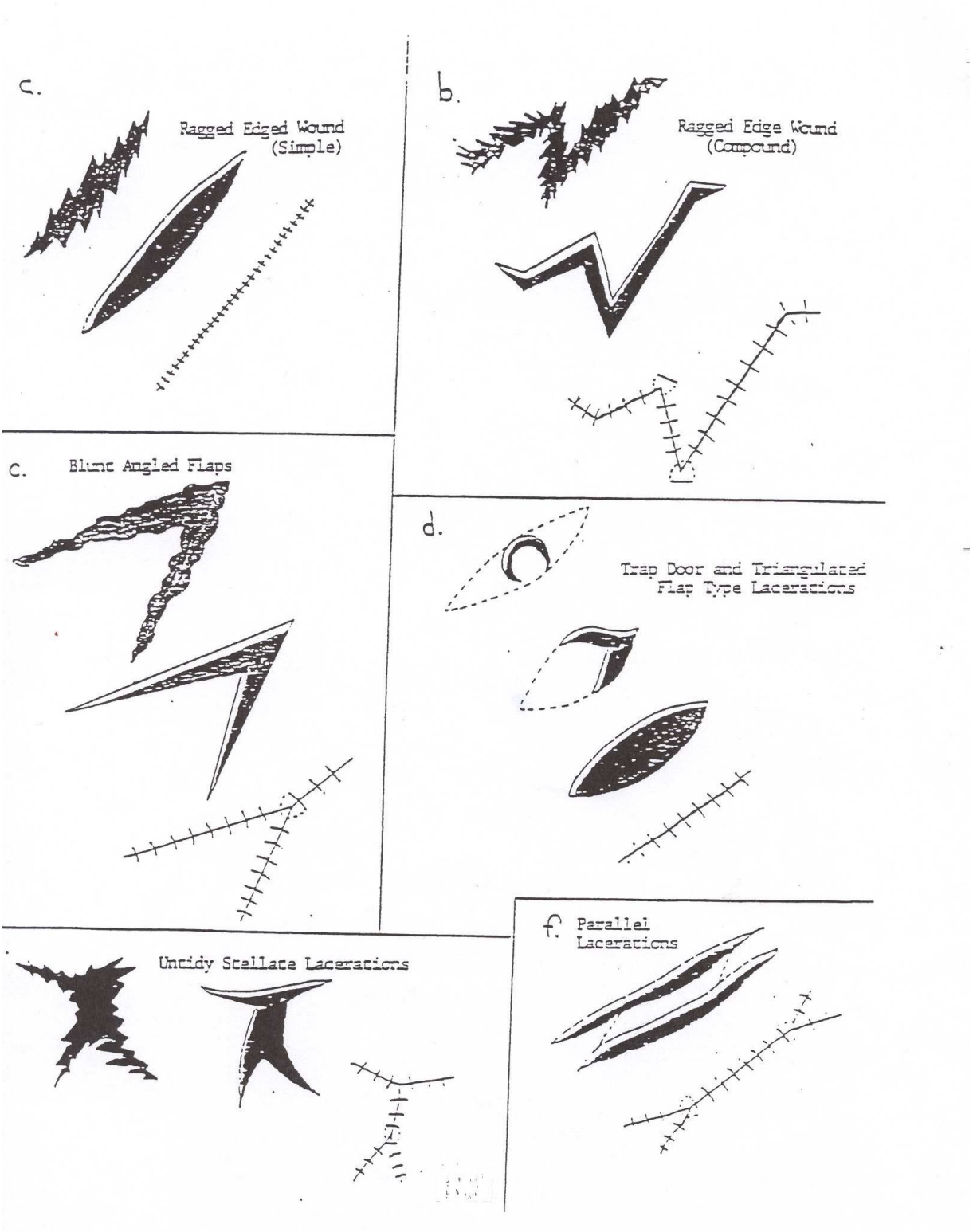


Technique for removing a "dog ear"

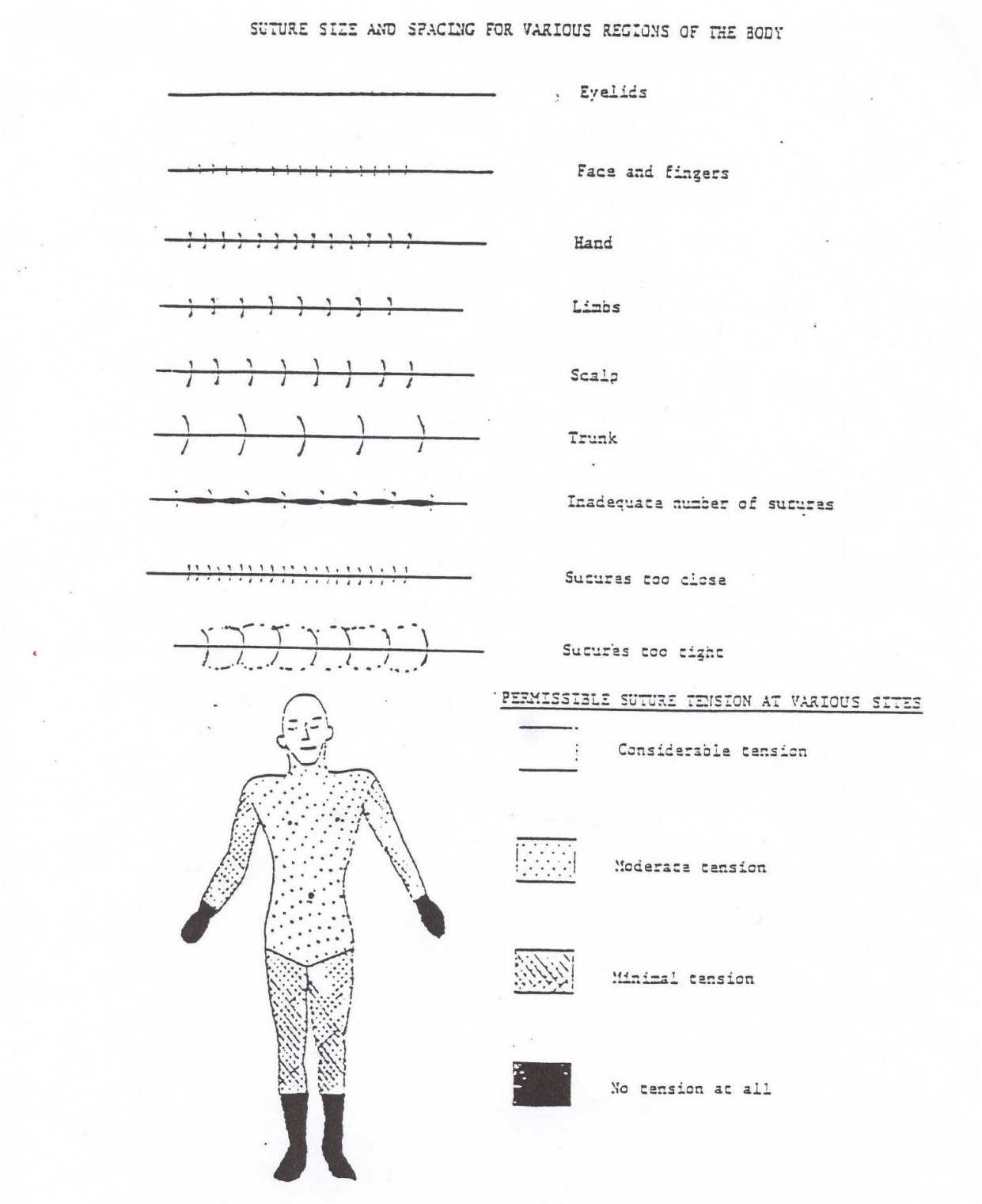


Basic surgeon's knot

APPENDIX VIII



APPENDIX IX


SUTURE SIZE AND SPACING FOR VARIOUS REGIONS OF THE BODY
Eyelids
Face and fingers
Hand
Limbs
Scalp
Trunk
Inadequate number of sutures
Sutures too close
Sutures too tight
PERMISSIBLE SUTURE TENSION AT VARIOUS SITES
Considerable tension
Moderate tension
Minimal tension
No tension at all

APPENDIX X

I. EPINEPHRINE

A. PHARMACOLOGY AND ACTIONS

1. Catecholamine with alpha and beta effects.
2. In general, the following cardiovascular responses can be expected:
   a) Increased heart rate
   b) Increased myocardial contractile force.
   c) Increased systemic vascular resistance.
   d) Increased arterial blood pressure.
   e) Increased myocardial O_2 consumption.
   f) Increased automaticity.
3. Potent bronchodilator.

B. INDICATIONS

1. Ventricular fibrillation
2. Asystole
3. Electromechanical dissociation
4. Systemic allergic reactions
5. Asthma in patients under 50.

C. PRECAUTIONS

1. Intramyocardial injection may produce intractable ventricular fibrillation.
2. Should not be added directly to bicarbonate infusion, since catecholamines may be partially inactivated by alkaline solution.
3. When used for allergic reactions, increased cardiac work can precipitate angina and/or MI in susceptible individual. Also may induce major arrhythmia.
4. Due to peripheral vasoconstriction, should be used with caution in patients with peripheral vascular insufficiency.
5. Wheezing in an elderly person is pulmonary edema or pulmonary embolus until proven otherwise.

D. ADMINISTRATION

1. Adult
   a) Cardiac arrest: 0.5-1.0 mg (5-10 ml of 1:10,000 solution) IV every 5 minutes during arrest (1.0 mgm may also be given via endotracheal tube).
   b) Allergic reaction (anaphylactic shock, laryngeal edema, severe asthma): 0.3 mg (0.3 ml of 1:1,000 solution), SQ, IM or injected sublingually, or 2-3 ml of 1:10,000 solution IV.
2. Pediatric
   a) Cardiac arrest: 0.01 mg/kg (0.1 ml/kg of 1:10,000) IV every 5 minutes during arrest.
      (May also be given via endotracheal tube.)
   b) Allergic reaction (anaphylactic shock, laryngeal edema, severe asthma) 0.01 mg/kg ml/kg of 1:1,000 solution), Sq, IM or injected sublingually, or 1-2 ml of 1:10,000 solution IV.

E. SIDE EFFECTS AND SPECIAL NOTES

1. Anxiety, tremor, headache.
2. Tachycardia, palpitations, PVC's.
3. Angina, hypertension.

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