Primary Health Care Initiatives (PHCI) Project
Contract No. 278-C-00-99-00059-00
Abt. Associates Inc.

MANAGEMENT OF WOUNDS AND LACERATIONS

LEARNING OBJECTIVES

- Understand the basic principles of wound healing
- Describe the critical elements of evaluation of a wound
- Describe the critical elements of wound management
- Develop skill in the most common forms of suture closure of an open wound
- Understand which wounds should be referred for specialist management

TEACHING STRATEGIES

- Use simple presentation materials for the didactic portions of the discussion
- Large group discussion can be used to develop key lecture points
- Use small groups to discuss and present the management of the suggested case studies
- Allow at least 90 minutes for a suture workshop, in which participants can practice various forms of suture repair

MATERIAL AND EQUIPMENT NEEDED

- Overhead projector and transparencies of didactic material
- Laceration repair instruments for workshop (minimum of: needle holder, forceps, suture scissors, suture material and needles)
- Material for practice in suture repair (commercial models, beef or lamb tongue, chicken breast or similar raw meat)

LEARNING POINTS

- Types of Wounds (Note that some complex wounds may show elements of more than one type of wound, ie, laceration with superficial abrasions)
  - Abrasion
    - Caused by a scraping or shearing force
    - Loss of epithelium and possibly dermis
    - Deep abrasions can bleed heavily; superficial abrasions bleed lightly
    - Deep abrasions similar to full thickness burns in healing process and management
  - Contusion
    - Caused by a blunt force
    - Injury to the dermis and subcutaneous tissues with intact epidermis
    - Results in collection of blood (hematoma) and edema fluid in subcutaneous tissues
    - May result in injury to important anatomic structures (nerve, ducts, solid organs, etc.)

- Laceration
  - Injury and separation of epidermis, dermis, and possibly underlying tissues, depending on depth
  - Greatest risk of damage to underlying structures, such as nerve, tendon, bone, ducts, solid organs
  - Requires decision on if and how to close wound

- Principles of wound healing
  - 0 – 4 hours
    - Initial vasoconstriction of blood vessels and clumping of platelets to control bleeding
    - Inflammatory response begins with movement of white blood cells and macrophages to site of wound, together with development of vasodilatation and edema
  - 4 – 48 hours
    - Fibroblasts (collagen producing cells) move into wound area, and begin to produce collage fibers
    - New blood vessels begin to form across the space of the wound
    - Epithelial cells from edge of the wound begin to move across the surface of the wound
  - 2 – 10 days
    - Collagen continues to be formed, and collagen fibers begin to contract (shorten)
    - Wound edges begin to be pulled together
    - Strength of collagen begins to increase
  - 10 – 30 days
    - Formation of strong scar
    - Remodeling, shortening, and contraction of fibrous scar tissue

- Essential elements of wound evaluation
  1. First priority – **A**irway, **B**reathing, **C**irculation of resuscitation, even though wounds may be most visible and alarming aspect of presentation
  2. Wound should be covered with sterile bandage until full evaluation and management can be done
  3. History of injury, when possible
     - Circumstances, mechanism of injury
     - Other factors involved (burn, explosion, firearms, medications, alcohol or drug use, etc.)
     - Past medical history, especially previous injuries, current medications, diabetes, hepatitis, HIV infection, medication allergies, etc.
  4. Examination of the entire patient, depending on degree of injury and risk
     - First priority – level of consciousness and mental status
     - Vital signs – blood pressure (including postural changes), pulse, respiration, temperature
     - Entire body should be examined for other wounds or injuries
     - Focus on functional status – use of arms and legs, walking, numbness or paresthesias, local tenderness
  5. Examination of wound
     - Use sterile gloves in examination to protect health care provider, and minimize further contamination of wound

- Evaluate extent and depth of wound, and degree of tissue missing or damaged
- Estimate level of bacterial contamination of wound. Bite wounds, embedded dirt or foreign bodies, large irregular wounds, old wounds all tend to have greater bacterial contamination
- Evaluate possible damage to underlying structures – tendon, nerve, bone, solid organ, duct. Use functional tests when possible, ie, check for movement of involved tendons, distal nerve sensation and motor function of involved nerves, X-ray of involved bones
- Be very cautious with penetrating wounds such as knife, gunshot, explosion-related wounds. These often result in much greater internal damage and bacterial contamination than is visible on the surface.

6. Decide whether wound can be managed in Health Center, or should be referred. Consider referral of the following
   - Decreased level of consciousness or change in mental status
   - Possible heavy bacterial contamination of wound
   - Other significant injuries associated with the wound (ie, fractures, burns, smoke inhalation)
   - Evidence of damage to underlying structures such as nerve, tendon, bone, muscle, or solid organs
   - Penetrating injuries such as knife, gunshot, or explosion related
   - Significant loss of tissue, such as large, deep abrasions or avulsed skin or muscle
   - Bite wound of potentially rabid animal

- Essential Elements of Wound Management
  1. Tetanus prophylaxis
     - Clean or lightly contaminated wounds – give tetanus toxoid (or dT) 0.5 ml. IM if more than 10 years since last tetanus immunization
     - Significant bacterial contamination of wound, or deep, old wounds – give tetanus toxoid (or dT) 0.5 ml. IM if more than 5 years since last tetanus shot
     - If patient has **never** had any tetanus immunizations previously (should be rare), begin tetanus toxoid protocol and give tetanus immune globulin at the same time.
     - Consider referral for rabies prophylaxis with bites of potentially rabid animals
  2. Preparation of the skin
     - Clip (do not shave) hair in areas where hair could interfere with repair or healing (Note that studies have shown that shaving increased bacterial contamination of the skin, compared with clipping of hair)
     - Clean wound area and wound edges with antiseptic solution such as dilute 1% povidone-iodine
  3. Give local anesthesia when appropriate
     - Even cleansing of wound can be painful, and anesthesia makes procedure more comfortable
     - Most commonly inject 1% - 2% lidocaine (with epinephrine unless on finger or toe or tip of nose) into wound margins. Use smallest gauge needle possible and sterile technique for injection
     - Can use local nerve block when appropriate (ie, base of finger)

4. Debridement and Irrigation
   - Remove obviously dark or dead tissue, and any foreign bodies. Use sharp dissection (scalpel) when possible to minimize tissue trauma
   - May need to mechanically remove dirt or embedded material with sterile gauze scrubbing
   - Irrigation under pressure with large volume of saline is the most effective way to reduce bacterial contamination and remove foreign material. Use large sterile syringe and 18 – 20 G needle for irrigation. Many studies show that irrigation is much more effective than cleaning wound with antiseptic solution for reducing wound infections.
   - Large or contaminated wounds may need 1 –2 liters of irrigation for effective cleaning.
5. Close wounds with proper suture and technique, when appropriate
   - DO NOT CLOSE the following wounds – most animal or human bites, heavily contaminated wounds, wounds older than 4-6 hours
   - Wounds with little tension can be closed with tape strips
   - Significant subcutaneous laceration should be closed with few absorbable sutures (chromic, Dexon, Vicryl, etc.) using buried knot technique
   - Skin should be closed with nylon rather than silk. Many studies and experience shows fewer stitch infections and better healing with nylon suture. Use 5 knots in each stitch to prevent loss of sutures
   - Bring skin edge to edge - Use mattress type suture in areas where skin is thin or could become inverted.
   - Skin sutures should only bring skin edges to touch – do not overly tighten sutures to avoid loss of circulation to skin edge
6. Dressing of the wound should prevent further contamination, and absorb discharge
   - In areas of edema, mild compression (compressive bandage) may reduce edema
   - Dressing should be sterile, and should be changed every 24 – 48 hours in general.
   - If there is significant bleeding or oozing of fluid, dressing may need to be changed more frequently to prevent infection
   - Dressing of abrasions requires more frequent attention – sterile Vaseline on gauze helps prevent sticking of dressing to wound, change dressing every 12-24 hours. Do not allow thick eschar (crust) to form on abrasion
7. Give patient appropriate wound care instructions.
   - Should be instructed when to return for a dressing change, or should be taught how to do it in a correct, sterile manner.
   - Instruct in danger signs, such as spreading inflammation or increased pain of infection, purulence, persistent bleeding
   - Advise against use of home remedies to prevent scarring or infection.
   - Answer questions patient may have.
8. Remove sutures in 5 – 10 days
   - Sutures can be removed early (5 days) in areas of good vascularity such as the face
   - Sutures should be left for 7 – 10 days in areas of tension (over joints) or on lower extremities
9. Promote rehabilitation

- Encourage patient to use injured area as normally as possible, with possibly some protection such as a simple dressing on exposed wounds for another 1-2 weeks
- Warn patient that scar will continue to mature over next 2 years – initially raised and red, will eventually flatten and become white
- If patient has formed keloid scars (large, fibrotic, hypertrophic scars extending beyond the wound) in the past, consider referral for prevention or reduction of keloid. This is more common in those of African origin.

PREVENTION ISSUES AND HEALTH EDUCATION MESSAGES

- The best method of treating a wound is to prevent it. Encourage family and community efforts to clean hazards from the environment, such as broken glass, nails, construction materials, unused equipment, etc.
- Encourage safe use of work equipment and tools
- Encourage patients to come to the Health Center or hospital as soon as possible for evaluation and management of a wound.
- Discourage use of home remedies to "prevent" scarring of a wound, such as Vitamin E, creams, ointments, or application of other materials. Most of these only increase the bacterial contamination and infection rate of the wound.

CASE STUDIES

I. A 15 year old boy is thrown off his bike because of a flat tire at a high speed. He suffers large abrasions of his elbows and forearms, knees, and forehead, but does not lose consciousness and is able to walk into the Health Center. There is a large amount of dirt embedded in the abrasions.

a. How would you further evaluate this patient?
b. How would you manage these wounds?
c. What instructions would you give this patient?

II. A 31 year old woman cuts her thumb deeply with a sharp knife while preparing taboule. It bleeds heavily for 5 minutes, but the bleeding decreases with firm pressure of a towel. In the Health Center, examination shows a 2 cm. laceration over the back of the proximal thumb, and she does not (or cannot) move the thumb.

a. How would you further evaluate this patient?
b. How would you manage this wound?
c. What instructions would you give this patient?

III. A 45 year old farmer is injured while trying to extinguish a fire in his equipment shed. While pouring water on the fire, the roof of the shed collapses on him, trapping him under some large beams of burning wood. He is pulled out by a friend, and brought to the Health Center. On examination, he smells of smoke, and is coughing heavily. BP is 95/60, pulse is 120, respirations are 24 with frequent coughing. He has several burns on his legs, and the right lower leg is swollen and very painful to move. He has a 6 cm. deep laceration of the scalp which is still bleeding, a 4 cm laceration of the forehead, and several abrasions of the right arm. He repeatedly asks where his son is, and appears somewhat confused.

a. What are the primary problems of this patient, and possible injuries?
b. How would you further evaluate this patient?

c. How would you manage this patient and his wounds?

CRITICAL ELEMENTS FOR REFERRAL

- Decreased level of consciousness or change in mental status
- Possible heavy bacterial contamination of wound
- Significant blood loss with evidence of postural changes in blood pressure or rapid pulse
- Other significant injuries associated with the wound (ie, fractures, burns, smoke inhalation)
- Evidence of damage to underlying structures such as nerve, tendon, bone, muscle, or solid organs
- Penetrating injuries such as knife, gunshot, or explosion related
- Significant loss of tissue, such as large, deep abrasions or avulsed skin or muscle
- Bite wound of potentially rabid animal

CRITICAL ELEMENTS FOR EVALUATION OF COMPETENCE

- Describe the critical elements in evaluation of a wounded patient
- Describe the most important steps in management of an open wound
- Demonstrate the most common forms of suture closure of a wound, including subcutaneous closure with a buried knot, simple interrupted suture, running continuous suture, vertical mattress suture
- List the situations or conditions in which a wounded patient should be referred