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Reducing Risk in Emergency Department Wound Management

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Overview of malpractice issues in wounds

There are more than 12 million visits a year to emergency departments (EDs) throughout the United States for traumatic wounds, making them one of the most common reasons for ED visits [1]. Most of the wounds are located on the head and neck or upper extremities, usually involving the fingers [2]. More than 50% of wounds are caused by blunt force, and most others are caused by sharp objects such as metal, glass, and wood [1]. Animal and human bites are responsible for less than 10% of wounds for which emergency care is sought [3].

Wound care is one of the most common areas of emergency medicine malpractice suits. Wound care accounts for 5% to 20% of all ED malpractice claims and 3% to 11% of all dollars paid out [4]. The individual case awards are not relatively high [5–7]. The most common reason for litigation involves failure to diagnose foreign bodies, wound infections, and failure to detect underlying injury to nerves, tendons, or violation of a joint capsule [4].

Although the economic impact may be small, when a wound malpractice case is lost by the defendant, mandatory reporting to regulatory agencies can be source of significant loss of professional standing. The time spent

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both in responding to the case and in explaining it in future credentialing processes is another real personal cost.

To be successful in a malpractice action, the plaintiff's lawyer must prove four elements. All of the elements must be shown, or the suit fails. These elements are

1. The defendant had a duty to the patient.
2. The defendant breached the duty to the patient (the standard of care was not met).
3. Harm occurred to the patient.
4. The harm was directly a result of the breach in the duty (proximate cause).

A review of the four legal elements with regards to wound care generally leaves room for optimism by the provider. Of course, when there is a bad outcome, it will be maintained that the physician owed the duty to the patient (element 1). With wounds, however, ancillary hospital staff often are responsible for significant parts of the overall care. For example in a wound infection, the staff may be responsible for the cleaning process. The hospital, through vicarious liability, then will be named in the suit. To avoid excessive legal expenses in a relatively low-cost settlement, the hospital may take responsibility, settle, and absolve the individual physician.

The second element requires the physician to practice according to the standard of care. Wound care has many controversial areas, and the lack of scientific evidence to guide some of the management leaves room for a variety of professional expert opinions. Many different experts can testify in a wound case. To be an expert, one usually must show only that he or she has special knowledge in the area. A surgeon, plastic surgeon, orthopedist, hand surgeon, radiologist, or infectious disease specialist could testify against an emergency medicine physician in given situations. A plastic surgeon is very knowledgeable in suturing, as is a surgeon. An orthopedist or hand surgeon may have great experience in handling emergent cases of dirty wounds or foreign bodies. An infectious disease specialist may have vast experience with managing animal bites and other infection-prone wounds. The court often has allowed expert testimony by specialists in fields other than that of the defendant when the deponents have special knowledge (proven education, skill, and experience) in the area. For example, an orthopedist has been allowed to provide expert testimony in testifying against a radiologist [8], and a cardiovascular surgeon was allowed to testify against an orthopedic surgeon [9]. These examples are only a couple of a multitude of similar court decisions in this area. Wound care crosses a variety of potential areas of specialty care. It behooves the emergency medicine provider to be aware of the practice of the specialists in the area. One should realize, for example, that although the emergency medicine literature may not support the use of prophylactic antibiotics in certain wound care situations, the local plastic or hand surgeon may practice differently. It also may be critical to

enlist opinions from appropriate local specialists as consultants in the more high-risk and controversial areas of wound management.

A likely reason for the low amounts recovered in litigation centers around the third element of malpractice, harm. It is difficult to prove harm in many cases. For example, if a tendon injury, nerve injury, or foreign body is missed, there may be no harm. The patient may require a surgery, but surgery would have been necessary anyway. Although there may be permanent damage, that damage also might have occurred anyway. When the plaintiff is successful in winning the case, the recovery often is focused only on the delay in definitive care with the associated patient pain and inconvenience.

The fourth element is proximate cause. In a recent case, *Brown v Brennan* [10], a 25-year-old woman came to the ED with a wound to the back of her leg. The wound was cleaned and dressed, and follow-up instructions were given. The wound became infected and required surgery with skin grafting. The plaintiff claimed that a failure to prescribe antibiotics caused the infection. The defendant claimed that infection is a known risk with all wounds. A defense verdict was returned. It is widely known that a certain percentage of wounds will become infected despite fastidious care, so it often is difficult to prove the defendant was the direct cause of the infection. Thus the fourth element of proximate cause may be difficult to prove in wound care malpractice suits.

Discharge instructions are critical in treating patients who have wounds. In recognizing that wounds are at risk for infection or missed injury, the physician must warn clearly about signs of infection, expected course of recovery, hallmarks of tendon or nerve damage, and the potential for a residual foreign body despite exploration or radiographic imaging. In high-risk wounds, specific follow-up is optimal. It is much better to have a patient later state, ''They told me that could happen,'' rather than, ''I had no idea what was going on.''

Wound preparation

The goals of laceration management are to avoid infection and to achieve a functional and aesthetically pleasing scar [1]. These goals can be achieved by reducing tissue contamination, débriding devitalized tissue, restoring perfusion in poorly perfused tissues, and establishing a well-approximated skin closer [2].

Wound repair requires anesthesia and may require procedural sedation. It is incumbent upon the emergency physician to be familiar with all the local anesthetics used and pay particular attention to the dosage recommendation. Local anesthetics have a multitude of side effects including central nervous effects such as paresthesias and seizures, cardiovascular effects including bradycardia and dysrhymias, and methemoglobinemia. Patients may become toxic with doses smaller than the recommended doses [11].

Procedural sedation may be necessary in children who have certain wounds. The equipment and protocols in place to ensure the safety of the procedure should include oxygen, suction, and airway equipment,

resuscitation medications, monitoring equipment, reversal agents, and dedicated nursing personnel to monitor the patient. There are many medications available, and their use depends upon the practitioner's experience and comfort level. Ketamine or a combination of narcotics and benzodiazepines is commonly used.

Visually inspecting the wound to its complete depth is required to search for foreign bodies and any anatomic injuries. Probing the wound with forceps will prevent potential injuries to the examiner. After exploration of the wound, irrigation can be performed. High-pressure irrigation is an effective method for removing bacteria and other potentially infective material; most authorities recommend irrigation with 5 to 8 psi. A 19-gauge needle with a 35- to 65-cm^3 syringe has been shown to generate this amount of pressure and more [12].

Normal saline is the most commonly used irrigant, although tap water has been shown to be just as effective and is readily available and cheaper [13,14]. Chlorhexidine, hydrogen peroxide, benzalkonium chloride, and detergent-containing products such as povidone-iodine should not be used for wound cleansing because they can result in local tissue injury and, in some instances, are less effective antimicrobials [12]. Most authorities recommend using 50 to 100 mL of irrigant per centimeter of wound length [15]. High-pressure irrigation is not necessary in all wounds, particularly in highly vascular wounds such as the scalp and face where there is no difference in the rate or infection or cosmetic appearance [16]. Soaking wounds is not effective and may be detrimental to repair and healing.

Hair removal may make closing the wound edges easier but is not required. Shaving should be avoided because of the potential for increased infection [17]. Hair removal should be avoided in the eyebrows because they are important as cosmetic landmarks in closure. In conjunction with irrigation and before skin closure, débridement may be necessary. The goal of débridement is removal of devitalized tissue that could increase the risk of infection. Additionally, removing any nonviable tissue around the wound edges may improve cosmetic appearance.

The timing of wound closure depends on a number factors including the location of the wound, the degree of contamination, and the amount of time that has elapsed from the injury to closure. It has been a generally accepted standard that wounds on the extremities can be open for 6 hours before closure, whereas wounds on the head and neck can remain open up to 24 hours. Wounds that are at high risk for infection even after copious irrigation and cleansing techniques may be candidates for delayed primary closure. Physician judgment is key in this decision making. When in doubt, ''one is never wrong not closing a wound.'' Patients also should be informed that all wound repair leaves scars, that scars sometimes can be revised, and that it will be months before the ultimate result is known. It should be emphasized that ''closing a wound loosely'' or using surgical tape instead of suture is considered primary closure of a wound with all the associated risks of infection and their sequelae.

Standard of care

Much of wound preparation and closure decisions are anecdotal with few good evidence-based studies in existence. It therefore is difficult to define a true standard of care. Practice among emergency physicians varies both in the methods of closure and the use of cleaning techniques. One study of board-certified emergency medicine physicians demonstrated that 38% soak wounds, 21% use full-strength (10%) povidone-iodine or hydrogen peroxide, 67% scrub wounds using cotton gauze or coarse sponges, 27% irrigate wounds with other than recommended irrigation, and 76% never or infrequently practice delayed primary closure [18].

Tendon and nerve injuries

Alexander Herrerra v New York City Health and Hospitals Corporation

A 22-year-old male slipped on a staircase at work and lacerated his left forearm in November 2001 [19]. Sutures were used to close the laceration. Soon afterwards he lost mobility of his left (dominant) hand. He developed a permanent claw-hand and cannot perform fine motor movement. He was forced to learn to write with his right hand. He claimed the laceration involved the ulnar nerve, and the involvement was undetected. The case settled for $1.5 million.

Joseph and Tonya Luby v. H Arthur Heafer MD and Susan Galbele

The plaintiff sustained a laceration to the distal joint of his left index finger when he accidentally closed the finger in a bank night-deposit drawer [20]. He presented to Presbyterian Hospital-Kaufman ED for treatment. The wound was cleaned and sutured by a physician's assistant under the supervision of Dr. Heafer. When the plaintiff failed to regain movement of the distal finger joint after 30 days, he was sent to a hand surgeon who discovered a previously undiagnosed rupture to the flexor profundus tendon at the site of the previous injury. A complex tendon transplant procedure followed but left the plaintiff with a deformed and disabled finger. The plaintiff claimed the tendon injury should have been discovered on the original visit when a simple repair could have been done easily and successfully. He also claimed the delay led to a more complicated surgery that was unsuccessful. The case was settled for a confidential amount.

Before exploration and before anesthesia, a functional examination should be performed to determine the extent of injury. The mechanism of injury should be elicited before the examination, and, in the case of hand injuries, the patient's dominant hand should be documented. Careful attention should be paid to the effects of fight bites, pain on movement, numbness, or weakness.

The exploration should be performed in a relatively bloodless field after anesthesia with optimal lighting. Methods used include increasing the blood

pressure cuff to 20 to 30 mm above the patient's systolic blood pressure for upper- or lower-extremity injuries. In the case of hand injuries, putting a plastic glove on the involved hand, cutting the finger tips, and rolling the glove down past the wound creates a tourniquet. Commercially available finger tourniquets can be used instead. Tourniquets should not be in place for longer than 30 to 60 minutes in the ED [21].

Examine the wound with good range of motion because the location or mechanism of injury may prevent easy visual inspection of the tendons. As much as possible, recreate the mechanism of injury. Inspect the wounds for any degree of tendon sheath or tendon involvement. Tendon repair may be done either primarily or in a secondary fashion depending on the type of wound involvement, the presence of foreign matter, involvement of the flexor or extensor tendon, and any other injury the patient may have. Flexor tendon injuries to the hand need to be repaired by a hand specialist or orthopedic surgeon. Primary repair is recommended, with most injuries being repaired in 12 to 24 hours [22,23]. In the event of excessive contamination, skin loss, unstable bony injuries, or missing tissue, delayed closure up to 2 to 3 weeks is possible with little difference in outcomes [22,23].

Extensor tendon injuries can be repaired by emergency physicians depending on the location and the physician's comfort level. If the laceration is between the distal wrist and metacarpal joint and is less than 8 hours old, and the skin and tendon wounds are sharp, easily visualized, and not heavily contaminated, the emergency physician can perform the repair if he or she feels qualified to do so and can arrange appropriate follow-up [23]. Not all tendon injuries need repair. Most tendon lacerations that are less than 50% can be treated without surgery [22].

Nerve repair, like tendon repair, can be done either primarily or in a secondary fashion. By definition, primary repair is done within 5 to 7 days of the injury and is most effective when the nerve ends can be reapproximated without tension in a well-vascularized area [24]. Secondary repair generally is performed about 2 to 3 weeks after injury and can involve either reapproximating the nerve ends or grafting. Most repairs are done in the upper extremities, although repairs can be performed in the lower extremities with mixed results [24]. For all nerve injuries, there is better likelihood of success in younger patients and those who have a cleaner mechanism of injury.

Patients should be involved in the decision-making process as much as possible. Explaining the potential for infections, the type of repair, and the expectation of function after repair are important elements. Practices may vary among consultants, and the emergency physician should discuss these differences of opinion with the patient. Although many of these injuries may be repaired acutely, it is possible that the orthopedic surgeon will want the skin closed primarily and the injured extremity splinted with follow-up arranged as an outpatient. Most patients requiring surgical intervention can be discharged after appropriate follow-up is arranged [25].

Foreign bodies

Nelson v Richter- Mich 2003

A 17-year-old male cut his foot when a glass fell from a counter. In eth ED wth wound was examined, cleaned, and dressed [26]. The wound was too small to be explored visually. Ten days later the patient returned with continued pain and stiffness. He ultimately went to surgery to remove a piece of glass from between his third and fourth metatarsals. The plaintiff's contention was that a radiograph should have been obtained. The defense stated that the patient returned for suture removal and not for problems, and that surgery might have been required anyway. There was a jury verdict for the defense.

Ashley v Gustafson and colleagues Jackson County (Missouri) Circuit Court

The 44-year-old plaintiff broke a glass and put the pieces in a trash bag but failed to notice that a piece of broken glass was jutting out from the bag [27]. While walking past the bag, she cut her ankle on the protruding glass. A doctor saw her and sutured the wound. No radiograph was performed. A second doctor saw her 9 months later for persistent pain and removed a 2.5-cm piece of glass from the wound. He did not obtain radiographs either. Seven months later she returned to the ED with more pain, and a radiograph was performed. It revealed three more pieces of glass. The plaintiff claimed a radiograph was required for this type of wound. The defendants claimed no radiograph was needed. A verdict for $179,000 was returned but was reduced to $119,930 after fault was allocated. Fault was designated as 42% to one ED physician, 25% to other ED physician, and 33% to the plaintiff.

In every patient presenting with a traumatic wound, there should be a concern for foreign bodies, with a high index of suspicion in certain animal bites or grossly contaminated wounds. The mechanism of injury may be a clue to the presence of foreign bodies. For example, a wound caused by sliding on gravel should heighten suspicion for retained fragments, whereas a puncture with a knife will be less suggestive. Additional clues would be wounds that have persistent pain, drainage, or that otherwise fail to heal. Patients who have glass injury may be able to feel the presence of the foreign body, and it may be useful to ask them [28].

A number of imaging techniques are used for foreign bodies. Their effectiveness is variable and depends on the material of the foreign body. Radiography is readily available and may locate a number of materials, including metal, bone, teeth, pencil graphite, certain plastics, glass, gravel, sand, some fish bones, some wood, and some aluminum [29]. Glass does not need to contain lead to be visible on a radiograph, and glass fragments 2 mm or larger are visible radiographically [30]. There should be a low threshold

for obtaining radiographs in glass wounds because they are one of the most common causes of foreign-body litigation. In one study, up to 7% of wounds caused by glass injury had retained glass, with puncture wounds being the most common cause [31]. Wounds at greatest risk included puncture wounds, head or foot wounds, wounds caused by stepping on glass, and those resulting from a motor vehicle accident [31].

CT scanning can detect more types of foreign material than radiographs and is 100 times more sensitive in differentiating densities [25]. Some wood, thorns, and spines not visible on plain radiographs have been identified with CT. Expense and radiation exposure does limit the usefulness of CT. Although ultrasonography is an option, its success is variable. The overall sensitivity ranges from 50% to 90%, and specificity is 70% to 97% for gravel, metal, glass, cactus spines, wood, and plastic [30]. The usefulness of MRI is limited in wounds that involve gravel or metal. It probably should be reserved for suspicion of vegetative matter that is not seen on other imaging techniques [29].

The need for foreign body removal depends on its location and type of material: vegetative material is markedly more reactive than metal. The benefits of removal need to be weighed against the trauma and tissue destruction that may occur with attempts at removal and the likelihood of successful recovery.

If one foreign body is found, it is important to be vigilant in searching for additional pieces, remembering the adage "where there's smoke there's fire." Educate the patient and the patient's family about the potential for foreign bodies and the potential for wound infection. Document that a search was performed and give good wound care and follow-up instructions.

High-risk wounds

Bessenyei v Raiti. US District Court- Maryland

Mr. Bessenyei had paint thinner injected into his thumb under high pressure and presented to the ED [32]. Dr. Raiti, the ED physician, consulted a hand surgeon, who was not on call but who previously had demonstrated a willingness to help. The hand surgeon recommended antibiotics and pain medications, which the patient was given. The patient's tetanus immunization was updated, and he was discharged with instructions to return if his condition worsened. The patient's thumb worsened, and subsequently a partial amputation was necessary. Mr. Bessenyei sued both physicians claiming they negligently failed to realize the seriousness of a high-pressure injection and did not appropriately incise and débride the thumb. The hand surgeon asked the judge to dismiss him from the case because he had no relationship with the patient or contractual duty; he simply provided advice. The judge agreed and held the ED physician solely liable. "It was Dr. Raiti (ED physician) who had direct contact with the patient, rendered care,

and initiated contact with the consultant. He could override the consultant by accepting or rejecting his recommendations and made the final decision.''

Although all wounds are at risk for infection and adverse outcomes, several types of wounds are associated with a considerably greater risk. These wounds include high-pressure injection injuries and wounds caused by human teeth, or ''fight bites.''

High-pressure injuries often present with a small puncture wound, primarily to the hand. The wound may seem innocuous to both the patient and the initial provider, but lack of vigilance in caring for these patients can result in substantial morbidity. The high-pressure spray guns in use discharge a variety of products including water, paint, thinners, solvents, and hydraulic oil and fluid.

Factors that affect morbidity include the site of injection and the type, amount, and viscosity and pressure of the material injected [33]. Solvents and paint thinner are significantly more damaging than grease and oil-based compounds because their lower viscosity allows the injected material to spread more easily [34]. If the material is injected into relatively nondistensible tissue such as the fingers, the increased tissue pressure can result in tissue damage and compromise of the microcirculation, causing a compartment-like syndrome [35]. The injury often occurs in the nondominant hand while a worker is clearing equipment or trying to steady in during it during its operation.

Plain-film radiographs may reveal varying distribution of radiopaque densities associated with paint or subcutaneous air from air or water injection. Although imaging may be important, a hand surgeon should be consulted expeditiously, because the amputation rate is significantly greater if surgical débridement occurs more than 6 hours from the time of injury and varies from 16% to 55% of patients [34].

Human bites can be divided into occlusional bites and bites of the hand involving the metacarpal phalangeal joint (clenched-fist injuries). Occlusional bites occur when the teeth break the skin, often tearing the tissue and leaving bite marks. When they occur in places other than the hand, they are no more dangerous than any other laceration or bite [36]. Injuries to the metacarpal phalangeal joint, on the other hand, often occur in younger men as a result of an altercation, and these are at substantial risk for infection. The extensor tendon often retracts proximally after the injury, seals the puncture, and creates an anaerobic environment for inoculated bacteria within the joint [37]. There is a basic axiom in emergency medicine that any wound over the metacarpal phalangeal joint of the hand joint is a fight bite until proven otherwise. Care must be taken to explore these wounds, and many of them may need timely involvement by the ED hand surgeon. The organisms involved include Streptococcus spp and *Staphylococcus aureus*, but there also is a high percentage of anaerobes [38].

Consultation

Lockard v. Lacker- Kentucky 2002

A 7-year-old boy tripped at school and had a minor cut on his middle finger. Later in the day he went swimming [39]. The mother looked at the cut and thought it did not need any attention. Later that night he awoke crying with vomiting and fever. He went to the ED at 2:30 AM. The physician performed a radiograph of the finger, which was normal, and examined the laceration, which looked "benign." The boy was diagnosed as having "stomach flu" and was released. Two days later his finger appeared swollen and purple with blisters. He was admitted with a necrotizing Strepotcoccus A infection, and ultimately the finger was amputated. The suit against the emergency medicine physician claimed that a plastic surgeon or orthopedist should have been consulted on the initial visit. The verdict found for the defense, deciding that the initial diagnosis was reasonable based on the presentation.

In general, a consultation over the telephone does not establish a physician–patient relationship; thus, the consultant cannot be held liable for malpractice related to advice. Most courts require an actual examination by the physician to establish a relationship or a specific and affirmative action by the physician that establishes that the doctor agrees to be involved in the patient's care. The courts are hesitant to have mere conversations (even in on-call situations) or an agreement to provide follow-up care represent the establishment of a formal relationship, because doing so would chill the normal communication between professionals that usually facilitates optimal patient care.

Antibiotics

Antibiotic prophylaxis has no usefulness in uncomplicated wounds [40]. Some practitioners give antibiotics for all wounds with the intent of avoiding litigation should an infection develop. This practice is not without consequence, because unneeded medications can result in selection of resistant organisms, side effects, allergies, or hypersensitivity. Litigation still can result even with this conservative and rather arbitrary approach. As mentioned previously, it may be prudent to find out how local specialists practice, because, depending on the injury, the emergency medicine physician's practices may be compared with their practice.

Certain factors are associated an increased likelihood of wound infection. These factors include advanced age, history of diabetes, the presence of foreign body in the wound, stellate shape of the wound, a wide laceration, jagged wound edges, and wounds deeper than the subcutaneous tissue [41]. Antibiotics also are sometimes recommended in an immunosuppressed host; an open fracture; a wound involving exposed tendon, bone, or joint;

grossly contaminated high-risk bite wounds (eg, puncture, crush, or extremity wounds); oral wounds; and wounds that have significant delay before presentation [42]. The location of the wound is also a factor; the incidence of infection ranges from 1% to 2% in head and neck wounds to as high as 7% in the lower extremities [21].

Discharge and follow-up instructions

Older Americans, particularly older women, some immigrants, intravenous drug users, and the poor are at risk for being underimmunized. The patient's status should be well documented in the medical record.

Patients may not have the ability to identify and assess wound healing properly [43]. Follow-up instructions should be explicit, especially for wounds that have a high risk of complications. All patients should be given specific wound-care instructions. These instructions are given most effectively best with a written form that identifies all potential complications and the need to return for any signs of swelling redness or fever. All wounds considered high risk should have a mandatory 24- to 48-hour recheck. Patients also should know that, even with meticulous treatment, wounds do get infected. Patients should be cautioned about using anything other than water to clean their wounds, because solutions such as hydrogen peroxide and Betadine are toxic to the tissues.

Summary

Although substantial dollar amounts are not involved, wound-care litigation constitutes a significant number of lawsuits to emergency medicine physicians resulting in an increased drain on the physician's time and exposing the physician to all the psychosocial effects involved in the medicolegal process. The procedures outlined in this article—paying attention to wound-care principles, involving patients in the medical decision-making process, and ensuring appropriate medical follow-up—can, it is hoped, reduce the incidence of medical claims.

References

[1] Singer AJ, Hollandr JE, Quinn JV. Evaluation and management of traumatic laceration. N Engl J Med 1997;337:1142–8.
[2] Hollander JE, Singer JE. Laceration management. Ann Emerg Med 1999;34:356–67.
[3] Hollander JE, Singer AJ, Valentine S, et al. Wound registry: development and validation. Ann Emerg Med 1995;25:675–85.
[4] Henry GL. Specific high risk medical-legal issues. In: Henry GL, Sullivan DJ, editors. Emergency medicine risk management. Dallas (TX): American College of Emergency Physicians; 1997. p. 475–94.
[5] Karcz A, Auerbach B, et al. Preventability of malpractice claims in emergency medicine: a closed claims study. Ann Emerg Med 1990;19:865–73.

[6] Karcz A, Holbrook J, et al. Massachusetts emergency medicine closed malpractice claims: 1988–1990. Ann Emerg Med 1993;22:553–9.
[7] Karcz A, Korn R, et al. Malpractice claims against emergency physicians in Massachusetts 1975-1993. Am J Emerg Med 1996;14:341–5.
[8] Silvas v Ghiatas, 954 S.W.2d 50 (Tes. App. San Antonio).
[9] Dempsy v Phelps, 700 So.2d 1340 (Ala 1997).
[10] Brown v Brennan. (Texas)
[11] Mulroy MF. Systemic toxicity and cardiotoxicity form local anesthetics: incidence and preventive measures. Reg Anesth Pain Med 2002;27:556–61.
[12] Singer AF, Hollander JE. Pressure dynamics of various irrigation techniques commonly used in the emergency department. Ann Emerg Med 1994;24:36–40.
[13] Valente JH, Forti RJ, Freundlich LF, et al. Wound irrigation in children: saline solution or tap water? Ann Emerg Med 2003;41:609–16.
[14] Howell JM, Chisolm CD. Wound care. Emerg Med Clin North Am 1997;15:417–25.
[15] Singer AJ, Hollander JE. Wound preperation. In: Singer AJ, Hollander JE, editors. Lacerations and cute wounds: an evidence-based guide. Philadelphia: FA Davis; 2003. p. 13–22.
[16] Hollander JA, Richman PB, Werblud MP, et al. Irrigation in facial and scalp lacerations: does is alter outcome? Ann Emerg Med 1998;31:73–7.
[17] Seropian R, Reynolds BM. Wound infections after pre-operative depilation vs. razor preparation. Am J Surg 1975;129:251–4.
[18] Howell JM, Chisolm CD. Outpatient wound preparation and care: a national survey. Ann Emerg Med 1992;21:976–81.
[19] Alexander Herrerra v New York City Health and Hospitals Corporation. NY Supreme Court Index Number 103063/03.
[20] Joseph and Tonya Luby v H. Arthur Heafer, MD and Susan Gabele- Kaufman County (Texas) District Court Case No. 58532.
[21] Hollander JE. Patient and wound assessment: basic concepts of the patient history and physical examination. Foreign bodies in wounds. In: Singer AJ, Hollander JE, editors. Lacerations and acute wounds: an evidence-based guide. Philadelphia: FA Davis; 2003. p. 9–12.
[22] Harrison BP, Hilliard MW. Emergency department evaluation and treatment of hand injuries. Emerg Med Clin North Am 1999;17:793–822.
[23] Trott A. The hand. In wounds and lacerations: emergency care and closure. St. Louis (MO): Mosby; 1991. p. 177–214.
[24] Allan CH. Functional results of primary nerve repair. Hand Clinics; 2000;16:67–72.
[25] Capellan MD, Hollandr JE. Management of lacerations in the emergency department. Emerg Med Clin North Am 2003;21:205–31.
[26] Nelson v Richter, Oakland County (MI) Circuit Court Case No. 03-048262-NH.
[27] Ashley v Gustafson et al. Jackson County (Missouri) Circuit Court, Case No. CV97–19936.
[28] Steele MT, Tran LV, Watson WA, et al. Retained glass foreign bodies in wounds: predictive value of wound characteristics, patient perception, and wound exploration. Am J Emerg Med 1998;16:627–30.
[29] Lammers R. Foreign bodies in wounds. In: Singer AJ, Hollander JE, editors. Lacerations and acute wounds: an evidence-based guide. Philadelphia: FA Davis; 2003. p. 147–57.
[30] Couter BI. Radiographic screening of glass foreign bodies. What does a "negative" foreign body series really mean? Ann Emerg Med 1990;19:997–1000.
[31] Montano JB, Steele MT, Watson WA. Foreign body retention in glass caused wounds. Ann Emerg Med 1992;21:1360–3.
[32] Bessenyei v Raiti. US District Court- Maryland No JFM-01-1029, June 9, 2003.
[33] Flotre M. High-pressure injection injuries of the hand. Am Fam Physician 1992;45:2230–4.
[34] Vasilevski D, Noorbergen M, Depierreux M, et al. High pressure injection injuries to the hand. Am J Emerg Med 2000;18:820–4.
[35] Karlbauer A, Gasperschitz A. High pressure injection injury: a hand threatening emergency. J Emerg Med 1987;5:375–9.

[36] Goldstein EJ. Management of human and animal bite wounds. J Am Acad Dermatol 1989; 21:1275–9.
[37] Talan DA, Citron DM, Abrahamian FM, et al. Bacteriologic analysis of infected dog and cat bites. N Engl J Med 1999;340:85–92.
[38] Griego RD, Rosen T, Orengo IF, et al. Dog, cat and human bites: a review. J Am Acad Dermatol 1995;33:1019–29.
[39] Lockard v Lacher, Jefferson Couty (KY) Circuit Court, Case No. 02–8116.
[40] Cummings P, Del Beccaro MA. Antibiotics to prevent infection of simple wounds: a meta-analysis of randomized studies. Am J Emerg Med 1995;13:396–400.
[41] Hollander JE, Singer AJ, Valentine S, et al. Risk factors for infection in patients with traumatic lacerations. Acad Emerg Med 2001;8:716–20.
[42] Moran GJ, House HR. Antibiotics in wound management. In: Singer AJ, Hollander JE, editors. Lacerations and acute wounds: an evidence-based guide. Philadelphia: FA Davis; 2003. p. 194–204.
[43] Seaman M, Lammers R. Inability of patients to self-diagnose wound infections. J Emerg Med 1991;9:215–9.