This study was designed to compare the infection rates of simple lacerations irrigated with tap water versus sterile normal saline before repair. Patients with simple lacerations to an extremity that were less than 8 hours from injury were prospectively enrolled. Exclusions from the study were: dog bites, hand lacerations, immunocompromised patients, and those on antibiotics at the time of injury. Patients who qualified were randomized to receive tap water or normal saline for wound irrigation. Before and after irrigation, wound cultures were obtained. After the procedure was complete, patients were scheduled for a 48 hour follow-up wound check. A total of 46 patients were enrolled in the study. Twenty-four patients were randomized to the normal saline group and 21 were assigned to receive tap water irrigation. There were 2 infected lacerations in both the tap water and normal saline groups. The organisms cultured from the wounds in both groups were similar and there was no difference in colony counts when tap water was used. The use of tap water for the irrigation of lacerations does not result in the growth of unusual organisms or increase the colony counts of organisms. Wound infection rates were the same in both groups. This pilot study suggests that the use of tap water for irrigation of wounds may be safe. Further validation is necessary. (Am J Emerg Med 2002;20:469-472. Copyright 2002, Elsevier Science (USA). All rights reserved.)

Traumatic lacerations are a common reason for pediatric ED (ED) visits. It is estimated that 50 to 60 per 1,000 children annually will sustain a laceration.23 Bacterial contamination and subsequent wound infection is the most common complication encountered after wound repair. Wound infections after laceration repair have been shown to occur in from 1% to 17% of patients.4-18 Many solutions and methods have been studied to ascertain the most effective way to irrigate wounds.15-18 Dire et al have shown that copious irrigation with sterile normal saline is the most effective and least costly method for reducing the incidence of wound infection after repair.19 Currently, EDs are using a variety of commercial and costly new technologies to facilitate the sterile irrigation of wounds before repair.

Angeras et al from Göteborg, Sweden, published the only randomized study comparing tap water with sterile normal saline in 1992.20 Although the infection rates in wounds cleaned with tap water were significantly lower than those irrigated with normal saline, this cost saving procedure has never been validated nor widely used. Riyat and Quanton investigated the bacterial cleanliness of tap water in an ED in the United Kingdom.21 Cultures from tap water within their facility failed to grow any pathogenic bacteria. Recently there have been 2 randomized controlled studies by Moscati using animal models that suggest that tap water may be equally effective as normal saline for irrigating wounds.22,23 Experimental lacerations made on rats were inoculated with bacteria. After 30 minutes, wounds were cultured and tap water was compared with normal saline as the wound irrigation solution. Both groups had similar outcomes when comparing infection rates and bacterial colony counts. These findings should not be surprising because tap water is the most common irrigant used outside of the hospital setting without any untoward effects.

This study was designed to show the safety and efficacy of tap water irrigation in children for the management of extremity laceration repairs in the ED.

METHODS

The study was undertaken at a large urban pediatric hospital with an annual census through the ED of over 100,000 visits. Approval was obtained by the Institutional Review Board. Patients were randomized to receive either sterile normal saline or tap water wound irrigation. The investigator and treating physicians were blinded to the form of irrigation used. Patients were recruited during a 15-month period from June 1999 through August 2000. Eligible patients were between 1 and 18 years of age who presented within 8 hours of a traumatic laceration to the extremities. Hand lacerations were excluded. Enrollment required verbal agreement to return for a follow-up wound check. Patients were excluded if they were immunocompromised, the laceration was sustained by a dog bite, or if the patient was on antibiotics at the time of repair. The definition of a simple laceration was one that did not extend to the muscle or bone and did not have any joint involvement. After consent was obtained, a data sheet was completed which included past medical history, history of prior lacerations and any associated complications. The wound was then cultured by applying a culture swab to the most central portion of the wound. Using a randomization schedule, a noninvestigator staff member then prepared 500 mL of the tap water or normal saline solution in a sterile basin and gave it to the investigator to perform wound irrigation. The investigator was blinded to the solution used. The wound was irrigated with a 35 mL syringe attached to an irrigation shield. This was done to achieve the goal of high pressure (25-40 psi) irrigation as recommended by Singer et al.24
After irrigation was completed, the wound again was cultured. Both the preirrigation and postirrigation cultures were submitted to the laboratory for qualitative and quantitative bacterial cultures. The laceration was sutured in the standard fashion. Information regarding suture materials used, number of sutures placed, and local anesthetic agents used were recorded. Antibiotic ointment was then applied to the wound and the wound was dressed. The patients were asked to return in 48 hours for a wound check.

Wound complications consisted of one or more of the following: (1) cellulitis or erythema of the wound margin of more than 4 mm with tenderness, (2) purulent discharge from the wound, (3) ascending lymphangitis, (4) dehiscence of the wound with wound separation of >2 mm.

STATISTICAL METHODS

Data were summarized using means and standard deviations (age) and numbers with percentages for categorical data. The 2 groups were compared using Student’s t test for independent groups (age) and with Chi-square contingency table analysis of Fisher’s Exact test, as appropriate, for the categorical measurements. Because postrepair infection rates is the only clinically pertinent variable, a sample size to prove a difference would have to be extremely large.

RESULTS

During the study period, a total of 46 patients were consented and enrolled in the study and 44 returned for follow-up. The remaining 2 patients were contacted by telephone. Patients ranged from 2 to 16 years of age. Table 1 illustrates the patient and wound characteristics for both the tap water and normal saline groups. There was no significant difference between the 2 groups in relation to gender, (P = .727) injury mechanism, (P = .905) length of wound (P = .419) or location of laceration, (P = .508). Nearly half of the injuries were caused by sharp objects (glass, and so on) and half by blunt tissue injury.

Table 2 provides information on pre- and postirrigation cultures from the wounds of both the normal saline and tap water groups. A postirrigation culture was positive in 11 of 21 (52%) for the tap water group, and 7 of 24 (29%) for the normal saline group. This was not statistically significant. (P = .200). Any growth on culture was included in the culture results. There was no attempt to sort out contami-
nants. There was no difference in the number of infected lacerations at 48-hour follow-up with 2 patients in each group returning with signs of wound infection. In regards to the 2 infected lacerations in the normal saline group, one was culture positive in the postirrigation phase, and the other was culture negative. The tap water group had one laceration infected which was preirrigation and postirrigation negative. The other tap water laceration infection was preirrigation positive and postirrigation positive. However, there was a reduction of colony counts between the pre- and postirrigation phase. Both infected lacerations in the tap water group had visible debris in the wound before irrigation.

DISCUSSION

Fortunately, serious complications from laceration repair are relatively uncommon events. However, this makes safety and efficacy studies comparing a change in standard care (normal saline irrigation), with a new method (tap water irrigation) a difficult task. When postrepair infection rates are the measurable adverse event, small numbers are expected and a statistically valid study is difficult to attain. Children have been found to have fewer postrepair infections than adults. This is in part attributable to the high incidence of facial lacerations in children. Simple facial lacerations have been shown to rarely become infected. The most common area to have a postrepair infection is the extremities, particularly the lower extremities. Heavy contamination and blunt injury with tissue damage will increase the rate of infection. The study population was limited to extremity lacerations which may explain the overall high incidence (nearly 9%) of patients with postrepair infections. This rate is similar to results from other investigators.

Lidocaine (4%), epinephrine (0.1%), and tetracaine (0.5%) (LET) solution was used for topical anesthesia on all patients. Additional analgesia using buffered lidocaine and conscious sedation were used at the discretion of the treating physician. The process of wound irrigation was identical in both the tap water and normal saline groups. Irrigation was accomplished using a 35 mL syringe attached to a plastic disposable splash guard (Zero-wet, Palos Verdes, CA). This allowed for high pressure (greater than 8 psi) irrigation without the threat imposed by a 19-gauge needle. The choice of suture material used for repair was left to the discretion of the treating physician.

A variety of different irrigation solutions have been studied in an attempt to reduce the bacterial wound load and decrease the chance of infection. Disinfectants such as alcohol, providone-iodine, hydrogen peroxide, hexachlorophene, and chlorhexidine have been shown to cause tissue toxicity and impair wound healing. Copious irrigation with normal saline has been shown to reduce bacterial colony counts, and reduce the risk of infection. High pressure irrigation, greater than 8 psi fluid pressure, has been shown to be more efficient in removing bacteria. Most investigators agree that the most efficient method of irrigation is with normal saline using continuous high pressure irrigation and copious quantities of irrigation fluid.

Although normal saline is considered the standard choice for wound irrigation, tap water appears to be safe, efficacious, and offers many advantages. It is readily available at essentially no cost. Local health departments maintain surveillance and monitor quality. Although some bacteria are present in commercial water supplies, the thresholds for bacterial load are insignificant when considering suitability for wound irrigation. High pressure and large volumes of tap water are readily available and easy to use. In a previous study from Sweden, tap water irrigation before laceration repair was found to be more effective than normal saline in reducing the incidence of postrepair wound infections. Recent animal studies by Moscati et al have also shown that tap water is as safe and efficacious as normal saline for wound irrigation. Our data, although small in numbers, suggests that there is no increased risk in using tap water to irrigate traumatic lacerations.

SUMMARY

Further validation of safety and efficacy of tap water as an irrigation solution for wound cleansing and debridement is necessary before widespread recommendation for use can be made. Our study suggests that tap water may serve as a cost-saving alternative to normal saline for irrigating simple lacerations before repair. Higher pressures and more prolonged and effective irrigation may be delivered at less cost.

REFERENCES