Evidence Based Medicine:
Wound Cleaning – Water or Saline?

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Abstract: A review of the evidence regarding the appropriate irrigating solution for wound cleaning is presented. An ongoing series in The Journal, each edition features an abstract of a systemic review from the Cochrane Database of Systematic Reviews and a commentary by an emergency physician knowledgeable in the subject area. The Authors conclude there is insufficient evidence to either support or refute the claim that tap water is comparable or superior to normal saline.

Systematic review Source: The source for this systematic review abstract is: Fernandez R, Griffiths R, Ussia C. Water for wound cleansing. (Cochrane Review). In: *The Cochrane Library,* Volume 2, 2005.

MeSH Words: Wound Cleaning, Irrigation, Saline, Laceration

Objective

To assess the effects of water (tap or distilled) compared with other solutions or no solutions for wound cleansing

Data Source

The primary source was the Cochrane Wounds Group Specialized Register. A broad search of MEDLINE, EMBASE, CINAHL, and the Cochrane Controlled Trials Register was conducted (ending June 2004). Primary authors, company representatives, and content experts were contacted to identify other eligible studies. Reference lists from included trials were also searched.

Study Selection

Randomized and quasi-randomized controlled trials comparing wound healing outcomes or infection rates in wounds cleaned with water and those cleaned with normal saline or any other solution were included. Trials involved patients of all ages with a wound (defined as a break in the skin) of any etiology and in any setting were included. Trials were excluded if they involved dental procedures or burns, compared various types of dressings or used solutions for purposes other than cleansing. The primary outcome of interest was wound infection (objective measures of infection, such as wound culture or biopsy, and of healing, such as change in surface area or depth) .Trials that included only subjective measures of infection or healing were also included, however these studies were analyzed separately.

Data Extraction

Two reviewers independently selected studies for inclusion and extracted the data, which were then confirmed by a third reviewer. All three reviewers evaluated the studies for methodological quality. The trials were stratified by whether the wounds were acute or chronic (as pre-specified in the protocol). When two or more trials compared similar solutions and used the same outcome measures, they were tested for heterogeneity using the I^2 statistic. Dichotomous variables were expressed as relative risk (RR) with 95% confidence intervals (CI).

Main Results

Twenty-four RCT's comparing wound cleansing solutions were identified, but only nine met the inclusion criteria of this review. Three trials compared wounds cleansed with tap water with those not cleansed and six trials compared wound cleansing with water and other solutions. There was significant heterogeneity in the types of wounds, the cleansing solution used and the outcome measures used. All trials used subjective measures to assess wound infection (pus, discoloration, friable granulation tissue).

1. *Comparison of tap water vs. no cleansing:*

Three RCTs compared infection or healing rates of surgical wounds in patients who were either allowed or not allowed to bathe or shower. Only one study measured infection rates (101 patients), with 2 incidents of wound infection (one in each group). The relative rate (RR) of infection was 1.06, CI 0.07 to 16.50 (not statistically significant). Pooled data from two trials of the (772 patients) demonstrated no statistically significant difference in the number of wounds that did not heal (RR 1.26, CI 0.18 to 8.66).

2. *Comparison of tap water vs. normal saline in acute wounds:*

Three trials compared tap water to normal saline in cleansing acute wounds. Two of the studies focused on children. The one adult trial compared 627 acute wounds (<6 hours) that were sutured. This trial demonstrated a statistically significant reduction in infection rates in wounds cleansed with tap water compared with those cleansed with saline (RR 0.55, CI 0.31 to 0.97, p = 0.04). The pooled results of the two pediatric trials included 535 patients and demonstrated no statistically significant difference in wound infection rates (RR 1.07, CI 0.43 to 2.64). .

3. *Comparison of tap water vs. normal saline in chronic wounds:*

One trial of 49 patients compared chronic, non-sutured wounds that were cleansed with either tap water or normal saline. This study reported no statistical difference in wound infection rates (RR 0.16, CI 0.01 to 2.96) or in wound healing (RR 0.57, CI 0.30 to 1.07). This study also reported the use of tap water reduced cost ($1.43 for normal saline vs. $1.16 for tap water).

4. *Comparison of water (distilled water and/or cooled, boiled water) vs. normal saline:*

There was one three-armed study which compared distilled water, normal saline, and cooled boiled water for the irrigation of open fractures. None of the three comparisons demonstrated a statistically significant difference in wound infection rates; however the study was under-powered with only 86 participants and 22 infections.

Conclusion

Evidence is limited; however one trial suggests that the use of tap water to clean acute wounds

reduces the infection rate while other trials conclude that there is no difference in the infection and healing rates between wounds that were not cleansed at all and those that were cleansed with tap water and other solutions.

Commentary: Clinical Implications

Wound lacerations are one of the most common injuries presenting to the Emergency Department. 11 million lacerations were treated in Emergency Departments around the country in 1996 (1). The estimated annual rate for lacerations for children each year is approximately 50-60 per 1000 children (2). With such a common complaint, a significant importance is placed on a) preventing wound infection b) aesthetic outcome for the patient.

The prevailing dogma in textbooks and clinical policy states that sterile saline, 100 cc per 1 cm of laceration, at a psi of 8 or above should be utilized to irrigate wounds (3, 4). In a wound registry study by Hollander et. al (5) of 1000 patients presenting to an ED, 51% of wounds were of the head and neck,, 13% of wounds were considered grossly contaminated, and 3% of all cases had foreign bodies removed. 64% of these wounds were irrigated, 97% of the time with 500 cc of sterile saline. Out of the 1000 patients, 34 wounds were considered to be infected (3.4%).

In order to decrease wound infection rates, factors such as length of time wound is open, foreign body, comorbidities of patient, mechanism of injury, quality of tissue and gross bacterial contamination have been researched in the literature.

Wound cleansing has been a controversial topic for many years. Antiseptic cleaners such as betadine solutions have grown out of favor as multiple studies have shown that these solutions actually hinder wound healing because they destroy viable tissue (6). Normal saline is most often preferred as it is relatively inexpensive, nontoxic to tissues, and does not affect normal skin flora. The use of tap water to cleanse wounds has also been examined.

Tap water is advantageous because it is highly accessible, inexpensive, can maintain high pressures right out of the faucet, is chlorinated and monitored for bacterial content through local governments, and has been used throughout the years for minor cuts in homes around the world (7).

In a small randomized, blinded crossover study of rats, 4 minutes of irrigation with tap water from a faucet reduced bacterial load by 80.6% in comparison to normal saline out of a syringe by 54.6% (8).

The systematic review conducted by Fernandez et. al performed an extensive literature search to evaluate the use of tap water versus normal saline for irrigation of wound.

The 3 randomized controlled trials (RCT's) that compared tap water to no cleansing material looked at post-operative surgical wounds that allowed the patients to shower their wounds versus keeping the wounds dry. The fixed effects model of the pooled data has a relative risk of infection of 1.06 (CI 0.07 to 16.50) which showed no significant statistical difference between the two groups. Keep in mind that there was only one incident in each group (2 total) in 871 patients.

3 trials compared tap water versus normal saline for rates of infection and healing rates in acute wounds (<6 hours). In the Angeras trial, the relative risk reduction of wound infection was 45% and a number needed to treat of 66 when utilizing tap water versus normal saline (RR=0.55; 95% CI 0.31 to 0.97; p=.04). This study is limited by the difference in temperatures of the irrigating solutions, namely that the tap water was 37 degrees Celcius compared to room temperature for the normal saline. Two of the trial included children only and were analyzed separately, the results were pooled which showed no statistical significance in infection rates for tap water versus normal saline (RR=1.07; 95% CI 0.43 to 2.64; p=0.88)

No trial looked at wound infection rates past 6 weeks so no long term conclusions can be made. None of the 9 trials stated the duration of time wound was irrigated. Finally, the overall small number of patients enrolled also undermines the conclusions drawn.

Overall, 6 of the studies showed considerable selection bias and only two trials adequately described the randomization process. The lack of quality limits the conclusions drawn from

these studies. The eligibility criteria and outcomes were also not well described within the trials. The addition of a validated data collection tool that looked at wounds at a specific time interval post-repair for standardized signs of wound infection would increase the strength of these studies. Because there was so much variability between studies, a meta-analysis could not be done.

As a result, there is insufficient evidence to either support or refute the claim that tap water is comparable or superior to normal saline. The results do suggest that although the literature is shifting toward tap water being a feasible alternative to normal saline for wound irrigation, clinicians should consider the quality of tap water, condition of the wound, and patients' past medical history before choosing to cleanse with tap water. Future research is needed to truly draw any conclusions. These studies will need to be in accordance to the CONSORT guidelines, have true randomization with allocation concealment, objective outcome measures of wound infection and aesthetics, and standard follow-up periods.

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