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A Comparison Between Traumatic Wound Infections after Irrigating Them with Tap Water and Normal Saline

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Abstract: Infection is a major factor that postpones wound healing specially in traumatic wounds. Many reports indicate important role of washing solutions on preventing wound infections. Tap water has been used for centuries as a wound cleanser without evidence of adverse effects or associated infection risk. Normal sterile saline is also regarded as the most appropriate and preferred cleansing solution because it is a nontoxic, isotonic solution that does not damage healing tissues. in this study we conducted to evaluate the comparative incidence rate of wound infections following their treatment with normal saline and tap water. In a clinical trial study fresh contaminated traumatic wounds of 600 patients were randomly washed perfectly with either normal saline or tap water and then sutured with a Nylon thread and left without any dressing. All wounds were followed for 1, 3 and 5 days and during each observation classic signs of infection were recorded for each patient. In this study wound infection progressively increased by the days after wound management in both groups and finally 8.3% of wounds washed with tap water and 8.6% of wounds washed with Normal saline showed one or more clinical sign of infection. its incidence rate increased with increase in patient's age.only In patients who were 30-60 years old, the incidence of wound infection in wounds washed with tap water was greater than those washed with normal saline. in this study there was no significant difference between wound infection in each sex group according to the type of washing solution, but in wounds washed with tap water the incidence rate of wound infection in males was significantly greater than females.In conclusion our findings appear to support the safety and ease of use of tap water in wound cleansing.

Key words: Tap water % normal saline % traumatic wound % infection

INTRODUCTION

Many factors such as wound etiology, delay in treatment, patient's age and some underlined diseases especially Diabetes mellitus affect wound healing [1]. Wound infection is the first suggested cause for delay in wound healing and is more prevalent in traumatic wounds [2]. According to degree of contamination and risk of infection, wounds can be divided into 4 categories [3]: 1-clean or non traumatic wounds 2- clean traumatic wounds 3-fresh contaminated traumatic wounds and 4-delayed contaminated traumatic wounds with debris and foreign particles. Wound care is typically initiated by cleaning the wound and surrounding skin [4]. Complications associated with infection are: 1-tissue damage, 2-foreign body contamination and 3- bacterial contamination [5]. The principles of wound management are designed to prevent further bacterial inoculation and to debride and cleanse the wound of necrotic tissue and foreign material [6]. Application of especial solutions and washing the wounds with water will be helpful to prevent infection, debride the necrotic tissue and clean the surrounding intact skin [7]. The most prevalent solution used for this purpose is normal saline. In 1991, Gruber *et al.* [8] evaluated the effectiveness of other solutions such as acetic acid (25%), provodone-iodine (Betadine), or hydrogen peroxide (3%) four times daily on the treatment of partial-thickness wounds. A control wound was treated with normal saline. They found a shorter time to full healing with the hydrogen peroxide-treated group and no difference in the other two solutions from that of normal saline. However, the authors

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noted that the peroxide-treated wounds developed air-filled blisters which would lead to ulcerations. Finally, these researchers found no gross differences in pigmentation or texture among wound sites, regardless of different treatments. They suggested that normal saline is a good solution with low cost in wound treatment. in this study we conducted to evaluate the comparative incidence rate of wound infections following their treatment with normal saline and tap water.

MATERIALS AND METHODS

In a clinical trial study fresh contaminated traumatic wounds of 600 patients referred to 2 emergency centers in Yazd, Iran were randomly washed perfectly with either normal saline or tap water and then sutured with a Nylon thread and left without any dressing. All wounds were followed for 1, 3 and 5 days and during each observation classic signs of infection such as erythema, swelling, warmth, purulent and bloody drainage and Crepitation [9] were recorded for each patient. the patients in 2 groups were matched according to age and sex.

For statistical analysis with assuming an alpha error of 0.05 and a beta error of 0.10, a study population of 300 patients per group was required forthis study, based on assumed wound infection rates of 2.0% for each group. The chi square test was used to determine whether there is any association between the presence of wound infection and post operative days [1, 3, 5] and also between the signs of infection and different types of washing solutions. To determine the existence of any age related wound infection in two groups Fisher exact test was used. Mean comparisons of wound infection in different age ranges were performed by the two-sample Student t test. The null hypothesis was rejected when P-values were less than 0.05.

RESULTS

In this study wound infection progressively increased by the days after wound management in both groups and finally in 5th postoperative day 25 wounds washed with tap water and 26 wounds washed with Normal saline showed one or more clinical sign of infection (Table 1). The incidence rate of different signs of wound infection in each group are shown in Table 2 according to the age in this study patients were divided into 3 categories and we found that there was a relatively age related incidence rate of infection in both groups and its incidence increased with increase in patient's age

Table 1: Incidence rate of traumatic wound infection in different post operation observational days (N-200)

	Groups				
	Normal saline		Tap water		
Sign of infection	No.	Percent	No.	Percent	Chi square test P-value
1st	10	3.3	11	3.6	0.819
3rd	19	6.3	19	6.3	0.992
5th	26	8.6	25	8.3	0.332

Table 2: Incidence rate of traumatic wound infection signs in different types of washing solutions (N-200)

	Groups				
	Normal saline		Tap water		
Sign of infection	No.	Percent	No.	Percent	Chi square test P-value
Erythema	24	12.0	23	0.888	11.5
Swelling	21	10.5	19	0.752	9.5
Warmth	21	10.5	16	0.402	8.0
Purulent drainage	16	8.0	17	0.851	8.5
Bloody drainage	16	8.0	17	0.851	8.5
crepitation	16	8.0	17	0.851	8.5
All signs	18	9.0	16	0.893	8.0

Table 3: Incidence rate of traumatic wound infection in different age categoties (N-200)

	Groups				
	Normal saline		Tap water		
Age categories (years)	No.	Percent	No.	Percent	Chi square test P-value
Less than 30	4	4	1	1	0.402
30-60	6	6	10	10	0.030
Over 60	16	16	14	14	0.488

Table 4: Incidence rate of traumatic wound infection according to the gender (N-200)

	Groups				
	Normal saline		Tap water		
Gender	No.	Percent	No.	Percent	Chi square test P-value
Male	14.00	9.3	16.00	10.7	0.583
Female	12.00	8.0	10.00	6.7	0.432
Chi square	0.49		0.03		

(Table 3). In patients who were 30-60 years old, the incidence of wound infection in wounds washed with tap water was greater than those washed with normal saline (10% vs. 6% p=0.03), but in age ranges less than 30 and greater than 60 years there was no significant difference in wound infection between tow groups

(p=0.488 and p=0.402, respectively, Table 3) in this study there was no significant difference between wound infection in each sex group according to the type of washing solution, but in wounds washed with tap water the incidence rate of wound infection in males was significantly greater than females (10.7% vs. 6.7% p= 0.03, Table 4).

DISCUSSION

In this study we evaluated the comparative incidence rates of wound infection following their treatment with normal saline or tap water. According to our findings there was no significant difference in wound infection rate among these 2 groups.

Wound Infection occurs when virulence factors expressed by one or more microorganisms in a wound and it will stimulate the host natural immune system. Subsequent invasion and dissemination of micro-organisms in viable tissue provoke a series of local and systemic host responses. Characteristic local responses are a purulent discharge or painful spreading erythema indicative of cellulitis around a wound [9]. The progression of a wound to an infected state is likely to involve a multitude of host factors, including the type, site, size and depth of wound, level of blood perfusion to the wound, the general health immune status of the host, the extent of nonviable exogenous contamination, the microbial load and combined level of virulence expressed by the types of microorganisms involved [10]. It has been demonstrated that approximately 50% of traumatic injuries of varied etiology, have a polymicrobial aerobic-anaerobic microflora [11].

Irrigation of wounds to remove bacteria and foreign materials to create a wound environment optimal for healing is an essential of wound management. Cleansing methods often differ among individual health care providers, institutions and facilities and many times are based on individual experiences and personal preferences [12, 13]. A variety of cleansing solutions exist and their selection should be based on cleansing effectiveness, lack of cytotoxicity and cost. Many cleansing solutions have demonstrated safe and effective results, whereas others may damage and destroy cells essential to the healing process [14]. Tap water has been used for centuries as a wound cleanser without evidence of adverse effects or associated infection risk. The history of its use might suggest the safety of tap water as a wound cleanser [15]. Normal sterile saline is also regarded as the most appropriate and preferred cleansing solution because it is a nontoxic, isotonic solution that does not damage healing tissues [16, 17]. our findings favors the results of several clinical implications regarding the use of tap water as a wound cleanserreviewed by Fernandez *et al*. [13] and provide support for the use of tap water for routine cleansing of acute and chronic wounds. According to this review article even a single group reported a 45% reduction in the relative risk of infection with tap water as compared with the normal sterile saline but in this case the authors used the tap water at body temperature and the normal sterile saline at room temperature and the researchers suggested that the temperature differences of the solutions could have affected tissue healing and microbial growth.

Our findings showed an infection rate of 8.3 and 8.6% for wounds washed with tap water and normal saline respectively in fresh contaminated traumatic wounds which is nearly the same as those reported by Olson M. *et al*. [18]. according to their findings the overall wound infection rate for a total of 574 infections in 20,193 wounds at the Minneapolis VA Medical Center for the entire study period (1977-1981) was 2.8%. By wound classification, a Clean wound infection rate of 1.8%, Clean-Contaminated rate of 2.9% and Contaminated rate of 9.9% were determined. However our rates were lower than Simchen and Sacks [19] who reported an overall infection rate of 22% in war injured patients. Although the incidence of wound infection in our study is markedly greater than Judd E. Hollander *et al*. [20] who reported that among five thousand five hundred twenty-one patients, 195 patients developed an infection (3.5%) however considering age and sex our findings favors them. They also suggested an increased likelihood of wound infection in association with age. Our findings demonstrated an increased rate of infection in wounds washed with tap water than those washed with normal saline in patients with 30-60 years old may be due to some risk factors which we could not exclude them in this study. Also we found an increased incidence rate of infection in male wounds washed with tap water than females which may be due to difference in their occupational status and unexcluded underline diseases.

In conclusion our findings as well as other mentioned reports appear to support the cost-effectiveness and ease of use of tap water in wound cleansing. However tap water could be used for cleansing when produced from a supply of potable drinking water. Tap water of lesser quality than was used in our study may produce different effects.

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