Original Article

The risk of wound infection after simple hand laceration

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BACKGROUND: This prospective observational study aimed to determine the infection rate of simple hand laceration (SHL), and to compare infection rates between patients who were prescribed antibiotics and those who were not.

METHODS: The study was performed at two urban hospitals enrolling 125 emergency department (ED) patients with SHL. Exclusion criteria included patients with lacerations for more than 12 hours, immunocompromized patients, patients given antibiotics, and patients with gross contamination, bites or crush injuries. Wound infection was defined as clinical infection at a follow-up visit (10–14 days) or wound was treated with antibiotics. Patient satisfaction was also measured using a visual analogue scale 1–10, asking the patients about wound appearance. Demographic data and wound characteristics were compared between the infected and non-infected wounds. The infection rates were also compared between patients who received prophylactic antibiotics and those who did not. The results were presented with medians and quartiles or percentages with 95% confidence intervals (CI).

RESULTS: In the 125 patients with SHL [median age: 28 (18, 43); range: 1–102 years old; 36% female], 44 (35%, 95% CI: 27%–44%) were given antibiotics in the ED. Wound infection was reported in 6 patients (4.8%, 95% CI: 2%–10%). Age, gender, history of diabetes and wound closure were not associated with wound infection ($P>0.05$). The infection rate was not significantly different between patients with or without antibiotic prophylaxis [7% (3/44), 95% CI: 2%–10% vs. 4% (3/81), 95% CI: 1%–11%, $P=0.66$]. Patient's satisfaction with appearance of infected and non-infected wounds were significantly different [7.5 (6, 8) vs. 9 (8, 10), $P=0.01$].

CONCLUSION: Approximately 5% of simple hand lacerations become infected. Age, gender, diabetes, prophylactic antibiotics and closure technique do not affect the risk of infection.

KEY WORDS: Wounds; Injuries; Wound infection; Hand lacerations

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INTRODUCTION

Hand injuries are commonly seen in the emergency department (ED) and constitute approximately 8% of trauma-related ED visits.^[1] Despite the high prevalence, management of simple hand lacerations has not been standardized and the literature on infection rate, risk factors for infection, and utilizing prophylactic antibiotics to prevent infection in simple hand lacerations (hand lacerations distal to the radial carpal ligament that do not involve any special structures such as bones, tendons, vessels, or nerves) is scarce.^[2] In addition, physicians' approach to management of simple hand lacerations

particularly relative to administration of prophylactic antibiotics has been shown to be varied.^[1] This study was designed to identify the incidence of wound infection in ED patients with simple hand lacerations while detecting host and wound characteristics that place patients at increased risk of infection.

METHODS

This prospective observational study was conducted at two urban academic centers. The joint institutional review board approved the study. Informed written

consent was obtained from all patients prior to enrollment.

Study setting and population

Kings County Hospital Center is a level 1 trauma center with annual ED census of approximately 150 000. Downstate Medical Center has approximately 70 000 ED visits annually. A convenience sample of patients was enrolled from September 2010 to July 2011.

Study protocol

Data collection was performed by trained data abstractors (research associates). Adult ED patients (≥ 13 years old) with simple hand lacerations were enrolled in the study. Patients with the following conditions were excluded: 1) immunocompromized patients (cancer, chemotherapy, transplant, HIV/AIDS); 2) current or recent (within two weeks) use of any antibiotics; 3) gross infection as determined by the treating clinician; 4) grossly contaminated wounds by dirt or other foreign substances (e.g. tar, oil, etc.); 5) bites (e.g. dog, cat or human); 6) crushed injury; 7) lacerations inflicted more than 12 hours prior to ED visit.

Patients with simple hand lacerations who met the inclusion criteria were brought to the ED. Written informed consent was obtained from the patient and demographics and medical history were recorded. Wound characteristics such as location, length, shape, presence or absence of foreign body and method of closure were documented. Whether prophylactic antibiotics were given was decided by the attending physician.

Outcome measures

Wound infection was defined as clinical infection by primary care physician at follow-up visit (10–14 days) or wounds requiring antibiotics after initial visit to the ED. The cosmetic appearance of the wound was determined by a visual analogue scale (VAS) at 30 days after the initial ED visit. At that time the patient selected the cosmetic appearance of the wound on a scale of 1–10 (1 for worst and 10 for best satisfaction) over the phone.

Statistical analysis

Data were presented as medians and 25%–75% quartiles for continuous variables and percentages with 95% confidence interval for proportions. Wound and host characteristics between the infected and non-infected wounds were compared using the Mann-Whitney *U* test for continuous variables and Fisher's Exact test for

categorical variables. The significant level was set at 0.05 (two-tailed test). Additional group comparisons were performed with Fisher's exact test for the outcome of wound infection between patients with and without prophylactic antibiotics respectively. Visual analogue scale (VAS) scores representing patient's satisfaction with the appearance of their wounds at 30 days were compared between the infected and non-infected wounds and between those who received prophylactic antibiotics and those who did not, using the Mann-Whitney *U* test. All analyses were performed with SPSS software (version 20.0, 2011, 1997. SPSS Inc., Chicago, USA).

RESULTS

A total of 125 patients were enrolled in the study [median age: 28 (18, 43), range: 1–102 years]. Sixty-four percent (95% *CI*, 55%–72%) of the patients were male. 112 (90%) patients were followed up for 30 days. The baseline characteristics of the enrolled patients were listed in Table 1. Wound infection occurred in 6 (4.8%, 95% *CI*: 2%–10%) of the 125 patients. ED physicians prescribed antibiotic prophylaxis for 44 patients (35%, 95% *CI*, 27%–44%) at initial visit. The most commonly prescribed antibiotics were cephalexin (36 patients, 82%), amoxicillin-clavulanic acid (6 patients, 14%), and others (2 patients, 4%).

Comparison of the infected and non-infected wounds was presented in Table 2. The infection rate was not significantly different between the patients with antibiotic prophylaxis and those without antibiotic prophylaxis (3 patients, 95% *CI*: 2%–10% vs. 4%; 2 patients, 95% *CI*: 1%–11%, *P*=0.66).

Patient's satisfaction with wound appearance of the infected and non-infected wounds were significantly

Table 1. Baseline characteristics of the enrolled patients

Variables	n/N	Percent (95% <i>CI</i>)
Age (years)*	125	28 (18, 43)
Wound length (cm)*	125	2 (1.5, 3)
Male gender	80/125	64% (55%–72%)
Wound shape		
Linear	87/125	70% (61%–77%)
Complex	38/125	30% (23%–39%)
Diabetes	7/125	6% (3%–11%)
Antibiotic prophylaxis in the ED	44/125	35% (27%–44%)
Repair method		
Dressing only	11/125	9% (5%–15%)
Suture	108/125	86% (79%–91%)
Steri-strip	3/125	2% (1%–7%)
Tissue adhesive	3/125	2% (1%–7%)

*: Medians and quartiles.

Table 2. Comparison of wound characteristics in patients with and without wound infection respectively

Variables	Infected (n=6) n (% , 95% CI)	Non-infected (n=119) n (% , 95% CI)	P**
Age (years)*	46 (24, 61)	28 (18, 42)	0.11
Wound length (cm)*	2.5 (1, 3)	2 (1.5, 3)	0.77
Patient satisfaction with wound appearance (VAS)*	7.5 (6, 8)	9 (8, 10)	0.01
Male gender	5 (83%, 44%–97%)	75 (63%, 54 %–71%)	0.42
Linear wound shape (vs. non-linear)	4 (67%, 30%–90%)	83 (70%, 61%–77%)	1.00
Diabetes	1 (17%, 3%–56%)	6 (5%, 2%–11%)	0.29
Receiving antibiotics in the ED	3 (50%, 19%–81%)	41 (35%, 27%–43%)	0.66
Repair method (suture vs. other methods)	5 (83%, 44%–97%)	103 (87%, 79%–92%)	0.86

*: Medians and quartiles; **: Mann-Whitney *U* test for comparison of age and wound length and Fisher's exact test for the rest of variables; VAS: visual analogue scale (range 1–10); CI: confidence interval.

different [median 7.5 (6,8) vs. 9 (8,10), $P=0.01$, respectively]. The difference between VAS scores comparing patients who were given prophylactic antibiotics in the ED with those who were not given prophylactic antibiotics was also statistically significant, favoring no prophylactic antibiotics [median VAS: 8 (7, 9) for prophylactic antibiotic group vs. 9 (8, 10) for no prophylactic antibiotic group, $P=0.032$].

We also compared the characteristics of patients who were prescribed antibiotic prophylaxis in the ED ($n=44$) with those of the patients who were not prescribed antibiotic prophylaxis ($n=81$). Patients who received prophylactic antibiotics were older [median age: 40 (quartiles: 28, 51) vs. 28 (quartiles: 16, 48), $P: 0.033$] than those who did not receive prophylactic antibiotics. Patients who received prophylactic antibiotics were more likely to have contaminated wounds [6/44 (14%) vs. 0/81 (0%), $P: 0.02$]. No significant difference was observed between the two groups when gender, wound shape, wound length, repair method, and history of diabetes were compared.

DISCUSSION

In this study we investigated the prevalence of wound infection after simple hand lacerations and the factors affecting the prevalence. Few studies on the infection rate of simple hand laceration have been mostly focused on the benefits of prophylactic antibiotics.^[3–6] The infection rate ranges from 5% to 32%,^[3–7] which originates from the differences in study designs, types of antibiotics used, definition of wound infection, and follow-up rate.^[2] The infection rate in our study cohort falls within this range (5%).

Because of the discrepancy of infection rates, the data on the role of antibiotics in preventing infection in simple hand lacerations provide conflicting results.^[2] The studies are generally old, have small sample sizes,

and are rife with methodological flaws.^[3–6] In the present study, we did not observe any statistical difference between those who received prophylactic antibiotics and those who did not. However, in the absence of a rigorous randomized control trial, assessing the role of prophylactic antibiotics is not possible. The low infection rate in our study indicates that the sample size for such trial would be very large.

Various studies^[8–10] have reported that the factors might increase the risk of infection in patients with simple hand laceration. Studies on the association of patient's age, number of sutures, length of laceration, presence of diabetes, and wound age with a higher risk of infection have produced conflicting results.^[7–10] Among these factors, wound age has received much more attention. It was believed that there exists a "golden period" beyond which the risk of infection significantly increases, a recent systematic review ruled out the presence of association between any wound age cut off and a higher risk of infection.^[11] Because of a small number of patients with wound infection, we were not able to perform the logistic regression analysis that was originally planned to identify factors that could predict wound infection in our study cohort. However, our univariate analyses did not identify any wound or host characteristics that were associated with a higher risk of infection.

According to the study by Singer et al,^[12] from patients' point of view the most important factor secondary to wound infection is the appearance of wound after repair. Having this in mind, we assessed the self-reported patient satisfaction with wound appearance in patients with and without infection as well as those with or without prophylactic antibiotics using a VAS scale. It was not surprising that the infected wounds had a lower satisfaction score. However, in our study there was a negative association between patient satisfaction and antibiotic prescription. This could be related to the likelihood that patients with more severe injuries and a

higher risk of bad scarring were more likely to receive antibiotics in the ED.

LIMITATIONS

The convenience sampling method in our study exposes our study results to sampling bias. It is possible that ED physicians did not refer patients with a higher risk of infection for enrollment.

This was a prospective observational study, which was not designed to specifically address the question of whether antibiotic prophylaxis has any role in preventing wound infection in simple hand lacerations. There is a clear need for a large multicenter randomized control trial to shed light on this issue.

Because of the small number of patients with wound infection, we were not able to identify factors associated with a higher risk of infection.

In conclusion, wound infection rate after repair of simple hand laceration is low. Wound infection is associated with lower patient satisfaction with wound appearance at 30 days post injury.

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Conflicts of interest: The authors have no commercial associations or sources of support that might pose a conflict of interest.

Contributors: Roodsari GS proposed the study. All authors

contributed to the design and interpretation of the study, and approved the final manuscript.

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