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Prophylactic Antibiotic Therapy in Contaminated Traumatic Wounds: Two Days versus Five Days Treatment

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ABSTRACT

Introduction: Emergency department manages several kinds of wounds including simple, non-bite traumatic wounds and lacerations. Prophylactic antibiotic therapy is one of pre-scribed treatment in these conditions. We aimed to compare the clinical efficacy of the two day regimen of prophylactic antimicrobial agents with the five day regimen in simple traumatic but highly contaminated wounds. *Methods:* Between January 2010 and May 2010, patients presenting with simple traumatic wounds or lacerations in different parts of the body, highly contaminated with soil, debris or feces in emergency department of a re-ferral educational hospital in Tehran (Rasul-Akram hospital), Iran, went for primary clo-sure. All of the patients were provided prophylactic antibiotic, however, prescribed for one group (A) of patients for 2 days and other group (B) received for 5 days, according to the physician concerned. As these treatments were routine, we selected 70 patients from each group using table of random numbers. The patients were warned about the signs of infec-tion including long-lasting erythema, purulent discharge and inflammation and were sup-posed to inform the concerned physician in any of such alarming situations. Oral Cepha-lexin 500 mg qid was prescribed for all patients enrolled for prophylaxis treatment. *Re-sults:* On follow-up 11 (8.2%) patients were found to develop sutured site infection (6 out of 70 (8.57%) in group A, and five out of 70 (7.14%) in group B (P=0.31)). There was no statistical difference between infection rates between men (8.6%) in comparison to women (6.25%) (P>0.05; CI=95%). *Conclusion:* Our study showed that 2-day prophylactic anti-biotic therapy using Cephalexin is at least as effective as a 5-day regimen in relation to development of surgical site infection in patients with simple traumatic contaminated wounds or lacerations.

Introduction

Patients with simple non-bite traumatic wounds and la-cerations are commonly managed in emergency depart-ments (ED) with a chief goal to prevent infection, in addition to achieve a functional and aesthetic scar. This is obtained by reducing tissue contamination with proper irrigation, debridement of dead tissue, and prescribing antibiotics judiciously, in conjunction with a well-approximated skin closure (Nakamura and Daya 2007). Even after the acute phase of injury is being treated, in-fection remains as one of the most common causes of morbidity and mortality.

Approximately 3 to 5 percent of infections regress how-ever, this rate varies widely according to mechanism, location, and patient factors (Hollander *et al* 2001). An-tibiotic prophylaxes are currently being used successful-ly for prevention of infectious morbidity following elec-tive surgical procedures (Classen *et al* 1992, Platt *et al* 1990). But even after multiple studies available on the use of prophylactic antibiotics to be implicated for sim-ple non-bite wound management in the ED, there is no clear standard practice (Wedmore 2005). Literature de-scribes some necessary factors like administration before the surgical insult begins, coverage targeted to specific

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organisms of the operation, and short duration of antibiotic administration for a successful management of infection (Classen *et al* 1992, Barie 2000, Bohnen *et al* 1992).

Most lacerations require primary closure which results in faster healing and less patient discomfort in comparison with secondary closure. Whereas, several methods for closing lacerations exist, the most commonly used method remains suturing (Hollander *et al* 1995). Several studies (Rodgers 1992, Berk *et al* 1992, Trott 1991, Sacks 1988) recommend against the routine use of prophylactic systemic antibiotics to prevent infection in simple lacerations and wounds, while others suggests use of them for wounds that are at high risk for infection (Berk *et al* 1992, Trott 1991, Carter 1983, Edlich *et al* 1986).

In contrast to well-established indications for prophylaxis, relatively few studies have addressed the optimal duration of treatment for managing simple contaminated wound. Although most of physicians prescribe prophylactic antibiotics 3 to 5 days for high risk simple non-bite wounds and 5 to 7 days for bite wounds as a routine because of no clear evidence (Stone and Carter 2004), available data indicate that longer courses of antibiotics confer no advantages over shorter ones (Hoth *et al* 2003, Perlman *et al* 2004).

In the current observational study, we compared the clinical efficacy of the 2-day regimen of prophylactic antimicrobial agents over 5-day regimen to manage simple traumatic highly contaminated wounds.

Materials and methods

Setting

This study was performed between January 2010 and May 2010 in ED of Rasul-Akram Hospital, which is a referral educational center located in Tehran, Iran.

Patients

Patients were enrolled in two groups receiving oral prophylactic regimens for two different interval of time under the supervision of ED physician concerned. Group A received 2-day of oral prophylactic antibiotics after being discharge from the ED and group B continued with the same treatment for 5 days. We randomly selected 70 patients from each group using table of random numbers. The random number table was prepared in the operating room by a person who was not a participant in the study and it was concealed till all cases were over and taken for analysis.

Inclusion criteria

Patients with simple but highly contaminated traumatic wounds and lacerations to be managed with primary closure and needed prophylactic treatment, were taken into study. The simple wounds consisted of non bite, non puncture wounds with no involvement of nerves, tendons or vessels, and intra- articular space or bone fractures and duration of injury not longer than 12 hours (Perlman *et al* 2004).

Exclusion criteria

Patients presenting with any pre-existing infection and providing history of diabetes, cirrhosis, renal failure, splenectomy, immune deficiency, allergy to the antibiotics (Cephalexin, Ceftriaxone or Penicillin) or consuming antibiotic, steroids and immunosuppressive drugs at the time of trauma, were excluded from the study.

Routine treatment

All wounds were prepared by the same group of surgical technicians, using a minimum of 1 liter of saline irrigation, a povidone iodine preparation, and sterile surgical technique, including mask and gloves for closure. Only the skin was sutured, using simple 3-0 or 4-0 nylon sutures.

Oral Cephalexin (500 mg) qid was prescribed for all patients as prophylaxis. The patients were cautioned about any development of signs of infection including long-lasting erythema, purulent discharge and inflammation and advised to consult the concerned physician. The patients were followed up for removal of sutures (between 7-10 days).

Data analysis

The data were registered in a data sheet. All statistical analysis was performed with SPSS software version 14.0 (SPSS Inc, Chicago, Ill) and comparison of discrete variables between groups was done using the T test for two independent samples and Chi-square test. $P \leq 0.05$ was considered to indicate a statistically significant difference in confidence interval (CI) of 95%.

Results

A total of 140 patients, including 124 men and 16 women with average age of 31.75 ± 4.16 years in the range of 18 to 47 years, received the recommended regimen (2 days for Group A and 5 days for Group B). Table 1 shows the demographic features of all the patients. None of the patient was excluded from the study during the follow-up.

The wounds in 21.43% of patients were due to sharp traumas while, 78.57% patients presented with blunt traumas. Location of wounds is shown in Table 2. The rate of infection rate in sharp wounds was 7.6% while, in those induced by the blunt traumas was 8.1%, the difference being not significant (P>0.05).

Table 3 shows the infection status in two groups. We found no difference in rate of infection between Group A and B (P=0.31). The rate of infection in men was more (8.6%) as compared to women (7.1 %), the difference not being statistically significant (P>0.05).

Seven out of 11 (5%) infections found in both groups had been developed in the lower limbs (3 infections in group A and 4 infection in group B) and four out of 11 (2.85%) had been seen in upper limbs (3 infections in group A and 1 infections in group B).

Table 1. Demographic information of patients

Gender	Number (%)	Age (Mean±SD)
Male	124 (88.9)	32.3±12.8
Female	16 (11.1)	27.2±12.8
Total	**140 (100)**	**31.7±12.7**

Table 2. Locations of wounds

Location of Wounds	Group A (%)	Group B (%)	Total (%)
Upper Limb	31 (44.3)	27 (38.6)	58 (41.4)
Lower Limb	26 (37.1)	29 (41.4)	55 (39.3)
Head and Neck	13 (18.6)	14 (20.0)	27 (19.3)
Total	**70 (100)**	**70 (100)**	**140 (100)**

Table 3. Infection rate

Infection Status	Group A (%)	Group B (%)	Total (%)
Infected	6 (08.57)	5 (07.14)	11 (07.86)
Uninfected	64 (91.43)	65 (92.86)	129 (92.14)
Total	**70 (100)**	**70 (100)**	**140 (100)**

Discussion

This study was performed with a hypothesis that short course (2-day regimen) of prophylactic Cephalexin therapy is as effective as five days regimen in preventing sutured site infection in patients undergoing simple contaminated wound closure. The study revealed that the overall rate of infection in simple, but highly contaminated wounds and lacerations sutured in the emergency was not different between two groups. Thus, we confirmed that the two days regimen of prophylactic antimicrobial treatment was as efficient as five days regimen to prevent infection in such injuries.

Prophylactic antibiotics have been documented to be of considerable value in reducing the incidence of wound infection in several areas of surgery. The benefits to be gained from a preventive antibiotic program include reductions in both morbidity and mortality. Rationally, the benefits of prophylactic antibiotics should outweigh the harm of administrating them. The harm includes, but is not limited to, development of resistance, altering the normal bacterial flora, adverse effects, allergies, and related costs.

In the past two decades, the incidence of antimicrobial resistant organisms has increased considerably therefore, the duration of the use of prophylactic antimicrobial agents should be kept as short as possible, not only to avoid the induction of bacterial resistance, but also not to waste medical resources. In other words, the longer duration of antibiotic use is associated with the risk of drug toxicity, appearance of resistant organisms and increased cost (Stone and Carter 2004, Hoth *et al* 2003, Perlman *et al* 2004, Terpstra *et al* 1999), thus, there is emerging general agreement that post-operative prophylactic antibiotics should be stopped shortly even for most major surgical procedures (Finkelstein *et al* 2002, ASHP 1999, Bratzler and Houck 2004, Gilbert *et al* 2003). The duration for antibiotic prophylaxis in ED is unknown; most physicians prescribe 3 to 5 days for non-bite wounds and 5 to 7 days for bite wounds (Mangram *et al* 1999).

To reduce the incidence of wound infections, antibiotics have been commonly used for years, although there is no clear evidence that antibiotic prophylaxis prevents wound infections in most patients whose wounds are closed in the ED.

Several clinical studies and a meta-analysis have found that there is no benefit to prescribe prophylactic antibiotics for routine laceration repairs (Cummings and Del Beccaro 1995, Day 1975, Grossman *et al* 1981, Roberts and Teddy 1977, Thirlby *et al* 1983). They advised that use of antibiotics should be individualized based on the degree of bacterial contamination, presence of infection-potentiating factors, such as soil, the mechanism of injury, and the presence or absence of host predisposition to infection.

There are few studies regarding the effect of antibiotics prophylaxis in preventing wound infections after suturing of simple contaminated lacerations referred to EDs (Rodgers 1992, Berk *et al* 1992, Trott 1991, Sacks 1988, Carter 1983, Edlich *et al* 1986). In contrast, there exist various investigations concerning the effect of antibiotics prophylaxis in preventing surgical site infections (SSI) after different surgical procedures.

In a study by Gupta *et al* (2010), on 235 patients undergoing CABG and valve surgery, they did not find a statistically significant difference in surgical site infection (SSI) and development of resistant microorganisms between groups receiving 48 or 72 hours of prophylactic antibiotics. In another research study conducted by Paul *et al* (2009) on patients undergoing cardiac surgery, they revealed that prolongation of antibiotic prophylaxis was not associated with a statistically significant decrease in sternal wound infection.

A meta-analysis of all randomized trials published before 1990 concluded that administration of prophylaxis beyond 48 hours is not associated with improved infectious outcomes in patients undergoing cardiac surgery (Kreter and Woods 1992).

Harbarth *et al* (2000) assessed outcomes following short vs. long (>48 h) antibiotic prophylaxis in a prospective observational study. Prolongation of prophylaxis did not decrease the risk of SSI, but was associated with a higher rate of isolation of pathogens with acquired resistance (enterobacteriaceae resistant to first- and third-generation cephalosporins or vancomycin-resistant enterococci). A large, well-controlled, prospective, randomized trial study by Fabian *et al* (1992) on 515 patients with penetrating abdominal trauma in a double-blinded trial of 1 day vs. 5 days of cefoxitin or cefotetan found no overall benefit from 5 days of therapy in the entire group or in the subgroup of patients with hollow viscus injuries, colon injuries.

In a study by Grossman *et al* (1981) on 265 patients with hand laceration which treated with saline irrigation, betadine preparation, and sterile surgical techniques of the wounds, the study subjects were randomized to one of 3 regimens: cephalexin, 250 mg orally every 6 hours for 6 days; intramuscular cefazolin, 1-g single dose; or the control group, who received a single intramuscular injection of a placebo. The rates of infection in these 3 groups were reported as 2.5%, 0%, and 1.1%, respectively. Although the rate of infection was lower than our results in this study, they concluded that the difference between groups was not significant.

In a review study by Zehtabchi (2007) on four published randomized clinical trials (Grossman *et al* 1981, Roberts and Teddy 1977, Haughey *et al* 1981, Beesley *et al* 1975) which had tested the ability of antibiotics to prevent infection of uncomplicated hand lacerations that were managed in the ED, of which three were of adequate methodological rigor for their results to be considered. These trials failed to demonstrate any statistically or clinically significant benefit to antibiotics among 778 total subjects. According to the selected trials, there was no statistically significant difference in the rate of infection among the groups, regardless of the choice or route of antibiotic administration. None of the specific antibiotics or regimens was superior to others in achieving the level of significance.

It should be emphasized that neglecting the role of standard wound care such as aggressive irrigation and debridement in preventing wound infection and replacing it with antibiotic prescription may, in fact, result in an increased infection rate.

Conclusion

Our study showed that 2-day prophylactic antibiotic therapy using a first-generation cephalosporin (Cephalexin) may be at least as effective as a 5-day regimen in relation to surgical site infection in patients with simple traumatic contaminated wounds or lacerations. However, further study involving a larger number of patients is needed to emerge with a better conclusion.

Limitations

To verify that the short period prophylactic antibiotic regimen is as effective as the longer one, a larger sample size is required. The sample size in the study was small and therefore definitive conclusions could not be drawn although, we randomly selected the patients, however, location of wounds was not similar in both groups. Furthermore, a control group including the patients not receiving the prophylactic antibiotics would increase the power of our study to compare the rate of infections between the groups.

At the time of study, this RCT did not register in RCT registries because of authors' unawareness about importance of registration.

Ethical issues

The proposal and final report of this project were approved by experimental protocol of a local medical ethics committee located in Tehran University of Medical Sciences, Tehran, Iran.

Conflict of interests

The authors declared no conflict of interests.

Acknowledgment

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