Bacterial Contamination of Fresh Traumatic Wounds at Trauma Center, Siriraj Hospital, Bangkok, Thailand

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Background: *Fresh traumatic wound is a common health problem in patients attending Trauma Center at Siriraj Hospital in Bangkok, Thailand. Antibiotic prophylaxis was given to nearly 90% of such patients. A contributing factor to a high prevalence of antibiotic prophylaxis is a lack of data on bacterial contamination at fresh traumatic wounds in Thai patients.*
Objective: *To determine prevalence and characters of bacterial contamination, and incidence of wound infection in adult patients with fresh traumatic wounds attending Siriraj Trauma Center.*
Material and Method: *Prospective study was conducted in 330 adult patients with fresh traumatic wounds from March 2012 and September 2012. All patients received wound care and antibiotic prophylaxis according to the judgment of their responsible physicians. A wound swab culture was taken from all patients. The patients were either called by telephone or asked to have follow-up visits in order to determine incidence of wound infection. The infected patient received regular care.*
Results: *Sixty-three percent and 8% of the patients had lacerated wounds and bite wounds, respectively. Ninety-one percent of them received antibiotics of which dicloxacillin and co-amoxiclav accounted for 80.3% and 11.4%, respectively. Wound swab cultures revealed that potential pathogenic bacteria i.e. S. aureus, streptococci, Enterobacteriaceae, Aeromonas spp., Acinetobacter spp. and non-fermentative gram-negative rods (NF GNR) were recovered from 7% of wounds. Incidence of wound infection was 1.2%, and all infected wounds were found in patients who had a contaminated wound and received antibiotic prophylaxis. Bacterial contaminations of infected patients were NF GNR, E. cloacae, and mixed organisms. All wound infections were successfully treated with appropriate wound care.*
Conclusion: *More than 90% of adult patients with fresh traumatic wound at Siriraj Trauma Center received prophylactic antibiotics. Less than 10% of these wounds were contaminated with potentially pathogenic bacteria. Incidence of wound infection in fresh traumatic wounds was low.*

Keywords: *Traumatic wound, Bacterial contamination, Anti-biotic prophylaxis*

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A fresh traumatic wound is defined as the wound resulted from accident and had received care at a healthcare facility within 6 hours of the incident. Fresh traumatic wound is one of the most common health problems in patients attending Trauma Center at Siriraj Hospital in Bangkok, Thailand. A fresh traumatic wound was found in 370 patients per month at Siriraj Trauma Center. Super imposed bacterial infection is an important complication of traumatic wound and it can lead to serious illness, long-term disability and death. Therefore, appropriate wound management is important to minimize the probability of wound infection[1]. The incidence of wound infection in patients with fresh traumatic wounds is low ranging from 1.1% to 12%; therefore, only some high risk patients should receive antibiotic prophylaxis[2]. The existing meta-analyses and a recent small randomized controlled trial on the value of routine use of antibiotic prophylaxis for simple traumatic wounds revealed that most of these patients did not receive significant clinical benefits from antibiotic prophylaxis[2-4]. Antibiotic prophylaxis had been given to nearly 90% of the patients with fresh traumatic wounds attending Siriraj Trauma Center whereas the clinical practice guidelines on management of fresh traumatic wounds recommended that antibiotic prophylaxis should be given to only the patients at high risk of wound infection[5]. Healthcare personnel

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at Siriraj Trauma Center believe that antibiotic prophylaxis should be provided to traumatic wounds since the wounds are contaminated with pathogens, and the wounds contracted through accident environments in a tropical country, including Thailand, are more likely to be contaminated with bacteria than wounds occurring in the patients from western countries, who were included in the aforementioned reports[2-4].

The objective of the study was to determine prevalence and character of bacterial contamination and incidence of wound infection in adult patients with fresh traumatic wounds attending Siriraj Trauma Center.

Material and Method

The present study was approved by the Institutional Review Board of Faculty of Medicine Siriraj Hospital. It was a prospective study conducted at Trauma Center in Siriraj Hospital, which is a 2,300-bed tertiary care university hospital in Bangkok, Thailand from March to July 2012. The eligible patient was an adult aged 18 years or older, had fresh traumatic wounds and signed the informed consent form to participate in the present study. Exclusion criteria were patient refusal, altered mentation, or severe injury interfering with the enrollment process. All patients received usual care according to the judgments of their responsible physicians. The relevant data were collected from the patients and their medical records including demographics, underlying conditions, type of accident, location of wound, type of wound, presence of wound contamination, wound care, vaccination as well as given antibiotic prophylaxis. The definition of wound contamination is the presence of bacteria within a wound without any host reaction[6]. Wound infection is diagnosed based on clinical symptoms and signs *i.e.* increasing pain, erythema, local warmth, swelling, and/or purulent discharge. Each patient received a wound swab culture according to Levine technique[7] prior to receiving the standard wound care from the responsible healthcare personnel. If the eligible patient had multiple sites of wounds, the swab culture would be done in the most contaminated wound or the largest wound. The wound swab was sent to Microbiology Laboratory for the determination of the presence of organisms and their antibiotic susceptibilities. The participating patient was either called by telephone or asked to have a follow-up visit at Siriraj Trauma Center in order to determine incidence of wound infection. The infected patient received regular care at Siriraj Trauma Center.

It was estimated that prevalence of bacterial contamination of fresh traumatic wounds was 30±5%. Therefore, a sample size of 330 patients was needed when 5% type I error (two-sided) was accepted. The data were analyzed by descriptive statistics.

Results

Among 330 participating patients, 67% of them were males, the mean age was 39.5 years (SD 17.5 years, age range 19 to 95 years) and 82% of them had no underlying illnesses. Eighty-eight percent of patients did not receive any antibiotics in the preceding 3 months. The average time from accident to attending Siriraj Trauma Center was 48.7 minutes (SD 58.9 minutes, range 5 to 360 minutes). The mean length of wounds was 2.94 cm (SD 2.4 cm, range 0.5 to 20 cm). Ninety-five percent of the eligible patients did not receive wound dressing before visiting at Siriraj Trauma Center. The locations of wounds are shown in Table 1. Most of the wounds were on hand, head, leg, face, arm and foot. The types of wounds are shown in Table 2. Lacerated wound was the most common type followed by abrasion and bite wounds. The presence of wound contamination was observed in 50.6% of the patients as shown in Table 3. The data on wound management and vaccination are summarized in Table 4. Most of the patients received wound sutures and dry dressings. Tetanus and rabies vaccinations were given to 68.8% of the patients. Three hundred patients (91%) received prophylactic oral antibiotics in which dicloxacillin was the most common drug as shown in Table 5.

Bacterial contamination of the wounds was found in 212 patients (64.2%) as shown in Table 6. However, most of the isolated organisms were commensal skin florae whereas the potential pathogenic bacteria, *i.e. S. aureus,* streptococci, Enterobacteriaceae, *Aeromonas spp., Acinetobacter spp.* and non-fermentative gram-negative rods (NF GNR), were found in only 7% of the patients. All isolated gram-

Table 1. Locations of wounds in 330 patients

Location	Number (%)
Hand	80 (24.2)
Head	59 (17.9)
Leg	54 (16.4)
Face	52 (15.8)
Arm	46 (13.9)
Foot	29 (8.8)
Mouth	1 (0.3)
Others	9 (2.7)

Table 2. Types of wounds in 330 patients

Type of wounds	Number (%)
Lacerated wound	207 (62.7)
Abrasion wound	58 (17.6)
Bite wound	26 (7.9)
Incisional wound	21 (6.4)
Penetrated wound	9 (2.7)
Crush wound	3 (0.9)
Burn wound	1 (0.3)
Others	5 (1.5)

Table 3. Wound contaminations in 330 patients

Type of contamination	Number (%)
No contamination	163 (49.4)
Contamination	167 (50.6)
Soil	105/167 (62.9)
Dirty water	12/167 (7.2)
Clean water	13/167 (7.8)
Food	6/167 (3.6)
Feces, urine and other secretions	20/167 (12.0)
Others	11/167 (6.6)

Table 4. Wound management and vaccination in 330 patients

Wound management	Number (%)
Wound suture	227 (68.8)
Dry dressing of wound	228 (87.3)
Wet dressing of wound	37 (11.2)
Unknown type of wound dressing	5 (1.5)
Vaccination	**Number (%)**
Tetanus vaccination alone	202 (61.2)
Rabies vaccination alone	4 (1.2)
Tetanus vaccination plus rabies vaccination	21 (6.4)

Table 5. Types of antibiotic prophylaxis regimens in 300 patients

Antibiotic	Number (%)
Dicloxacillin	241 (80.3)
Co-amoxiclav	34 (11.4)
Cephalosporins	12 (4.0)
Clindamycin	5 (1.6)
Amoxicillin	3 (0.1)
Others	5 (1.6)

negative bacteria were susceptible to common antibiotics including ampicillin, cefuroxime, cefoxitin, ceftriaxone, cefotaxime, ceftazidime, cefepime, ciprofloxacin, trimethoprim/sulfamethoxazole, gentamicin, amikacin and co-amoxiclav. Wound infection occurred in 4 patients (1.2%) and all of them had contaminated wound. All patients who developed infected wounds received antibiotic prophylaxis. The clinical features, antibiotic prophylaxis and wound care, clinical courses and treatment outcomes of four patients with infected wounds are described in Table 7. Most of infected patients had bite wounds and were caused by gram-negative bacteria, *i.e.* NF GNR and *E. cloacae*. All wound infections were successfully treated with appropriate wound care.

Discussion

Many factors are contributed to evolution of microorganisms in a wound from contamination/ colonization to infection. The presence of bacteria in wound does not necessarily indicate infection and wound healing occurs in the presence of bacteria[8]. Wound contamination/colonization with bacteria is usually the presence of replicating bacteria adherent to the wound in the absence of injury to the host. Most of these bacteria are normal skin flora such as coagulase negative *Staphylococcus spp.*, *Corynebacterium spp.*, *Bacillus spp.* and *Proprionibacterium acnes*[8]. *Staphylococcus aureus* and *Steptococcus pyogenes* are colonized on skin of some people and they may be present in the environments. Although the use of prophylactic antibiotics in traumatic wound is a common practice in many hospitals and institutions, the routine use of prophylactic antibiotics is not recommended in the current practice guidelines[1,9,10]. Antibiotic use should be individualized based on the degree of bacterial contamination, the presence of infection potentiating factors, the mechanism of injury, and the presence or absence of host predisposition to infection[9]. The benefits of antibiotic prophylaxis should outweigh the harm of using them. The harm includes, but is not limited to, development of antibiotic resistance, adverse effects, allergies, and related costs[10].

The present study revealed many important observations: 1) the prevalence of pathogenic bacterial contamination of fresh traumatic wounds was low, 2) all potential pathogenic bacteria isolated from the wounds were susceptible to common antibiotics including co-amoxiclav, 3) most of the patients received antibiotic prophylaxis, 4) incidence of wound infection was uncommon and wound infections in two patients

Table 6. Wound swab culture results in 330 patients

Organism	Number (%)
Growth	212 (64.2)
Commensal skin flora	155 (46.9)
Mixed organisms	34 (10.3)
Potential Pathogenic bacteria	23 (7)
Staphylococcus aureus (MSSA)	5 (21.8)
Streptococcus spp.	2 (8.7)
Enterobacteriaceae (*E.coli*, *Klebsiella spp.*, *Enterobacter spp.*)	8 (34.8)
Aeromonas spp.	2 (8.7)
Acinetobacter spp.	3 (13.0)
Non-fermentative gram negative rod (NF GNR)	3 (13.0)

Table 7. Clinical features, antibiotic and wound care, clinical courses and treatment outcomes of 4 patients with infected wounds

No.	Type of wound/location of wound/isolated organism	Antibiotic prophylaxis	Suturing	Antibiotic treatment	Wound management	Outcome
1	Lacerated wound/leg/ NF GNR	Dicloxacillin	No	Co-amoxiclav	Wet dressing	Cure
2	Bite wound/face/NF GNR	Dicloxacillin	Yes	Co-amoxiclav	Remove stitches Wet dressing	Cure
3	Bite wound/hand/*E. cloacae*	Coamoxiclav	No	Co-amoxiclav	Wet dressing	Cure
4	Bite wound/arm/ mixed organisms	Coamoxiclav	Yes	Co-amoxiclav	Remove stitches Wet dressing	Cure

were observed in the patients who already received co-amoxiclav prophylaxis, and 5) all infected patients recovered after receiving appropriate wound care and the same antibiotics as prophylactic antibiotics were continued in two patients. The aforementioned observations implied that antibiotic prophylaxis was over-used in the patients with fresh traumatic wounds and at least 50% of the patients with fresh traumatic wounds did not require antibiotic prophylaxis according to the recommendation of antibiotic prophylaxis in fresh traumatic wound from Thailand's Antibiotics Smart Use Project[5]. Moreover, it is suggested that the evidences derived from several international studies could be applied to Thai patients with fresh traumatic wounds[2-4].

The present study had several limitations. The number of the patients who did not receive prophylactic antibiotics and the number of infected patients were too small to determine any significant risk factors associated with wound infections in the patients with fresh traumatic wounds. However, the infected patients usually had bite wounds and dirty contaminated wounds. The true causative bacteria of wound infections were unknown since the cultures from infected wounds were not done.

The clinical practice guideline on antibiotic prophylaxis in adults with fresh traumatic wounds is being made according to the data from this study and it will be implemented at Siriraj Trauma Center. The data from another 600 patients with fresh traumatic wounds managed with this guideline will be collected and analyzed. It is hoped that the prevalence of antibiotic prophylaxis in the patients with fresh traumatic wounds will have decreased to less than 50% after implementing the guideline.

Conclusion

More than 90% of adult patients with fresh traumatic wound at Siriraj Trauma Center received prophylactic antibiotics. Less than 10% of these wounds were contaminated with potential pathogenic bacteria. Incidence of wound infection in fresh traumatic

wounds was very low. Rational use of antibiotic prophylaxis of fresh traumatic wounds should be promoted.

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Potential conflicts of interest

None.

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การปนเปื้อนของแบคทีเรียที่บาดแผลสดของผู้ป่วยที่มารับการรักษาที่ศูนย์อุบัติเหตุโรงพยาบาลศิริราช

รุจิภาส สิริจตุภัทร, ปรีชา ศิริทองถาวร, วิภาภรณ์ ศรีพจนธรรม, อธิรัฐ บุญญาศิริ, วิษณุ ธรรมลิขิตกุล

ภูมิหลัง: *บาดแผลสดเป็นปัญหาสุขภาพที่พบบ่อยในผู้ป่วยที่มารับบริการที่ศูนย์อุบัติเหตุ โรงพยาบาลศิริราช ผู้ป่วยดังกล่าวได้รับยาปฏิชีวนะเพื่อป้องกันการติดเชื้อประมาณร้อยละ 90 ปัจจัยที่ทำให้อัตราการใช้ยาปฏิชีวนะในการป้องกันการติดเชื้อสูงคือการขาดข้อมูลการปนเปื้อนของแบคทีเรียที่บาดแผลสดในผู้ป่วยไทย*

วัตถุประสงค์: *เพื่อทราบความชุก ลักษณะของแบคทีเรียที่ปนเปื้อนแผลสด และอุบัติการณ์การติดเชื้อที่แผลในผู้ใหญ่ที่มีบาดแผลสดที่มารับการรักษาที่ศูนย์อุบัติเหตุ โรงพยาบาลศิริราช*

วัสดุและวิธีการ: *ศึกษาผู้ป่วยผู้ใหญ่จำนวน 330 ราย ที่มีบาดแผลสด ตั้งแต่เดือนมีนาคม พ.ศ. 2555 ถึงเดือนกรกฎาคม พ.ศ. 2555 ผู้ป่วยทุกรายได้รับการดูแลแผลและยาปฏิชีวนะเพื่อป้องกันการติดเชื้อตามดุลยพินิจของแพทย์ผู้รักษา ผู้ป่วยทุกรายได้รับการตรวจหาเชื้อโรคจากแผลโดยการป้ายแผลแล้วส่งเพาะหาเชื้อโรค และได้รับการติดตามทางโทรศัพท์หรือนัดตรวจติดตามเพื่อประเมินการการติดเชื้อที่แผล หากผู้ป่วยมีการติดเชื้อจะได้รับการรักษาตามมาตรฐาน*

ผลการศึกษา: *ผู้ป่วยมีแผลฉีกขาดร้อยละ 63 แผลถูกสัตว์กัดร้อยละ 8 ผู้ป่วยร้อยละ 91 ได้รับยาปฏิชีวนะเพื่อป้องกันการติดเชื้อ โดยได้รับยา dicloxacillin ร้อยละ 80.3 และ ยา co-amoxiclav ร้อยละ 11.4 ผลเพาะเชื้อจากแผลพบแบคทีเรียที่อาจก่อโรคประมาณร้อยละ 7 ของแผล ได้แก่ S. aureus, streptococci, Enterobacteriaceae, Aeromonas spp., Acinetobacter spp. และ non-fermentative gram negative rods (NF GNR) อุบัติการณ์ของแผลติดเชื้อร้อยละ 1.2 และผู้ป่วยทุกรายที่ติดเชื้อเป็นผู้ป่วยที่มีแผลปนเปื้อนและได้รับยาปฏิชีวนะ แบคทีเรีย ที่ปนเปื้อนแผลในผู้ป่วยเหล่านี้ได้แก่ NF GNR, E. cloacae, mixed organisms ซึ่งผู้ป่วยทุกรายหายดีหลังได้รับการดูแลแผลอย่างเหมาะสม*

สรุป: *ผู้ป่วยผู้ใหญ่ที่มีบาดแผลสดที่มารับการรักษาที่ศูนย์อุบัติเหตุ โรงพยาบาลศิริราชมากกว่า ร้อยละ 90 ได้รับยาปฏิชีวนะเพื่อป้องกันการติดเชื้อ ขณะที่พบการปนเปื้อนของแบคทีเรียที่อาจก่อโรคในบาดแผลสดน้อยกว่าร้อยละ 10 และมีอุบัติการณ์ของการติดเชื้อที่แผลต่ำ*