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Surgical Site Infections in Orthopedic Patients; a public health dilemma

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ABSTRACT

Back ground: All surgery has risk of complications. These are rare but do occur despite our best attempts to avoid them. Some risks are specific to certain operations or injuries and others are present for most orthopedic operations. Surgeons encounter the surgical site infection, which is a major public health dilemma.

Objectives: To estimate the incidence and risk factors of surgical site infections in the orthopedic patients at BV Hospital Bahawalpur

Study design: This was prospective observational study. The patients were interviewed for socio demographic profile.

Methodology: This study was conducted in orthopaedic patients admitted in orthopaedic unit of Bahawal Victoria Hospital Bahawalpur. A structured questionnaire was used. All those patients were included in the study that were clean contaminated or infected and operated in the orthopedic OT. Their wounds were evaluated 15 days post operatively for the presence or absence of infection.

Results A total of 654 clean contaminated and infected patients were assessed after operation. When cases were grouped by wound classification, out of 654 cases. there were 529 (80.7 %) clean contaminated and 125 (19.3 %) infected patients. Out of the 654 operated patients included in the study, 163 (27.7%) developed an infection. The incidence of surgical site infections significantly depended on wound class, with a rate of 23.3 % for clean contaminated wounds, and 32.0% for infected wounds.

Conclusion: The impact of surgical site infections was the mean length of postoperative stay of these patients significantly longer than for those without these infections.

Key words: Clean contaminated, infected, trauma, public health

INTRODUCTION

A wound is defined by the Center for Disease Control (CDC) as an interruption or break in the continuity of the external surface of the body or the surface of an internal organ, caused by surgical or other forms of injury or trauma. A surgical site infection (SSI) is clinically defined as presence of pain at a surgically created wound, which is accompanied by erythema, induration and local tenderness or presence of purulent discharge at wound site (1). SSIs are not a modern phenomenon. As early as 14-37AD there is documentary evidence that Cornelius Celsus (a Roman physician) described the four principal signs of inflammation and used 'antiseptic' solutions. Another Roman physician, Claudius Galen (130-200 AD) had such an influence on the management of wounds that he is still thought of by many today as the 'father of surgery'.

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All surgery has risk of complications. These are rare but do occur despite our best attempts to avoid them. Some risks are specific to certain operations or injuries and others are present for most orthopedic operations. Surgeons encounter wound infections in two major ways: patients present with an infection that requires surgical treatment, like drainage of an abscess; or infection complicates a surgical procedure, e.g. SSI. This problem was almost universal prior to the development of aseptic surgery in the last century but, in spite of our more sophisticated understanding of the nature of infection and an arsenal of antimicrobial agents, SSI still remains a major surgical problem today.

SSIs have a significant impact on patients, increasing length of hospital stay, contributing to overuse of hospital stay, contributing to an overuse of antibiotics and increased associated costs, and contributing to increased mortality[2].

SSIs are common, comprising about 12% of all hospital-acquired infections. The rate of infection varies depending on the type of surgery undertaken. Especially high rates are associated with contaminated surgery in orthopedic surgery.

Post-surgical infection can make recovering from an operation a nightmare. About 600,000 of the 30 million people who have surgery each year develop infections after surgery—increasing their hospital stays, their hospital bills, and even their chance of death. In the 1960s, studies showed that using antimicrobials (medicines to stop the growth of bacteria, pathogens, and other unsavory little creatures) greatly reduced the risk of infection. However, antimicrobials are not always used as they should be. As part of a project to promote the correct practices, doctors from around the country looked at whether or not surgery patients were being treated properly to prevent infection[3].

By definition, a surgical site infection (SSI) is an infection that develops within 30 days after an operation or within one year if an implant was placed and the infection appears to be related to the surgery[1]. Post-operative SSIs are the most common healthcare-associated infection in surgical patients[4].

In the United States, between 500,000 and 750,000 SSIs occur annually[5,6]. Patients who develop an SSI require significantly more medical care. If an SSI occurs, a patient is 60 percent as likely to spend time after surgery than is an uninfected surgical patient[7] and the development of an SSI increases the hospital length of stay by a median of two weeks[8].

This study was designed to calculate the incidence rate of infection in clean contaminated and infected cases and associated risk factors, so that on the basis of these results a better strategy could be made for reducing the risk of post surgical infection in orthopedic patients.

MATERIAL AND METHODS

This was a prospective, observational cohort study conducted in Orthopedic unit of Bahawal Victoria Hospital Bahawalpur from Jan 2009 to July 2009. This study comprised of 654 clean contaminated and infected operations. There were 529 clean contaminated patients and 125 patients presented with infected wounds. All the patients were operated as early as possible. The time between arrival of the patient and surgery was kept to the minimum. No discrimination was done between senior or more experienced surgeon and the trainee residents. Data regarding socio demographic status, type of injury and nature of injury was noted.

The wounds were graded into two types. The first grading was done on the status of wound as clean contaminated or infected. The second type of grading was done on trauma force and regional distribution.

Clean contaminated patients were those patients with open fracture treated or closed fractures with compromised overlying skin with no apparent infection. Infected patients were those having open fractures with overt infection. While on the basis of trauma force the injuries were divided into low energy trauma as in case of fall on the ground, patho-physiological or house hold injuries, while all open fractures, fire arm injuries, comminuted and segmental fractures are included in high energy trauma injuries.

Antibiotics in all these cases were started from admission in the orthopaedic unit to 1—4 weeks post operatively according to the condition of wound and grading of the fracture. The antibiotics were modified according to culture and sensitivity report which was not part of this study.

RESULTS

During the study period, a total of 654 clean contaminated and infected patients were assessed after operation. There were 529 (80.7 %) clean contaminated and 125(19.3%) infected patients. The mean age of the study population was 45.2±15.7 years, and 65.3% were men. All these patients were operated and rate of infection calculated without any modification in the existing conditions. The incidence rate was 27.7% (95% CI, 22.5-32.3).

The evaluation of the patients was done on fifteenth day and the presence or absence of infection was recorded. Late infections were not part of this study. The influence of surgeon experience, type of injury and regional distribution were evaluated. There was no infection in 491(72.3 %) patients .Out of the 654 operated patients included in the study, 163(27.7%) developed an infection. Among these 98(20.35%) developed infection under the deep fascia and 65(7.2%) under the superficial fascia. The incidence of surgical site infections significantly depended on wound class .The rate of infection was 27.7% in clean contaminated patients, while in infected patients it was 32.32%. None of the patients had more than one surgical site infection.

Along with other characteristics of these patients, the rate of infection according to age is presented in Table -1

Among the 529 (80.7 %) clean contaminated, the infection was detected in 123 (23.3. %) patients. There were 61 (11.5 %) superficial and 63 (12.8%) deep infections. As the experience of surgeons increases, the rate of infection decreases. The rate of infection below the age of fort was as low as 15.5% and above the age of forty it was as high as 28.5%, showing that In older age, the rate of infection was more as compared with younger patients. The patients inflicted by high energy trauma show higher rate of infection.

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Table 1: Effect of age on infection rate in clean contaminated and infected patients (Clean Contaminated=529) (Infected=125)

Age of clean contaminated Patients	Total cases	Infected cases	Rate of infection in %age	Age of infected patients	Total cases	Infected cases	Rate of infection in %age
0—20	290	46	15.5	0—20	79	17	22
21—40	186	41	22	21—40	40	10	25
41—60	37	10	27.5	41—60	04	02	50
> 61	16	2	28.5	> 61	02	02	100
Total	529				125		

Table II: Effect of experience of surgeon on rate of infection in clean contaminated patients.

Surgeon	Total cases	Infected cases	Rate of (%) infection
Consultants	28	5	17.8
Registrars	431	101	23.4
House surgeons	70	17	24.2

Table-III Effect of mechanism of injury in clean- contaminated patients.

Injury	Total cases	Infected cases	Rate of (%) infection
Low energy trauma	103	23	22.3
High energy trauma	385	95	24.7
Miscellaneous	41	05	12.1

Table IV: Regional effect on infection in clean contaminated patients.

Region	Total cases	Infected cases	Rate of (%) infection
Shoulder / arm	24	3	12.5
Elbow / forearm	89	16	17.9
Wrist / hand	115	25	21.7
Thigh	51	6	11.76
Knee / leg	124	37	29.00
Ankle / foot	126	36	28.5

Table V: Experience of Surgeon

Surgeon	Total cases	Infected cases	Rate of (%) infection
Consultants	11	2	18.1
Registrars	69	22	31.8
House officers	45	16	35.5
Surgeon	Total cases	Infected cases	Rate of (%) infection

Table V: Effect of Mechanism of injury

Injury	Total cases	Infected cases	Rate of (% infection
Low energy trauma	0	0	0
High energy trauma	74	25	33.7
Miscellaneous	39	12	30.7

Table VII: Regional effect on infection rate

Region	Total cases	Infected cases	Rate of (% infection
Shoulder / arm	11	2	18.1
Elbow / forearm	26	7	26.9
Wrist / hand	23	6	26.08
Pelvis / hip	0	0	0
Thigh	17	5	29
Knee / leg	32	15	46.87
Ankle / foot	16	5	28.5

The rate of infection in low energy trauma was lessened 22.3 as compare to high energy trauma injuries that was 24.7%. The infection rate in arm and thigh surgery was 12.5 and 11.78% respectively. While in the region of wrist and ankle surgery it was 21.7 and 28.5% showing that, the rate of infection is much high in distal part of lower extremity.

In this study, 125 patients presented with infected wounds. The infection could not be eradicated in 40 (32 %) patients. The rate of infection was higher in older patients. It was as low as 22% in the age group of 20 years while it was as high as 50% and 100% in the age of below 60 and above 60 years respectively. The patients who presented with high energy trauma & nonunion were having high rate of infection. The rate of infection decreased as the experience of surgeon increased. Even in these dirty and infected wound patients the rate of infection in consultant cases were as low as 18.1% and in house surgeons it was as high as up to 35.5% The rate of infection was more in knee & leg area than other parts of the body. It was 28,5% un ankle and foot 29%in thigh surgery case as shown in the respective table.

The rate of infection in non union cases was 25% while in high trauma cases it was 33.7% showing the high incidence rate of infection due to sever crushing injuries of soft tissues in these cases.

DISCUSSION

Out of the 654 operated patients included in the study, there was no infection in 491 (72.3 %) patients. 163 (27.7%) developed an infection. Among these 98 (20.35%) developed infection under the deep fascia and 65 (7.2%) under the superficial fascia. The incidence of surgical site infections significantly depended on wound class .The rate of infection was 27.7 % in clean contaminated patients, while in infected patients it was 32.32 %. None of the patients had more than one surgical site infection.

Among the 529 (80.7 %) clean contaminated, the infection was detected in 123 (23.3. %) patients. There were 61 (11.5 %) superficial and 63 (12.8%) deep infections. As the experience of surgeons increases, the rate of infection decreases. In older age, the rate of infection was more as compared with younger patients. The patients inflicted by high energy trauma show higher rate of infection. The rate of infection is much high in distal part of lower extremity.

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The incidence rate of surgical site infections found in the present study was 29.7%. The independent risk factors for development of surgical site infections identified in the study were a contaminated or dirty wound; the rate of infection is higher in older patients. The patients who presented with high energy trauma & nonunion were having high rate of infection. The rate of infection decreases as the experience of surgeon increases. The rate of infection was more in knee & leg area than other parts of the body.

In clean contaminated, the cases operated by consultant / specialized surgeons, patients the rate of infection was 17.8% while the rate of infection in the cases operated by registrars and house surgeon was 23.4% and 24.2% respectively, showing that as the experience of surgeons increases, the rate of infection decreases. The same findings were observed in a study conducted in United States that among more specialized hospitals, there were fewer serious post-surgical complications such as blood clots, infections and heart problems, as well as fewer deaths. The findings, which were published online Feb. 11 by the British Medical Journal, were based on data for nearly 1.3 million patients who received hip or knee replacement surgeries between 2001 and 2005 at 3,818 hospitals in the United States[9].

It is matter of reality that when there is post surgical infection, it loses the faith of the patient on the surgeon. The patient shows quite dissatisfaction on the procedure. In our study 163 (27.7%) developed an infection. Among these 98 (20.35%) developed infection under the deep fascia. Deep infection after surgery is one of the most serious complications of orthopedic cases especially in total joint replacement. A study showed that 23% of patients who experienced postsurgical complications report being completely dissatisfied with their procedure. "This research contributes to the understanding of the overall burden of postoperative infection on the individual and the community," report lead author Dr Paul Smith[10].

It is the time that we should introduce novel methods of orthopaedic surgery to reduce the rate of infection and as a result to reduce the burden on the individuals and the community. Such type of novel techniques are being applied in several developed countries. In a separate scientific exhibition, researchers evaluated whether using space suits might help reduce infection rates. Astronaut gear costing about US $650 is sometimes used to protect both the patient and the surgeon during total joint arthroplasty. In this five-year retrospective study, the

group looked at over 3800 total joint surgeries and reviewed the infection rates with and without the use of space suits. The researchers, led by Dr Jack Bert, an orthopedic surgeon based in Saint Paul, MN, focused on deep infections. There were only two infections in the total-hip arthroplasty group using space suits and six infections in those not using the suits. In the total-knee arthroplasty group, there were nine infections in the space-suit group and 19 infections in the no-suit group[11].

The incidence rate in our study was remarkably higher than the incidence rates in orthopedic patients from developed countries[12,13,14]. but it was also higher than the rates in some developing countries (15,16). The incidence rates stratified by wound class exceeded those reported by other studies .High rates of contaminated, dirty, and trauma-related wounds in our study might have contributed to the high incidence of surgical site infections.

There are some limitations of the study. It covered a period of only 6 months and thus may not account for seasonal variations. Demographic characteristics of hospital population (age, for example) may be changed during winter.

Since the number of patients included in the study was relatively small, the power of the study was not great enough to estimate the effect of less frequent variables – therefore, investigation performed on a larger number of patients would be desirable.

The merit of the study is that it confirmed that active surveillance of surgical site infections might be organized in countries with limited resources. Surgical site infections are a considerable problem in orthopedic wards in Pakistan, with incidence rates being much higher than in other countries, particularly in clean wounds.

CONCLUSION

Surgical site infection is a major problem of public health; it not only impairs the health of the individual but rather puts him in depression. He feels him ad burden not only on the family but also on the community. The sympathetic attitude of the surgeon gives him strength. The impact of surgical site infections was the mean length of postoperative stay of these patients significantly longer than for those without these infections. The reduction in the rate of SSI can be obtained by several integrated efforts. The new aseptic operative techniques should be used and the incidence of injuries should be minimized by good road engineering and implementing the traffic rules and regulation.

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