Audit of Early Post-Surgical Orthopaedic Infections in a Tertiary Center

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Abstract: Background: Post-surgical orthopaedic infections utilise limited resources, affects quality of life and could be fatal.

Our objectives were to:

1.Report early infection rate(IR) for orthopaedic surgeries

2.Study the complex interplay of variables and effect of co-morbidites on IR

3.Report mortality rate and measures to reduce it

Methods: All consecutive surgeries assisted/performed by a resident over 25 consecutive months against stringent inclusion/exclusion criteria formed the study cohort. Prospective data pertaining to patient demographics, nature of surgery and environmental factors were collected adhereing to a structured proforma. Thus collected data was analysed by SPSSv.11 and uni/multivariate analysis with logistic regression was performed.

Results: 22/745 developed infection (superficial[8];deep[14]). There were two deaths. The overall IR was 2.95%. The relative risk(RR) of dying following infection was 12.63 ($p<0.005$). The average follow-up was 14 months (range: 3-25 months). One patient had persistent infection and amputation was contemplated to optimize function. The most common organism was MRSA. There was no difference in IR between those who had 3 vs. 14 days of antibiotics.

Conclusion: This study resulted in major restructuring of trauma services and streamlining of admissions for elective cases. Infection register was set-up to monitor all infections. A standardised post-op antibiotics prescription policy was implemented.

Key Words: Surgical site infections (SSI), Infection rate (IR),Prophylactic antibiotics ,Relative risk (RR),Case fatality rate (CFR)

THESIS SUMMARY

Introduction

Postoperative infection could be devastating as they consume enormous amount of limited resources and manpower. They are also associated with functional disability, poorer quality of life and may be potentially fatal. A myriad of agent, host and environmental factors act in a complex fashion predisposing some individuals to acquire surgical site infections (SSI). As rightly quoted "An ounce of prevention is better than a pound of cure", it's better to be meticulous and diligent in preoperative work-up and intraoperative techniques coupled with appropriate prophylactic antibiotics and excellent postoperative care to keep the infection rate (IR) to minimum. Certain co-morbidities like rheumatoid arthritis (RA), diabetes mellitus (DM), tuberculosis (TB), human immunodeficiency virus (HIV) and remote site infections (RSI) all enhance the risk of developing SSI. Despite best efforts, infections may be inevitable in some cases (e.g. Multidrug resistant tuberculosis [MDR-TB] and patients on anti-cancer medications). Advances in theatre sterility and use of high energy particulate air (HEPA) filters have significantly reduced the IR in contemporary era. The recommended IR in elective orthopedic total joint replacement surgeries as accepted standard of care recommended by the American academy of orthopedic surgeons

(AAOS) is <1%.

Aims and Objectives

- To establish early infection rate (IR) at our institute
- To study the influence of various predisposing factors on incidence of infection
- To evaluate the complex interplay of such predisposing factors and calculate relative risk(RR) with 95% confidence intervals for each variable
- To formulate good clinical practice (GCP) guidelines to aid existing ones in reducing IR.

Methods

715 consecutive patients who underwent 749 orthopedic procedures on 745 anesthetic episodes which a resident (NSH) was involved in over 25 months as a part of his residency rotation formed the study cohort. The data pertaining to patient demographics (age at surgery / sex / socio-economic status), nature of surgery (simple vs. polytrauma / closed vs. compound fractures / arthroscopic and percutaneous vs. open surgeries / elective vs. emergency operations / use of tourniquet), associated medical comorbidities (DM / RA / TB / HIV), preoperative blood investigation results (serum hemoglobin, total proteins and white blood cell counts), duration of surgery & preoperative inpatient stay in hospital, venue of surgery (i.e. laminar vs. non-laminar air flow theatres), rank of lead operating surgeon, use of prophylactic antibiotics (drugs used and duration of administration), amount of perioperative blood transfusion and venue of surgery was comprehensively collected as per a structured proforma (fig 1). The first 70 procedures in 69 patients was collected retrospectively and the remaining 679 procedures in 646 patients was collected prospectively. In total, 17 parameters that potentially influences one in developing a SSI were assessed and evaluated in detail. The minimum follow-up in all patients was at least one month. All infected patients were followed up at least until cure / control of infection or mortality whichever was latter. No patient in infected group was lost for follow-up.Permission from departmental head and faculty members was taken prior to collection of data as IRB and ethics committee permission was not mandatory to undertake this project.Consent for participation in this study was taken from all patients. The stringent inclusion and exclusion criteria was strictly adhered to throughout the course of study. The criteria for labelling patients as infected or otherwise (i.e. not infected) were as per center for disease control (CDC) guidelines for SSI. An 'Infection register' with detailed records of all patients who had SSI was maintained and updated diligently at regular intervals that provided invaluable insight into understanding and preventive measures to be employed in reducing infections.

Results

22 of 715 patients developed SSI and this included 16 males and 6 females. Eight of them were superficial and 14 were deep infections. The overall infection rate (IR) was 2.94% and the deep infection rate was 1.87%. The most common organism isolated on culture and sensitivity was methicillin resistant staphylococcus aureus (MRSA) which was seen in nine out of 14 deep infection cases. None of the eight superficial infections grew any organism. There were two deaths out of 22 patients and the case fatality rate (CFR) was 9.1%. The relative risk of dying on contacting orthopedic SSI was 12.6 and was statistically significant ($p<0.005$). One patient had persistent infection and above knee amputation was contemplated to optimize function.The use of laminar air flow theatres was associated with reduced infection rate though this did not statistical significance. The study also interestingly shattered the myth that administration of antibiotics (Abs) up to suture removal (14 days) did not confer any additional benefit by reducing IR in comparison to those who received prophylactic Abs for only 3 days. The relative risk (RR) for each of the 17 individual parameter with 95% confidence intervals and infection rate were tabulated. The single most important factor that was statistically significant on multivariate analysis and logistic regression (SPSS v10, Chicago, IL; USA) was 'amount of blood transfusion'. Finally the power analysis (i.e. $1 - \beta$) was low (i.e. <80%) for fiveparameters (small sample size).

The independent risk factorsthat were statistically significant on univariate analysis were:

- Duration of surgery
- Preoperative stay in hospital as in-patient
- Amount of perioperative blood transfusion (in units; 1 unit = 350mls of whole blood).

Conclusion

This was the first study at our institute that challenged the conventional notion of administering prophylactic Abs until suture removal (i.e. 14 days). The study brought a sea change in orthopedic trauma service delivery by streamlining the orthopedic trauma theatre traffic and up gradation into a laminar air flow OT to curb infection rate (IR). The general surgical trauma cases were segregated from orthopedic ones to further reduce risk of contamination with gut / gram negative organisms. Other changes implemented as part of department's efforts to further reduce IR were:

- Streamlining of all elective orthopedic admissions where in majority of patients were admitted either the night before or on the day of surgery to optimize bed utilization, reduce pre-op inpatient stay and prevent colonization by nosocomial / drug resistant organisms.
-Establishment of department's Infection register along the lines of Arthroplasty register with prospective collection of data about all patients with SSI following orthopedic surgeries
-Collaboration between microbiology and orthopedic departments to formulate guidelines regarding use of prophylactic Abs
-Commitment to follow-up and treat all infected patients until they were completely cured / eradicated of infection.
-Objectively measure risk ratio (RR) of parameters that predispose an individual to SSI and utilize this research info to counsel patients appropriately when consenting for surgeries
-Introduction of preoperative MRSA swabbing from nose, throat and groin in patient scheduled for total joint replacements as this was the most common organism causing deep infections
-Get insight into complex interplay of risk factors that

predisposed an individual to infection and innovative strategies to break this chain and attempts towards improving quality of care to our patients / taxpayers.

Clinical Message

Surgical site infections (SSI) are due to a complex interplay of agent, host and environmental factors and SSI following orthopedic surgeries can be fatal.

- Administration of prophylactic antibiotics beyond 3 days did not reduce infection rate in this series of 715 patients and may potentially promote emergence of drug resistant organisms.
- The most common organism causing deep infection following orthopedic surgeries was MRSA (methicillin resistant staphylococcus aureus).
- The relative risk (RR) of death following orthopedic SSI in this study was 12.60 and case fatality rate (CFR) was 9%.
- Maintenance of infection register and regular collaboration with microbiologists in optimizing the choice of prophylactic Abs is of paramount importance in reducing IR.
- Individualized antibiotic prophylaxis driven by patients' unique characteristics maybe standard of care in coming years / near future.

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