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EFFECTIVENESS OF LOCAL VANCOMYCIN POWDER TO DECREASE SURGICAL SITE INFECTION

Orthopaedic

KEYWORDS:

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ABSTRACT

Introduction: Surgical site infection remains a complication of spine surgery despite routine use of prophylactic antibiotics. retrospective clinical clinical studies have decreased prevalence of surgical site infection after spine surgery. The purpose of present study was to assess the efficacy of intrawound vancomycin powder in terms of eradicating surgical site infection.

Aim & Objectives: To determine the effect of local application of vancomycin powder in controlling surgical site infection

Methodology: 40 patients who underwent open spinal surgeries were administered locally 1 gram vancomycin powder prior to closure. All sterile procedures were observed pre, intra and post-operatively. Surgical site dressings were done on day 3 and suture removal done on day 11 and discharged.

Patients followed up for a period of 1 month.

Results: out of 40 patients 38 had no infection and 2 patients had surgical site infection.

Conclusion: So the present study shows that the use of intrawound vancomycin powder eliminated surgical site infections and we are able to offer evidence regarding the effectiveness of local vancomycin in preventing delayed and chronic infections.

INTRODUCTION

The infection of a wound can be defined as the invasion of organisms through tissues following a breakdown of local and systemic host defenses, leading to cellulites, lymphangitis, abscess and bacteraemia. Surgical site infection (SSI) has always been a major complication of surgery and trauma and has been documented for 4000-5000 years. Galen recognized that localization of infection in wounds, inflicted in the gladiatorial arena, often heralded recovery, particularly after drainage.[1]

Surgical Site Infections (SSIs), previously called post operative wound infections, result from bacterial contamination during or after a surgical procedure. Surgical site infection (SSI) is the second most common health care associated infections.[2] According to data to report to the National Healthcare Safety Network (NHSN) in 2006 to 2008, the mean SSI rate was 0.7% to 4.2% for spinal fusions, 0.7% to 2.3% for laminectomies, 0.6 to 2.4% for joint arthroplasties, depending on NHSN risk class.[3] Thus it is important to use precautionary methods to decrease incidence of SSIs.

The criteria used to define surgical site infections have been standardized and described three different anatomic levels of infection: superficial incisional surgical site infection, deep incisional surgical site infection and organ/space surgical site infection.[4]

According to the degree of contamination wounds may be classified as clean, potentially contaminated, contaminated, and dirty. The incidence of infection, morbidity and mortality increases from clean to dirty. The risk of infection is greater in all categories if surgery is performed as an emergency.[5] The risk of wound infection is infl uenced but not entirely determined by the degree of contamination.

Multiple risk factors and perioperative characteristics can increase the likelihood of superficial surgical site infections. Important host factors include diabetes mellitus, hypoxemia, hypothermia, leucopenia, nicotine, long term use of steroids or immunosuppressive agents, malnutrition, nares contaminated with Staphylococcus Aureus and poor skin hygiene. Preoperative / environmental factors are operative site shaving, breaks in operative sterile technique, early or delayed initiation of antimicrobial prophylaxis, inadequate intra-operative dosing of antimicrobial prophylaxis, infected or colonized surgical personnel, prolonged hypotension, poor operative room air quality, contaminated operating room instruments or environment and poor wound care postoperatively.[4]

Staphylococcus aureus, including methicillin-susceptible (MSSA) is the most common organism causing SSIs but infection can even be seen with other organisms Wound infections usually appear between fifth and tenth post operative day, but they may appear as early as first post operative day or even years later. The first sign is usually fever, and post operative fever requires inspection of the wound. The patient may complain of pain at the surgical site. The wound rarely appear severely inflamed, but edema may be obvious because the skin sutures appear tight.[1]

According to severity, surgical site infections can be divided into two types, major and minor. Criteria of major SSI are significant quantity of pus, delayed return home and Patients are systemically ill. Minor SSI may discharge pus or infected serous fluid but should not be associated with excessive discomfort, systemic signs or delay in return home.[1]

The use of antibiotic prophylaxis before surgery has evolved greatly in the last twenty years. Vancomycin powder is recommended over intravenous vancomycin because of its systemic side effects. Vancomycin powder can be applied to wounds easily, is inexpensive, and can achieve high local concentration with low systemic levels.[6] Local vancomycin powder has an advantage because it has no systemic or serious local complications. Vancomycin is also effective against methicillin resistant staphylococcus aureus infections. It can also be used in patients with beta lactam allergy.

Surgical site infection is the most important cause of morbidity and mortality in the post operative patients, but it is preventable in most of the cases if proper assessment and appropriate measures are taken by the surgeons, nursing staffs, patients and others in the preoperative period.

Thus, in this study it had been tried to find out effectiveness of local vancomycin powder to decrease surgical site infection.

AIM:

- To determine the effect of local application of Vancomycin powder in controlling surgical site infection.

OBJECTIVE:

To evaluate the effect of intraoperative powdered Vancomycin on rates of postoperative deep spinal wound infections

MATERIAL AND METHODS

Study Design:

The present study was a hospital based prospective study undertaken to study effectiveness of local Vancomycin powder to decrease surgical site infection.

Study Period:
The study period was 24 months. (August 2014 to August 2016)

Study Population:
The study population was patients attending Orthopaedics OPD and Casualty of Bharati Hospital and Research Center, Pune during the study period.

Sample Size:
A total of 40 cases by simple random sampling attending OPD and admitted in hospital during study period considering the inclusion and exclusion criteria were included in the study.

Inclusion Criteria:
- Patients undergoing all spinal surgeries in hospital.

Exclusion criteria:
- Patients undergoing endoscopic spinal surgeries

Ethical Consideration:
The study was approved by the Ethical Committee of the Medical College.

Methodology of study:
- All 40 patients undergoing spinal surgeries, of both the sexes operated were included.
- After giving written and informed consent and ethical clearance, patient underwent detailed history recording, clinical examination and relevant laboratory investigations.
- If the patient agrees to participate and meets all the criteria required for the study, the patient was included in the study.
- The patient was explained about the study and asked to sign the attached consent form.
- A demographic data, detailed history and clinical examination findings will be captured on a predetermined proforma.
- All these patients underwent spinal surgery and during the procedure, the retractors were repeatedly released to avoid tissue necrosis and if tissue necrosis was evident these portions were debrided.
- At the end of the surgery after a thorough wash, 1gm Vancomycin powder was placed before closure of the wound.
- Along with Vancomycin powder, all the patients were given the routine prophylactic antibiotics pre-operatively and post-operatively.
- The surgical site was examined and on postoperative day 3 dressing was done, postoperative day 11 sutures were removed and at 4 weeks postoperative.
- If surgical site infection was seen postoperatively a swab was taken for culture and sensitivity.

Investigations:
The investigations done in the cases selected for the study are: (as per the patient's financial condition and availability)
- Routine Blood investigations
- Culture and sensitivity

RESULTS

Table 1: Distribution of Patients according to comorbid conditions:*

Comorbid conditions	Frequency (n=40)	Percentage
Hypertension	04	10.00
Diabetes Mellitus	05	12.50
Coronary artery disease	03	07.50
IHD	02	05.00
Others	03	07.50

(* Multiple response Present)

Table 2: Distribution of Patients according to intra operative characteristics of Surgery:

Characteristics		Frequency (n=40)	Percentage
Length of operation (Hours)	<2	04	10.00
	2-3	33	82.50
	3-4	02	05.00
	>4	01	02.50
Blood transfusion	0 unit	15	37.50
	1-3 unit	23	57.50
	>3 unit	02	05.00
Level of spine exposed	<3	22	55.00
	>3	18	45.00

Table 3: Distribution of patients according to surgical site infection:

SSI	Frequency (n=40)	Percentage
Superficial	01	02.50
Deep	01	02.50
Total	02	05.00

Table 4: Distribution of organisms isolated from SSI:

Organisms isolated	Frequency	Percentage
E. coli	01	50.00
MRSA	01	50.00
Total	02	100

	Not required	02	10	

(*P<0.05; statistically Significant)

DISCUSSION

The present study was prospective study undertaken to find effectiveness of local application of Vancomycin powder in controlling surgical site infection.

The study was conducted during the period of July 2014 to July 2016 at Bharati Hospital and Research Center, Pune.

All the patients presenting to the Orthopedics OPD and Emergency department with history trauma going for spinal surgery were included as study population.

A total sample size of 40 patients was included in the study. The patients undergoing all spinal surgeries were included in the study. The patients in which Vancomycin coated implants and instruments had been used and patients undergoing endoscopic spinal surgeries were excluded from the study.

All the subjects included in the study volunteered after proper consent and reported for follow up at right time.

The study was conducted after obtaining clearance from the ethical committee of the institute.

The data collection was done by using predesigned pretested questionnaire. The questionnaire consisted socio-demographic details and complete medical and surgical history along with culture and sensitivity for microorganisms.

In the present study it was observed that majority of patients were in age group 41-60 years (45%). It was observed that mean age was 41.20 ±8.07 years.

In the study done by Jae-Sung Ahn et al to assess the diagnostic value of suction drain tip culture in patients undergoing primary posterior spine surgery for SSI observed the mean age was 64.23±11.74 years.

In the table above distribution according to sex was described. It was observed that majority of patients were male (60%) while females were 40%.

Similar findings were seen in the study done by Jae-Sung Ahn et al

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where among 133 patients, 79 (59.4%) were males and 54 (40.6%) were females.

The findings were in contrast to study done by Farzad Amuzadeh Omrani et al to study the effect of intra-wound vancomycin powder application in reducing surgical site infections after total hip arthroplasty observed majority of patients were females. (61.6%)

The co-morbid conditions among study population showed that the majority of patients had diabetes mellitus (12.5%) followed by hypertension (10%). The CAD and IHD were observed in 7.5% and 5% patients respectively. The majority of patients had addiction of smoking (22.5%) and alcohol (12.50%)

In the present study, the majority of ASA score was 3 (47.50%) followed by ASA score 2 (37.50%) The ASA score 5 was observed in only 1 (2.5%) patient.

In the study done by Jae-Sung Ahn et al to assess the diagnostic value of suction drain tip culture in patients undergoing primary posterior spine surgery for SSI observed that majority of patients were in ASA score 2 (66.2%) followed by ASA score 3 (24%).

The ASA grade is a measure of systemic disease and serves as a proxy for comorbidities and overall health in the patients undergoing surgery. American Society of Anesthesiologists grade of 3 or greater has previously been identified as a risk factor for SSI.

The majority of patients' surgeries in patients took 2-3 hours. (82.5%) The blood transfusion among patients was found majority as 1-3 unit (57.50%). The distribution of level of spine exposed was <3 in 55% patients and >3 among 45% patients.

In the present study it was observed that among 40 patients 2 (5%) had SSI. The majority of patients had deep infection (2.50%) and superficial infection in 2.5% patients.

The findings seen in the study done by Jae-Sung Ahn et al where among 133 patients, 10 (8.13%) patients had SSI.

In the study done by Sweet et al on the effectiveness of intrawound vancomycin powder use to prevent SSIs in spine surgery observed that 911 of 1,732 consecutive posterior instrumented thoracic and lumbar spinal arthrodeses from 2000 to 2006 had 2 g of intrawound vancomycin powder added as prophylaxis. They had a deep infection rate of 2.6% in the 821 patients not receiving the vancomycin powder compared to 0.2% in the group receiving the vancomycin powder. The reduction was statistically significant ($p<0.0001$).

O'Neill et al published a study on the effectiveness of intrawound vancomycin powder to prevent infections following spinal surgery in a trauma population. They compared 54 control patients not receiving the vancomycin powder to 56 patients receiving the powder over a two year period. They found seven infections (13%) in the group not receiving vancomycin and no infections in the vancomycin group ($p=0.02$).

In the present study organisms isolated from surgical site infection among patients showed that most common organism isolated was MRSA. (50%) and E. Coli (50%). It was observed that MRSA showed maximum resistance to antibiotics.

In study done by Aniruddha S. Mundhada et al to know organisms causing surgical site infections and their antimicrobial susceptibility in a tertiary care Government Hospital observed that Staphylococcus aureus was the most common organism isolated. Drug resistance was widespread, especially in Enterobacteriaceae, where the Cefotaxime resistant strains of Escherichia coli and Klebsiella pneumoniae were ESBL producing.

Surgical site infection following spine surgery usually occurs through direct inoculation during the surgical procedure. The other two possible routes of infection are hematogenous spread and early post-operative contamination. Staphylococcus aureus remains the leading agent of SSI responsible for around 50% of cases, although estimates in various studies range from as low as 12–65%. Additional common causes of SSI include coagulase-negative staphylococci, mainly Staphylococcus epidermidis, mostly associated with implanted spinal prosthesis. In addition, Gram-negative organisms can been countered, including Pseudomonas aeruginosa, Escherichia coli, and Proteus species.

The correlation between surgical site infection and demographic characteristics showed that age, sex and presence of comorbidity showed no statistical difference among surgical site infection present and absent groups. ($P>0.05$)

The findings were contrast to study done by Farzad Amuzadeh Omrani et al where people with diabetes, the incidence of surgical site infection was significantly higher than in non-diabetics.

In the present study correlation between surgical site infection and surgical characteristics showed that length of operation, blood transfusion and level of spine exposed showed statistical difference among surgical site infection present and absent groups. ($P<0.05$)

The findings were similar to study done by Farzad Amuzadeh Omrani et al to study the effect of intra-wound vancomycin powder application in reducing surgical site infections after total hip arthroplasty observed significant difference in average operation time between patient with and without surgical site infection.

The ICU admission showed no statistical difference among surgical site infection present and absent groups. ($P>0.05$)

Reasons for higher rates of infection include longer operative time, prolonged retraction and of course the use of foreign biomaterials. The techniques that have been developed with aim at reducing the rate of infection following surgical procedures include generous irritation, debridement and extra effort at shorter operating times.

Surgical site infection following spine surgery is a major cause of increased morbidity following spine interventions and an immense burden on the health care system. A high index of suspicion should be kept in the first 3months after the procedure.

Bacterial contamination increases with the duration of surgery, also the cells are increasingly damaged by prolong exposure and surgical instrumentation is liable with blood loss thereby reducing the patients general resistance. All these factors may contribute to increased rate of infection.

The findings showed a significant decrease in the number of infections in the group treated with Vancomycin. This finding is very promising in decreasing the risk of postoperative surgical site infection and anticipates that the use of intra-wound Vancomycin application will continue to increase. Therefore, intra-wound Vancomycin application may be used to decrease infection rates in surgeries without causing any adverse complications as identified in this study.

The limitations of this study include mainly the short term follow-up of patients, and small sample size.

CONCLUSION

Surgical site infection following spine surgery is a major cause of increased morbidity following spine interventions and an immense burden on the health care system.

In the present study, the findings showed a significant decrease in the number of infections in the group treated with Vancomycin powder at surgical site. This finding is very promising in decreasing the risk of

postoperative surgical site infection and anticipates the use of intra-operative local Vancomycin will continue to increase. Therefore, intra-operative local Vancomycin may be used to decrease infection rates in surgeries without causing any adverse complications as identified in this study.

The present work may add to the growing body of evidence in support of this effective adjuvant to standard antimicrobial prophylaxis.

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