# **ORIGINAL RESEARCH**

# To Assess The Efficacy Of Intrawound Application Of Vancomycin Powder With Systemic Cefuroxime (Postoperatively) On Post Operative Wound Infection In Spine Surgery With Metallic Implant Fixation

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#### ABSTRACT

**Background:** A post operative surgical site infection in spine surgeries is a potentially devastating complication . The present study was conducted to assess the efficacy of Intrawound application of vancomycin powder with systemic cefuroxime (postoperatively) on post operative wound infection in spine surgery with metallic implant fixation. **Material & methods:** Study drug was allocated into two groups as: Group A- Intra wound application of local vancomycin powder with post operative systemic antibiotics in patients of spine surgery and Group B - Post operative use of systemic antibiotics in patients of spine surgery and Group B - Post operative use of systemic antibiotics in patients of spine surgery. Findings were noted. All the results were summarized in Microsoft Excel sheet. P value<0.5 was considered as significant. **Results:**On comparing both the Groups with respect to co-morbidities along with SSI's, non significant results were obtained (p=0.32). On comparing the Post operative discharge among Group A and Group B ,significant results were obtained. The number of cases showing pathogens in pus and culture sensitivity report of patients who developed SSI's was less in Group A. On comparing the Post operative Wound status among Group A and Group B and Group B ,significant results were obtained with p value=0.037. **Conclusion:** The study concluded that there was significant reduction in surgical site infections observed in patients of spine surgeries with metallic implant fixation in whom combined therapy was given.

Keywords: Intrawound, vancomycin, cefuroxime, spine surgery.

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#### INTRODUCTION

Surgical site infections (SSIs) serious are complications following spinal surgery, often associated with increased morbidity, mortality, and medical costs. SSIs are currently the most common hospital-acquired infection, surpassing urinary catheters and central lines and are estimated to account for 31% of all infections among hospitalized The complications from SSIs cause patients. significant patient distress and jeopardize a full recovery despite meticulous surgical accomplishment.1 The 2013 North American Spine Society (NASS) Evidence-Based Clinical Guidelines found that the incidence of SSI in spine surgery ranged from 0.7–10%, with higher rates with medical

morbidities. National guidelines currently co recommend first-generation cephalosporin's as first line prophylaxis. Due to an increase in MRSA cases in our institution, a combined antibiotic strategy using vancomycin IV, standard prophylactic antibiotics, and vancomycin powder was implemented for all spinal instrumentation surgeries.<sup>2</sup> Methicillin-Sensitive aureus(MSSA) Staphylococcus (41.9%) and methicillin-resistant (17.0%) Staphylococcus aureus (MRSA) were the most commonly isolated pathogens, whereas gram-negative bacteria accounted for 25.4% of cases. Operative treatment was required in 81.8% of SSI cases.<sup>3</sup> The initial tests that should be ordered on clinical suspicion of postoperative infection should include a complete blood count, erythrocyte

sedimentation rate (ESR), and C-reactive protein (CRP), Pus culture sensitivity report when discharge is present.<sup>4</sup> Vancomycin is a glycopeptide antibiotic that exerts its bactericidal effect by inhibiting the polymerization of peptidoglycans in the bacterial cell wall. The bacterial cell wall contains a rigid peptidoglycan layer that has a highly cross-linked structure composed of long polymers of Nacetylmuramic acid (NAM) and N-acetylglucosamine (NAG). Vancomycin inhibits the crosslinking of Dalanyl D-alanine, thereby preventing the synthesis and polymerization of NAM and NAG within in the peptidoglycan layer. This inhibition weakens bacterial cell walls and ultimately causes leakage of intracellular components, resulting in bacterial cell death.<sup>5</sup> Vancomycin is active against skin pathogens that can potentially contaminate the wound during spinal surgery. The local application of vancomycin in its powder form ensures adequate surgical-site concentrations with maximum antibacterial activity. Moreover the local application of vancomycin is minimally absorbed systemically therefore showing less adverse effects.<sup>6</sup> The present study was conducted to assess the efficacy of Intrawound application of vancomycin powder with systemic cefuroxime (postoperatively) on post operative wound infection in spine surgery with metallic implant in situ.

#### **MATERIAL & METHODS**

The present hospital based prospective, comparative and single blind study. The present study was conducted in the department of orthopaedics, G.G.S. Medical College and hospital, Faridkot, after taking approval from the Institutional Ethical Committee. A written informed consent was obtained from all patients prior to enrollment in this study. Keeping in view of less number of patients who required spine surgeries with metallic implant fixation, the purposive sampling technique was implemented in this study. The study was conducted prospectively on 60 patients (30 each) from 18-80 years of age. The Spine surgeries with metallic implant fixation, male or female aged 18-80 years, patients who underwent spine fusion for traumatic cervical, thoracic or lumbar surgery were included in the study. Septic patient, known allergy to vancomycin, patient who were allergic to beta lactam group of antibiotics(penicillin group and cephalosporin's), history of radiation therapy at surgical site, Immunosuppressed cases (disease or drug induced) were excluded in the study. The Patients fulfilling the inclusion criteria were included in this study.

### Method of Collection of Data

- Patients who required spine surgeries with metallic implant fixation were selected.
- Informed and written consent was taken.
- History was taken to assess the risk factors responsible for SSI's.

- Clinical examination both local and systemic was done to assess the level of spine involved
- Radiological examination using X-ray, CT scan, MRI and other imaging modalities were done to confirm the level of spine injury and severity of the injury.

Investigations: Baseline and others were done.

**Diagnosis:** Clinical and radiological was established. The patients were randomly allocated to one of the two treatment groups of 30 patients each. Randomization was done using computer generated random number table.

Study drug was allocated into two groups as:

- **Group A-** Intra wound application of local vancomycin powder with post operative systemic antibiotics in patients of spine surgery.
- **Group B** Post operative use of systemic antibiotics in patients of spine surgery

Assessment of stitched wound was done post operatively by the two different surgical experts who did not know about the intra operative wound therapy given to the patient. They assessed the post operative wound for any post operative discharge and to check for stitch line whether clean or not. Any occurrence of post operative fever was noted.

Post operative CBC, ESR, CRP, and Pus culture sensitivity report was done in patients developing SSI's.

#### **Procedure Followed**

Under all aseptic conditions, vancomycin powder was put over the metallic implant below muscular layer just before the closure of the wound in the patients of spine surgeries who underwent metallic implant fixation.

Under all aseptic conditions, one gram of vancomycin powder put inside the wound intra operatively by the operating surgeon below the muscular layer just before the closure of the wound in one of the patient of spine surgery who underwent metallic implant fixation.

Assessment of post operative stitched wound was done before discharge of the patient, at the removal of sutures and subsequently on each visit. Post operative assessment of the wound was done by the surgeon who did not know about the status of intra operative local vancomycin powder application.

#### **Statistical Analysis**

All the results were summarized in Microsoft Excel sheet. Results of this study were shown as mean and percentage. Non paramedic test- Chi square with or without Yates correction and Fischer test were applied for assessment of level of significance. P value<0.5 was considered as significant.

Age Group(years)	GROUP A		GROUP B		
	Number	Percentage	Number	Percentage	
18-30	4	13.33	5	16.66	
31-40	7	23.33	5	16.66	
41-50	9	30	6	20	
51-60	2	6.66	2	6.66	
61-70	6	20	9	30	
71-80	2	6.66	3	10	
MEAN AGE	46.8		51		
Gender	GROUP A		GRO	OUP B	
	Number	Percentage	Number	Percentage	
Males	20	70	18	60	
Females	10	30	12	40	
Total	30	100	30	100	

#### RESULTS

Table 1: Distribution of patients

33.32% of the patients of Group A and 46.66% of the patients of Group B belonged to the age group of 51 to 80 years. Mean age of the patients of Group A and Group B was 46.8 and 51 years respectively. 30 % of the patients of Group A and 40 % of the patients of group B were females while the remaining were males.

#### Table 2: Spine level wise distribution among group A and group B

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Level of spine involved	Group A	Group B			
Cervical	3	4			
Dorsal	7	9			
Lumbar	20	17			

Three cases of cervical region, seven cases of dorsal region and twenty cases of lumbar region among Group A and Four cases of cervical region, nine cases of dorsal region and seventeen cases of lumbar region among Group B were operated who needed metallic implant fixation.

#### Table 3: Gender wise distribution of patients with SSI's among group A and group B

	GROUP A	GROUP B
Number of males with SSI's	1	2
Number of females with SSI's	1	6

The number of males infected with SSI's was one in group A and two in Group B and number of females infected with SSI's were one in group A and six in Group B.

Table 4. 551 5 among patients with comor bidities					
	Patients with co morbidities who developed SSI's	Total Patients with Co morbidities	P value		
Group A	1	8			
Group B	5	12	P=0.32		

## Table 4: SSI'S among patients with comorbidities

On comparing both the Groups with respect to co-morbidities along with SSI's, non significant results were obtained (p=0.32).

Type of pathogen found	Group A	Group B	P value
MSSA	1	4	
MRSA	1	3	P=0.07
Klebsiella pneumoniae	0	1	
Total	2	8	

Table 5: Pathogens of infected cases among group A and group B

On comparing both the Groups with respect to pathogens, non significant results were obtained with p value=0.07.

Table 6: Comparison of post operative discharge among group A and group B				
Post op discharge	Group A	Group B	P value	
Present	2	8		
Absent	28	22	P=0.037	
Total	30	30		

n

On comparing the Post operative discharge among Group A and Group B, significant results were obtained with p value=0.037.

Table 7: Compar	rison of post	operative feve	r among grou	p A and group	) B
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Post Operative fever	Group A	Group B	P value
Present	1	5	
Absent	29	25	P=0.085
Total	30	30	

On comparing the post operative fever among Group A and Group B, non significant results were obtained with p value=0.085.

Tuble of Comparison of Post operative Would Status among group II and 2					
Post Operative wound status	Group A	Group B	P value		
Healthy	28	22			
Infected	2	8	P=0.037		
Total	30	30			

Table 8: Comparison of post operative wound status among group A and B

On comparing the post operative wound status among Group A and Group B, significant results were obtained with p value=0.037.

#### DISCUSSION

Postoperative spine infection can be a devastating complication after spine surgery in both the short term and long term. Infection places a patient at a high risk to pseudoarthrosis, chronic pain, adverse neurological sequelae and has worse long-term outcomes. There is a lower incidence of infection in a simple lumbar decompression or microdiscectomy ( $\sim 0.6\%$  to 3%) compared with an instrumented fusion (~6% to 18%).4

In the present study, mean age of the patients of Group A and Group B was 46.8 and 51 respectively. Comparable results were obtained while assessing the age wise distribution of patients. Our results were in concordance with the results of previous authors who also reported similar findings in their respective studies.6,7

In a study conducted by Sweet et al, mean age of the patients of group with local vancomycin and group without local vancomycin was 56 and 53 respectively.<sup>7</sup>

30 percent of the patients of Group A and 40 % of the patients of group B were females. Comparable results were obtained while assessing the gender wise distribution of patients. Our results were in concordance with the results of previous authors who also reported similar findings in their respective studies.6,7

In a study conducted by O'Neil et al,37 percent of patients of the group with local vancomycin and 35 percent of patients of group without local vancomycin were females while the remaining were males.<sup>6</sup>

In this study, patients who developed SSI's were mainly females .50 percent of females among Group A and seventy five percent of females among Group B developed SSI's. Comparable results were obtained while assessing the gender wise distribution of patients with SSI's. Our results were in concordance with the results of previous authors who also reported similar findings in their respective studies.<sup>7,8</sup>

In a study conducted by Strom et al. sixty seven percent of females among Group with local vancomycin powder and forty six percent of females among Group without local vancomycin powder developed SSI's.8

In the present study, most of the spine surgeries with metallic implant fixation belonged to dorsal and lumbar region. Three cases of cervical region, seven cases of dorsal region and twenty cases of lumbar region among Group A and Four cases of cervical region, nine cases of dorsal region and seventeen cases of lumbar region among Group B were operated who needed metallic implant fixation. Comparable results were obtained while assessing the spine level distribution of patients among Group A and Group B. Our results were in concordance with the results of previous authors who also reported similar findings in their respective studies.8,9

In a study conducted by Strom et al, most of the patients underwent lumbar laminectomy and posterior fusion.8

In the present study, out of total twenty patients with co morbidities, one patient among Group A and five patients among Group B developed SSI's. The co morbidities in patients were mainly diabetes mellitus,

hypertension. Comparable results were obtained while assessing the SSI's among patients with co morbidities. Our results were in concordance with the results of previous authors who also reported similar findings in their respective studies.<sup>10,11</sup>

In one study conducted by Molinari et al, it was found that at least one pre-exiting co-morbidity was present in patients who developed SSI's. <sup>10</sup>

In another study conducted by Abdullah et al, it was found that co morbidities like hypertension, obesity were present in patients having SSI's .<sup>5</sup>

Pathogens responsible for SSI's were as one case of MSSA, one case of MRSA among Group A while four cases of MSSA, three cases of MRSA and one case of K.pneumoniae among Group B. Appropriate antibiotics were started according to the causative pathogen found and assessment of post operative wound was done daily .Improvement in SSI's was noted after starting the appropriate antibiotics in most of the cases of SSI's but one case among Group A and 3 cases required further surgical debridement. During the surgical debridement, sample again collected and sent for pus culture sensitivity and appropriate antibiotic therapy was started and improvement of the post operative SSI's was noted. Our results were in concordance with the results of previous authors who also reported similar findings in their respective studies.10,7

In another study conducted by Sweet et al, Methicillin sensitive staphylococcus aureus and Methicillin resistant staphylococcus aureus were the commonly found pathogens in infected cases and similar further management was done for SSI's.<sup>7</sup>

In the present study, assessment of post operative wound was done by the two surgical experts who did not know about the intra operative wound therapy given to the patient for any post operative discharge and to check for post operative wound site whether clean or not. It was found that the post operative discharge and post operative wound site was infected in two cases(6.6%) among Group A patients and eight cases(26.6%) among group B patients. On comparing both the groups with respect to post operative discharge and post operative wound site status, significant results were obtained.

Post operative fever was seen in one patient among Group A and five cases of post operative fever were seen in patients of Group B. On comparing both the Groups with respect to post operative fever non significant results were obtained.

It was found that use of local vancomycin powder led to significant reduction in the occurrence of the post operative SSI's .Our results were in concordance with the results obtained by Evaniew et al.<sup>12</sup> who found the intra wound use of vancomycin in patients of spine surgeries with metallic implant fixation attractive because of the higher local concentration, less systemic antibiotic exposure and lower cost. Significant reduction in post operative SSI's were seen with the use of Intra wound vancomycin. Shan et al<sup>13</sup> have recently reported that that local application of vancomycin powder is an effective and safe method to prevent SSI after spinal surgeries and found significant differences between the vancomycin and control groups (non-vancomycin group) concerning the incidence of SSI.

The number of cases showing pathogens in pus and culture sensitivity report of patients who developed SSI's was less in Group A as compared to Group B.

Both the therapies, the one with combined use of local vancomycin powder and systemic antibiotics and one with use of only systemic antibiotics in patients with spine surgeries with metallic implant fixation were well tolerated and no serious adverse effects were found.

There is the need to conduct more studies in a large group of patients to see the efficacy of local vancomycin powder in patients with spine surgeries with metallic implant fixation.

#### CONCLUSION

Under the light of above obtained results, following conclusion were withdrawn:

There was significant reduction in surgical site infections observed in patients of spine surgeries with metallic implant fixation in whom combined therapy in the form of intra wound vancomycin powder along with systemic antibiotics was given.

Bacteriology analysis and risk factor assessment proved to be valuable tools in assessing the efficacy of a new prophylactic measure and in the planning of future protocols.

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