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## Efficacy of local vancomycin in preventing surgical site infections following spinal instrumentation

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### Abstract

**Background:** Surgical site infections is one of the frequently seen complication following instrumented spinal surgeries. Although numerous prophylactic measures have been tried out to prevent surgical site infections, it still remains a concern. Local use of powdered vancomycin is one of the newer method which is being tried all over the world to reduce the rates of infection.

**Materials and methods:** The study was conducted in our Institute in a prospective manner from January 2012 to June 2017. A total of 80 patients who underwent spinal instrumentation for various indications were included in the study. Patients were divided into two groups, first group a Control Group(CG) and second group- Vancomycin Group (VG). Both the groups comprised of 40 patients each. One gram of powdered vancomycin was impregnated below the fascial layer after completion of surgery in patients who belonged to Vancomycin Group.

**Results:** There found to be no statistical significant difference between the groups for the following variables: age, sex, operating time and blood loss. Infection rates in the two groups were compared. There were total 6 cases of infection. 5 out of 40 (12.5%) patients in the control group had either superficial or deep infections. While only one patient (2.5%) belonged to vancomycin group had infection, that too it was a superficial infection. There was a statistically significant reduction in the rate of infection in the vancomycin group on comparing with the control group when 'p' value was calculated, with a value of < 0.001.

**Conclusion:** Use of local powdered form of vancomycin following spinal instrumentation surgeries is an effective prophylactic method in reducing the rates of infection. However, further randomized double blind studies with larger sample size is needed.

**Keywords:** Vancomycin, spinal instrumentation, surgical site infection

### Introduction

Surgical site infections is one of the frequently seen complication following instrumented spinal surgeries<sup>[1]</sup>. They significantly increase the morbidity, duration of hospitalization and increase the health care costs<sup>[2]</sup>. The rate of infection following spinal surgeries without instrumentation ranges from 0.7 to 2.3%, the incidence of infection following instrumentation increases from 0.3 to 20% as reported in the literature<sup>[3-5]</sup>. Most common causative organism for surgical site infections is *Staphylococcus aureus*, followed by coagulase negative staphylococci<sup>[6, 7]</sup>. If it turns out to be methicillin-resistant strain, it will further worsen the management of these cases. It is the responsibility of the operating surgeon to take all measures to prevent the occurrence of infection following instrumentation. There are certain modifiable and non-modifiable risk factors that can increase the rate of infection. Common modifiable risk factors are increased operative time, increased blood loss, instrumentation, revision surgeries, glycemic status of the patient, cessation of smoking and reducing movements inside the operation theatre. Non modifiable risk factors are patients age, immunity status, a must instrumentation situation and obesity<sup>[8, 9]</sup>.

Surgeons all over the world have tried multiple measures to prevent the rates of infection following spinal instrumentation. Common among these are preoperative and intraoperative antibiotic prophylaxis, wound wash with detergent solutions and povidone-iodine solution before wound closure, low pressure irrigation using pulsed lavage system and recently use of local powdered antibiotics. Since most common organism causing surgical site infection is

*Staphylococcus aureus*, surgeons prefer using vancomycin in its powdered form following instrumented spinal surgeries. In our study we have used local vancomycin to reduce the rate of infection. The aim of this study is to evaluate the efficacy of local powdered form of vancomycin in reducing the rates of surgical sites of infection following spinal instrumentation surgeries.

### Materials and methods

The study was conducted in our Institute in a prospective manner from January 2012 to June 2017. A total of 80 patients who underwent spinal instrumentation for various indications were included in the study. Surgeries performed in cervical, thoracic and lumbar regions were included in the study. Surgeries were performed by multiple surgeons belonging to different units of the Institute. Patients were divided into two groups, first group a Control Group (CG) and second group- Vancomycin Group (VG). Patients were divided evenly into both the groups. Both the groups comprised of 40 patients each. Following is the list of various indications that were included in the study:

1. Fracture dislocations of cervical spine.
2. Compressive myelopathy of cervical spine
3. Fracture dislocations of thoracic spine
4. Fractres of Lumbar spine
5. Spondylolisthesis surgeries

Infective spondylodiscitis, revision spinal surgeries and paediatric spinal surgeries were excluded from the study.

All the spinal instrumentation were given universal antibiotic

prophylaxis with intravenous ceftriaxone plus sulbactam combination prior to surgery. One gram of powdered vancomycin was impregnated below the fascial layer after completion of surgery and thorough wound wash in patients who belonged to Vancomycin Group. Vancomycin was not used in patients who belonged to control group. Suction drain was not used in any of our cases. Instead compression bandaging was done. Post operatively intravenous antibiotics were used for a period of 48-72 hours, followed by oral antibiotics for another 5 days. Surgical site infections occurring up to period of 6 months were considered for the study, those occurring after 90 days were considered as late infections.

Patients were followed up regularly during hospitalization and also after discharge. During each wound inspection, assessment was done for signs of infection such as discharge from the wound, wound dehiscence with necrosis and fever. On suspicion of infection, it was confirmed by laboratory investigations, gram stain and culture reports. Both superficial and deep infections were included in the study. Once infection was confirmed, patients were treated with intravenous or oral antibiotics as per the severity of the infection. For all the patients diagnosed with surgical site infection, additional operations required, vacuum assisted wound closures and number of additional hospitalization days required were recorded. Then the rates of surgical site infections were compared between the two groups.

Distribution of different surgical procedures performed is as shown in Table 1.

**Table 1:** Distribution of different surgical procedures.

Serial No.	Type of surgical procedures	Total numbers
1	Fracture dislocations of cervical spine	10
2	Compressive myelopathy of cervical spine	8
3	Fracture dislocations of thoracic spine	20
4	Fractres of Lumbar spine	22
5	Spondylolisthesis	20

### Results and analysis

A total of 80 patients who underwent spinal instrumentation for various indications were included in the study, which was conducted in a prospective manner from January 2012 to June 2017. Patients were evenly distributed into control group and the vancomycin group, with 40 patients in each group. Mean age of the patients was 51.2 years, ranging from 27 to 68 years. 41 patients were males and 39 were females. Mean follow up period was 12 months ranging from 6 to 18 months. Mean operating time was 133 minutes and mean blood loss was 460ml. Diagnosis of infection was made either when patients were in hospital or during follow up. Both the groups were compared for statistically significant differences for the following variables: age, sex, operating time and blood loss. There found to be no statistical significant difference between

the groups (Table 2).

**Table 2:** Comparison of variables between two groups.

Parameter	Total	Vancomycin group	Control group	P value
Age (years)	51.2	50	52	0.081
Females	39	49%	53%	0.0137
Mean OT time	133 min	135 min	132 min	0.032
Amount of bleeding	460 ml	466 ml	458 ml	0.092
Infection	06	01	05	<0.001

Distribution of different surgical procedures between two groups is shown in Table 3.

**Table 3:** Distribution of different procedures in two groups

Surgical procedures	Control group (n-40)	Vancomycin group (n-40)
Fracture dislocations of cervical spine	06	04
Compressive myelopathy of cervical spine	04	04
Fracture dislocations of thoracic spine	09	11
Fractres of Lumbar spine	10	12
Spondylolisthesis	11	09

Infection rates in the two groups were compared. There were total 6 cases of infection. 5 out of 40 (12.5%) patients in the

control group had either superficial or deep infections. While only one patient (2.5%) belonged to vancomycin group had

infection, that too it was a superficial infection. Out of total six cases of infection, 4 were methicillin-resistant *Staphylococcus aureus*, 1 was methicillin-sensitive *Staphylococcus aureus* and 1 was klebsiella. Klebsiella was isolated from patient belonging to vancomycin group. There was a statistically significant reduction in the rate of infection in the vancomycin group on comparing with the control group when 'p' value was calculated, with a value of  $< 0.001$ .

One key factor noted in our study was that 4 of the 6 patients with infections had one or the other risk factors such as age  $> 60$  years, diabetes or smoking. This gives an indication of contribution of these factors towards infection following spinal instrumentation.

### Discussions

Surgical site infections following spinal surgeries is a dreaded complication that significantly increases the morbidity to the patient and also big headache for the operating surgeons to manage these patients. The rate of surgical site infections following spinal surgeries is 0.7 to 2.3% as per the literature. This rate significantly increases when instrumentation is done during spinal surgeries and it is 0.3 to 20% following instrumentation. Occurrence of infection following spinal instrumentation significantly increases the healthcare costs and patient morbidity, by fourfold approximately as per the literature [10]. Many a times, these cases may require removal of the instrumentation, thereby spoiling the very purpose of the surgery itself. In this prospective study we have made an attempt to study the role of Vancomycin in reducing the rates of surgical site infection following spinal instrumentation case.

Surgeons have tried multiple prophylactic methods to reduce the rates of surgical site infection following spinal surgeries. Universal preoperative antibiotic prophylaxis still remains a gold standard method all over the world. However it is not so effective method in reducing the rates of infection. Lonstein *et al* [11] showed that contamination of wound is an important cause for surgical site infections. The use of crystalloid solutions and povidone iodine, debridement of devitalized tissues, use of pulse lavage systems to give adequate wound wash at the end of procedure are few of the techniques commonly used worldwide to reduce the rates of post operative infections [12, 13]. However the level of evidence to support these studies in the literature is very low.

Numerous risk factors are known to increase the rates of infection following spinal surgeries. Few of the risk factors are patient related such as age, obesity, smoking, nutritional status and diabetes. Some other risk factors are surgeon and surgery related. They are operative time, amount of blood loss, number of levels of surgery, revision surgeries, aseptic measures taken and movements inside the theatre. It is the responsibility of the operating surgeons to minimize the risk factors such as reducing the glycemic status, cessation of smoking, improving the nutritional status of the patient, by reducing the operative time, minimizing the blood loss and reducing the movements inside the theatre. However, there is no proper literature support to prove that these risk factors increase the rates of infection or that infection rates are reduced by minimizing the risk factors.

The role of topical antibiotics in reducing the rates of infection is controversial. Maguire [13] demonstrated that the use of neomycin powder and found reduced infection rates. On the other hand Nachamie *et al* [15] studied the use of dilute neomycin and found the technique to be ineffective. To date, the literature remains unclear on the effectiveness of these

techniques. Use of suction drainage system has not been shown to reduce the rates of infection as per the literature [16].

Powdered form of antibiotics used intra operatively before the closure of wounds has been shown to reduce the rates of post operative infections [17]. It is theoretically known to achieve high levels of antibiotic concentration in the surgical wound. Vancomycin is the most commonly used powdered antibiotic for surgical wounds, because it is cheap, effective against methicillin resistant *Staphylococcus aureus*, has got very good diffusion and concentration properties when compared to other antibiotics.

O' Neil *et al* [18] and Sweet *et al* [19] showed that the use of powdered antibiotic before wound closures reduces the rate of surgical site infections significantly. However, these studies did not had a control group. Our study had a control group. We have tried to allocate equal distribution of different procedures in both the categories. There was a clear reduction in the rates of surgical site infections in the vancomycin used group when compared to control group. There were no systemic complications following the use of vancomycin in our study.

Limitations of this study was that it was not a randomized study, sample size was less, surgeries were not performed by a single surgeon which can be a cause for increased operative time and increased blood loss and also the results of reduced infection rates in the vancomycin group cannot be entirely attributed to the vancomycin in view of multiple modifiable and non-modifiable risk factors involved in the study.

### Conclusion

Surgical site infections are known to increase when instrumentation is used in spinal surgeries, incidence being 0.3 to 20%. Local application of Vancomycin is known to reduce the rates of surgical site infection. Hence we conducted a study on the efficacy of Vancomycin in reducing the surgical site infection in spinal instrumentation surgeries. Results of our study suggested a reduction in the rates of infection following the use of local powdered form of Vancomycin before wound closure. We conclude that use of local powdered form of Vancomycin following spinal instrumentation surgeries is an effective prophylactic method in reducing the rates of infection. However, further randomized double blind studies with larger sample size is needed to authoritatively confirm the efficacy of Vancomycin in reducing the surgical site infections.

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