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Topical vancomycin: Does it reduce surgical site infection in bone tumors?

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Abstract

Introduction: We retrospectively analyzed a consecutive group of patients operated for bone tumors of extremity and pelvis who received only perioperative antibiotics (Group A) against a similar group that had additional 1 g topical vancomycin sprinkled in the wound before closure (Group B). The aim was to determine if the addition of topical vancomycin decreases the incidence of deep surgical site infection (SSI). **Materials and Methods:** A total of 221 patients operated between January 2011 and December 2011 were analyzed in Group A and 254 patients operated between April 2012 and March 2013 were analyzed in Group B. Any patient who required operative intervention for wound discharge was considered to be infected. All patients had a 1 year follow-up to determine the incidence of SSI. **Results:** The overall rate of SSI was 7% (31 of 475 patients). Seventeen (8%) of Group A patients had SSI as against 14 (6 %) of Group B patients (P = 0.337). A subgroup analysis of endoprosthetic reconstructions, internal fixation implants (plates/intramedullary nails), extracorporeal radiation treated bones and strut allografts showed no difference between the two groups of patients. **Conclusion:** Our data suggest that the addition of topical vancomycin before wound closure in patients operated for bone tumors does not decrease the incidence of SSI. Further investigation of this technique using a case–controlled methodology with an increase in the dose of vancomycin may be warranted.

Key words: Antibiotics, endoprosthesis, surgical site infection, topical vancomycin

Introduction

The advances in neoadjuvant chemotherapy, modern surgical techniques, and affordable megaprosthesis have increased the number of complex surgeries we undertake in patients with bone tumors in recent times. Infection remains one of the major complications of these surgeries with literature documenting infection rates varying from 2.2% to 19.5%.[1] This is much higher when compared with the 2% infection rates in conventional joint replacement.[2] The higher infection rate in tumor surgeries can be attributed to their complexity, prolonged duration, extensive blood loss, use of megaprosthesis and allografts, and the immunocompromised status of patients receiving cytotoxic chemotherapeutic agents.[3] Surgical site infections (SSIs) often necessitate multiple surgeries and prolonged antibiotic treatment leading to increased morbidity and cost. An appropriate perioperative antibiotic regimen can play a vital role in reducing SSI, but there is little consensus regarding this when it comes to bone tumor surgeries. Current clinical practice is highly varied, with respect to antibiotic type, duration, and mode of administration.[1]

The presence of hematoma, edema, and ischemic tissue may reduce the efficacy of intravenous (i.v.) antibiotics by preventing access to the local site.[4] The use of topical antibiotics which enable high concentration at the local site with less systemic toxicity thus offers an attractive avenue to help reduce SSI.[5] Recent studies have shown that topical vancomycin reduces SSI in spinal surgeries.[6,7] The efficacy of similar topical vancomycin has not yet been studied in bone tumor surgeries. The aim of our study was to evaluate the efficacy of additional topical vancomycin in reducing SSI in bone tumor surgeries.

Materials and Methods

We compared the rates of deep surgical wound infection in two groups of consecutive patients operated for bone tumors of the extremity and pelvis. Information was collected from a prospectively maintained database and patient records. Patients who had evidence of infection at the surgical site or a previous history of infection at the surgical site and those who underwent an amputation were excluded from the study. Group A consisting of 236 patients operated between January 2011 and December 2011 had received only perioperative antibiotics as per our department protocol. Group B consisting of 276 patients operated between April 2012 and March 2013 received similar perioperative antibiotics along with additional topical vancomycin at the wound site before closure. Distribution based on the etiology in Group A and Group B are given in Table 1.

Our antibiotic protocol uses 1.5 g of i.v. cefuroxime 30 min before the incision (vancomycin was used if the patient was allergic to cephalosporins). An additional 1.5 g of cefuroxime infusion is started 45 min after the skin incision for 4 h. If a tourniquet is used, a repeat 1.5 g of cefuroxime bolus after deflation of tourniquet is given in lieu of the infusion. Postoperatively, 500 mg of oral cefuroxime is given twice daily till drain removal. The patients in Group B received an additional 1 g of vancomycin powder topically sprinkled over the wound before closure of the deep fascia after achieving hemostasis. The negative suction drain was kept closed for half an hour after wound closure to prevent the vancomycin from draining out.

As per the Centre for Disease Control and Prevention guidelines for deep SSI (infection occurring within 30 days after the operation if no implant is left in place or within 1 year if implant is in place) patients in both groups were followed up for 1 year to document SSI.[8] Any patient who required surgical intervention for a wound discharge was considered to be infected. Because the vancomycin powder was placed under the deep fascia, only the rate of deep surgical wound infection was analyzed.[9] Deep infection has been shown to be a more accurate parameter for research documentation.[9] In Group A, 12 patients were lost to follow-up and three patients died due to disease. Hence, 221 patients were available for analysis. In Group B, 21 patients were lost to follow-up and one patient died due to disease. Hence, 254 patients were available for analysis.

Ethics

The data of the present study were collected in the course of common clinical practice and, accordingly, the signed informed consent was obtained from each patient for any surgical and

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clinical procedure. The study protocol conforms to the ethical guidelines of the "World Medical Association Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects" adopted by the 18th WMA General Assembly, Helsinki, Finland, June 1964, as revised in Tokyo 2004. No approval of the institutional review committee was needed.

Statistical analysis

All statistical analyses were carried out with the IBM Statistical Package for the Social Sciences (SPSS) version 20, (United states of America). $P < 0.05$ was considered statistically significant.

Results

A total of 31 patients of the 475 (7%) patients available for analysis developed SSI [Table 2]. Sixteen (52%) of these patients developed an infection within 4 weeks of surgery. A subset analysis of the infection rate based on type of surgery [i.e., endoprosthetic reconstruction, use of internal fixation devices, extracorporeal irradiation and reimplantation, strut allograft is shown in Table 3].

Discussion

The rate of SSI following surgery for bone tumor varies from 2.2% to 19.5%.[1] In Hendersons' series, infection was found to be most common cause of failure of megaprosthesis accounting for 34% of cases.[10] SSI after bone tumor surgery can have disastrous consequences. Jeys *et al*. series of 1261 patients undergoing endoprosthestic replacement documented the risk of amputation being as high as 19% in patients with proven infection.[11]

Local administration of antibiotic at the surgical site before wound closure theoretically achieves high concentration at the local site with less systemic side effects. There is well-established evidence in general orthopedic literature supporting the local use of antibiotics in the form of antibiotic-coated implants and cement beads.[12] Local powdered vancomycin is inexpensive and has a broad coverage against typical organisms responsible for SSI. There are conflicting reports in literature regarding its efficacy in reducing SSI in spinal surgeries. Sweet demonstrated a 2.6% infection rate in posterior dorso-lumbar spine fusion surgeries done with only i.v cephalexin coverage when compared to 0.2% of infection in dorso-lumbar spine fusion surgeries treated with local vancomycin with i.v. cephalexin.[7] A recent meta-analysis also concluded that the local application of vancomycin in spinal injuries reduces SSI, deep incisional SSI, and *Staphylococcus aureus* SSI.[6] As against this, a prospective randomized study showed no significant reduction in infection rates with use of local vancomycin in spinal surgeries.[5] Martin too in his study failed to show a significant reduction in infection rate with the use of local vancomycin in spinal deformity correction surgeries.[13]

In our study, while the overall infection rate of 7% was comparable to other similar studies. We failed to demonstrate an improvement with the use of additional topical vancomycin (infection rate of 8% in Group A versus 6% in Group B with $P = 0.337$).[14-16] This also held true across all the subsets for individual types of surgeries [Table 2].

Although our study is the only study to analyze the effect of additional local vancomycin in SSI in bone tumor surgeries, it does have its limitations. It is a retrospective study which includes mixed etiologies. Our definition of infection included only wounds which required surgical intervention thus possibly missing out on infections which subsided with medical treatment alone. This is unlikely to be a major drawback as deep infection which was our parameter for comparison usually involves reoperation as a standard treatment.[9] We used 1 g of vancomycin powder, which may not be sufficient to prevent infection for these large incisions, and further studies are needed to evaluate whether an increased amount would be more beneficial.[13] The adjutant treatments (chemotherapy and radiotherapy) received between two groups was not significant. Other confounding variables which may contribute to postoperative infections, such as duration of surgery, blood loss, and other medical comorbidities were not evaluated.

In spite of these shortcomings, we feel that this study with relatively large numbers provides a springboard for similar prospective studies that aim to rationalize perioperative antibiotic usage in bone tumor surgeries with a view to reduce SSI.

Table 1: Distribution based on etiology in Group A and Group B

Diagnosis	Group A	Group B
Osteosarcoma	104	106
Ewing's sarcoma	22	39
Chondrosarcoma	19	19
Benign	72	84
Others	4	6

Table 2: Comparison between two groups

Site	Group A		Group B		*P*
	n	Number of infections (%)	*n*	Number of infections (%)	
Femur	102	8 (8)	112	5 (5)	0.301
Tibia	57	4 (7)	68	6 (9)	0.711
Pelvis	15	5 (33)	23	1 (4)	0.017
Fibula	6	0	6	0	0
Foot	0	0	1	1 (100)	0
Humerus	28	0	27	1 (4)	0.304
Forearm	1	0	5	0	0
Wrist + hand	12	0	12	0	0
Total	221	17 (8)	254	14 (6)	0.337

Table 3: Subset analysis

Subgroups	SSI (%)		*P*
	Group A	Group B	
Endoprosthetic reconstruction	9 of 97 (9)	7 of 99 (7)	0.573
Internal fixation	3 of 76 (4)	4 of 87 (5)	0.275
ECRT and strut allograft	1 of 14 (7)	2 of 14 (14)	0.185
Allograft	0 of 33 (0)	2 of 25 (8)	0.087

SSI=Surgical site infection, ECRT=Extra-corporeal radiotheray

Conclusion

While our data suggest that the addition of topical vancomycin prior to wound closure in patients operated for bone tumors does not decrease the incidence of SSI further investigation of this technique using a case–controlled methodology with an increase in vancomycin dose may be warranted.

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Conflicts of interest

There are no conflicts of interest.

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