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Intrawound application of vancomycin reduces wound infection after open release of post-traumatic stiff elbows: a retrospective comparative study

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Background: With the improvements in wound healing through the use of intravenous prophylactic antibiotics and technical refinements, postoperative elbow infections have become less common but still occur in certain elective elbow surgeries. The objective of this study was to evaluate the safety and efficacy of prophylactic application of vancomycin into the operative site to reduce the incidence of infection after the open release of post-traumatic stiff elbows.

Methods: A retrospective review of 272 such patients during a 4-year period was performed. In the control group (93 patients), simple prophylaxis with standard intravenous antibiotics was performed; in the vancomycin group (179 patients), vancomycin powder was applied directly into the wound before closure along with standard intravenous prophylaxis.

Results: After a follow-up of at least 6 months, the control group was found to have 6 infections (6.45%; confidence interval: 2.40%-13.52%) compared with none (0%; confidence interval: 0-2%.04%) in the vancomycin group, which was a statistically significant difference ($P = .0027$). No adverse effects were documented from the direct use of the vancomycin powder.

Conclusions: The local application of vancomycin powder may be a promising means of preventing postoperative elbow infections after elbow release in patients with post-traumatic elbow stiffness.

Level of evidence: Level III, Retrospective Cohort Design, Treatment Study.

Keywords: Post-traumatic stiff elbow; elbow stiffness; open release; wound infection; vancomycin; local application

Despite advances in the treatment of injuries around the elbow, approximately 12% of patients develop elbow stiffness, which is a common problem that can be associated with significant morbidity, posing a challenging dilemma for the surgeon, therapist, and patient.[6,25] A variety of nonoperative treatments have been described, and surgical arthrolysis may be indicated for those patients with

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persistent impairment of the functional range of motion despite adequate conservative treatment.[4,15,17,30,36]

Despite the prophylactic use of systemic antibiotics and improved surgical technique, surgical site infections remain a serious concern, especially in joint surgery.[1] Such infections have a profound impact on patients as they often require additional surgery and prolonged systemic administration of antibiotics; rehabilitation is delayed, surgical outcome is poor, and significant additional medical expense is incurred.[34] An open release of the post-traumatic stiff elbow with extensive dissection and arthrolysis often produces local hematoma or seroma that is inaccessible to systemically administered antibiotics, resulting in an increased potential for infection. A review of the literature suggests that the incidence of wound infection after surgical release of the stiff elbow is about 1.3% to 6.5%.[8,15,16,21,36]

Local delivery of antibiotics is attractive for wound infection prophylaxis because high concentrations are achieved directly at the wound site and systemic toxicity is limited.[11] Recent studies have examined the efficacy of intrawound application of vancomycin powder and have shown decreased infection rates with no adverse events in diverse populations.[2,5,9,26,35] To our knowledge, local application of vancomycin after operative release of the stiff elbow has not been reported. The purpose of this retrospective study was to evaluate the safety and efficacy of adding prophylactic vancomycin into the operative site during the open release of a post-traumatic stiff elbow as an adjuvant to standard intravenous (IV) prophylaxis.

Patients and methods

This is a retrospective case-control study of evaluating the safety and efficacy of prophylactic application of vancomycin into the operative site to reduce the incidence of infection after the open release of post-traumatic stiff elbows. We reviewed all patients undergoing open release of stiff elbows during a 4-year period from February 2009 through March 2013. All the operations were performed by a single surgeon (C.F.) at our institution. Inclusion criteria consisted of patients who had suffered from a stiff elbow after trauma and had undergone open release of the elbow combined with a hinged external fixator. Exclusion criteria included patients with a previous history of elbow infections, elbow stiffness due to nontraumatic causes (such as rheumatoid arthritis and burns), and postoperative follow-up time of less than 6 months. Baseline demographics, clinical characteristics, and operative details were obtained from the medical records. Patient demographics (age and sex), body mass index, hypertension, smoking history, steroid use, presence of diabetes, and original injury types were recorded. In addition, the details of surgical intervention were also noted for comparison.

Standard systemic antibiotic prophylaxis consisting of 1 g IV cefazolin within 1 hour before incision followed by 1 g IV cefazolin every 8 hours for 1 day was used for all patients. If the patient was allergic to penicillin, 900 mg IV clindamycin was administered instead. For children, the weight-based same prophylactic antibiotic was adopted. Patients who received preoperative systemic antibiotics alone were assigned to the control group, and those with additional wound application of 1 g of vancomycin powder intraoperatively were designated the vancomycin group.

All of the patients had a standard povidone-iodine (Betadine) preparation and were treated with similar surgical techniques as described in our previous reports.[18,19,28,29,33] All of the releases were performed by approaches that were based on the source of the elbow stiffness and previous surgeries. Arthrolysis was accompanied by reconstruction with anchors and radial head replacement as needed. Absorbable suture was used to close the fascia and subcutaneous layers; silk suture was used for skin closure. A hinged external fixator was used for 6 weeks in most of the patients based on the elbow stability for the assistance of postoperative rehabilitation. Double drains were kept in place for 2 to 4 days, depending on the drainage volume. Operative time, surgical approach, estimated blood loss, and materials used intraoperatively were obtained from the chart. In the vancomycin group, the powder was placed directly around the coronoid fossa anteriorly and olecranon fossa posteriorly before wound closure (Fig 1).

The primary outcome evaluated was the incidence of wound infection, but the incidence of pin site infection was excluded from the study. Superficial wound infections were identified by wound inspection, whereas deep infections were confirmed during exploration and débridement. Cultured organisms and subsequent treatments were recorded. Superficial infections were treated with local wound care and 5 to 7 days of oral antibiotics; deep infections were managed with serial surgical débridement, IV antibiotics, and consultation with infectious disease specialists.

Statistical analysis

A 2-tailed Fisher exact test was used to compare characteristics for categorical variables and a 2-tailed t test for normally distributed continuous variables. Fisher exact tests were also performed to evaluate differences in infection between groups, and 95% confidence intervals (CIs) were determined. All values were calculated as mean $\pm$ standard deviation unless otherwise noted. Statistical significance was considered at the 5% level.

Results

Between February 2009 and August 2010, 127 consecutive open releases of stiff elbows were performed; 110 met the inclusion criteria, and 93 were available for follow-up and review in the control group with an average follow-up of 14 months (range, 6-37 months). Starting in September 2010, 209 patients were treated routinely with adjunctive vancomycin powder applied to the local wound in addition to the IV antibiotics; 179 patients met the inclusion criteria as the vancomycin group with an average 13-month follow-up (range, 6-28 months). Overall, the 2 groups were statistically similar ($P > .05$) with regard to all patient parameters (Table I). The surgical approach, estimated blood loss, preoperative mean active range of motion, and materials used were statistically similar between the control group and the vancomycin group. The operative time was