

Efficacy of Prophylactic Antibiotics in Preventing Surgical Site Infection in Cases of Hand Injuries

Eficácia de antibióticos profiláticos na prevenção de infecção pós-operatória e infecção do sítio cirúrgico em casos de lesões na mão

Manjunath Kalapurmat¹ Durga Sowgandhi Chilikuri¹ Sunmathi Parasuramulu¹
Venkatesh Mysore Srinivasa¹

¹ Department of Plastic Surgery, Ramaiah Medical College, Ramaiah University of Applied Sciences, Bangalore, Karnataka, India

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Address for correspondence Manjunath Kalapurmat, MS, DNB, M.ch (Plastic surgery), Department of Plastic Surgery, Ramaiah Medical College, Ramaiah University of Applied Sciences, New BEL Road, MSR Nagar, Bangalore, 560054, Karnataka, India
(e-mail: drknmanjunath@gmail.com; manjunathkn.rmc@msruas.ac.in).

Abstract

Keywords

- ▶ antibiotic prophylaxis
- ▶ drug resistance, multiple
- ▶ hand injuries
- ▶ prostheses and implants
- ▶ surgical wound infection

Introduction Traumatic hand injuries are common in plastic surgery. Surgical site infections (SSIs) are the most common preventable complication following surgery, and the most common nosocomial infection. In the few studies that directly assess SSI in hand and wrist trauma, the risk ranges from 3 to 10%, rates similar to those reported for all operative procedures. But there are increasing concerns regarding the inadvertent use of antibiotics, as well as an increasing incidence of antibiotic resistance. The efficacy of prophylactic antibiotics in preventing infection is questionable. Hence, we have decided to conduct the present study.

Materials and Methods Patients admitted with hand injury between June 1st, 2022, and June 31st, 2024, were included. The patients who received prophylactic antibiotics (1 dose within 60 minutes of the incision) and those who did not were divided into 2 groups. In the follow-up records, we checked for signs of infection or for the evidence of SSI in both groups, and its statistical significance was analyzed.

Results Among the 216 patients with hand injuries analyzed, 116 received prophylactic antibiotics (group A) and 100 did not (group NA). A total of 1.7% of group A and 1% of group NA developed SSIs, but this was not statistically significant.

Conclusion In terms of demographics, younger people are disproportionately affected by hand injuries; however they present fewer comorbidities and high vascularity, which are advantageous for wound healing and resistance to SSI. The variables of the surgical procedures, such as the use of implants and surgery duration, have fewer implications for the incidence of postoperative SSI.

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Resumo

Palavras-chave

- profilaxia antibiótica
- resistência a múltiplos medicamentos
- traumatismos da mão
- próteses e implantes
- infecção da ferida cirúrgica

Introdução Lesões traumáticas nas mãos são comuns em cirurgia plástica. Infecções do sítio cirúrgico (ISCs) são a complicação evitável mais comum após a cirurgia e as infecções nosocomiais mais frequentes. Os poucos estudos que avaliaram diretamente as ISC em traumas de mão e punho relatam que o risco de seu desenvolvimento varia de 3% a 10%, taxa semelhante à de todos os procedimentos operatórios. No entanto, há preocupações crescentes quanto ao uso inadvertido de antibióticos e à crescente incidência de resistência a estes fármacos. Como a eficácia da profilaxia antibiótica na prevenção de infecções é questionável, realizamos este estudo.

Materiais e Métodos O estudo incluiu pacientes admitidos com lesão na mão entre 1º de junho de 2022 e 31 de junho de 2024. Os pacientes que receberam antibióticos profiláticos (1 dose nos primeiros 60 minutos após a incisão) e os que não receberam foram divididos em dois grupos. Nos registros do acompanhamento, verificamos os sinais de infecção ou evidência de ISC nos dois grupos, e sua significância estatística foi analisada.

Resultados Dos 216 pacientes com lesões nas mãos analisados, 116 receberam antibióticos profiláticos (grupo A), e 100 não receberam (grupo NA). A taxa de desenvolvimento de ISC foi de 1,7% no grupo A, e de 1% no grupo NA, sem diferenças estatisticamente significativas.

Conclusão Em termos de dados demográficos, jovens são desproporcionalmente mais afetados por lesões na mão; no entanto, eles apresentam menos comorbidades e alta vascularização, características vantajosas para a cicatrização de feridas e resistência às ISC. As variáveis relacionadas aos procedimentos cirúrgicos, como uso de implantes e duração da cirurgia, têm menos implicações na incidência de ISC pós-operatórias.

Introduction

Traumatic hand injuries are common in plastic surgery, and the procedures to treat them, as with all surgeries, carry a risk regarding the development of surgical site infection (SSI). The Centers for Disease Control and Prevention¹ (CDC) define SSI as an infection associated with an operative procedure that occurs at or near the surgical incision, within 30 days following the procedure or within 90 days if a prosthetic implant is used during surgery. These infections are the most common preventable complication following surgery and the most common nosocomial infection. The proper management of traumatic hand injury is crucial to prevent wound infection. Moreover, antibiotics in various forms are prescribed to avoid this complication. In the few studies that directly assess SSI in hand and wrist trauma, the risk ranges from 3 to 10%, rates similar to those reported for all operative procedures.² Previous studies³ on the risk of developing SSI have reported varying degrees of importance of pre- and perioperative factors, such as wound contamination, grade of vascular disruption, smoking status, presence of systemic illness, use of prophylactic antibiotics, and location of the procedure. The use of preoperative prophylactic antibiotics has been highlighted as a major factor in SSI prevention. But there are increasing concerns regarding the inadvertent use of antibiotics, as well as an increasing incidence of antibiotic resistance. Since younger people are

disproportionately affected by hand injuries and they present good vascularity in the hand, there are fewer chances of infection. Since the efficacy of prophylactic antibiotics in the prevention of postoperative infection is questionable, we have decided to conduct the present study to analyze their efficacy.

Objective

The objective of the current study is to determine the efficacy of prophylactic antibiotics in preventing postoperative infection or SSI in hand injuries patients.

Materials and Methods

We conducted a retrospective analysis of the hospital records of all patients with hand injury admitted between June 1st, 2022, till June 31st, 2024. The demographic profile and the comorbidities of the patients were analyzed. The wounds were classified as clean (closed), clean-contaminated (open) and contaminated (open and with significant soiling, including open fractures). The patients were divided into 2 groups: those who received prophylactic antibiotics (defined by the administration of 1 dose of antibiotics within 1 hour of the incision; group A) and those who did not (group NA). The follow-up records of all patients were checked for signs or evidence of infection (such as pus discharge, redness, pain,

increased temperature, and need of a secondary procedure) or SSI (as determined by the hospital Infection Committee). All patients received postoperative antibiotics as per the policy of the hospital Infection Committee. The statistical significance of the rates of postoperative infection and SSI in both groups were analyzed.

Statistical Analysis

Regarding the demographic profile of the patients, age, sex, side, and comorbidities were expressed as percentages. The rates of postoperative infection and SSI rates were also expressed as percentages, and their statistical significance was assessed through the paired *t* test. Statistical significance was set at $p < 0.05$.

Results

Of the 216 patients with hand injuries analyzed, 116 were allocated into group A, and 100, into group NA. Group A was composed of 79% of male and 21% of female subjects with ages ranging from 3 to 69 years; 86% of the wounds were clean-contaminated, 9%, contaminated, and 5%, clean. Right hand injury was found in 54.2% of the subjects, left hand injury, in 45%, and bilateral injury, in 0.8%. Comorbidities

such as diabetes and hypertension were found in 5% of the patients, and 95% did not present any comorbidity. Implants were used in 36% of the sample and not used in 64%. A total of 1.7% the patients developed SSI or postoperative infection, while 98.3% did not (►Table 1).

Group NA was composed of 87% of male and 13% of female patients with ages ranging from 4 to 73 years; 90% of the wounds were clean-contaminated, 7%, contaminated, and 3%, clean. Right hand injury was found in 52% of the subjects, left hand injury, in 47%, and bilateral injury, in 1%. Comorbidities such as diabetes and hypertension were found in 6% of the patients, and 94% did not present any comorbidity. Implants were used in 53% of the sample and not used in 47%. A total of 1% of the patients developed postoperative infection or SSI, while 99% did not (Table 1).

Discussion

The current guidelines of the National Institute for Health and Care Excellence⁴ (NICE) recommend the use of prophylactic antibiotics for certain types of surgery, such as clean surgery involving the placement of a prosthesis or implant, clean-contaminated surgery, contaminated surgery, and surgery on a dirty or infected wound. However, there are no specific guidelines for hand trauma, leading to a wide

Table 1 Demographic profile of the study sample

	Preoperative antibiotics: n (%)	No preoperative antibiotics: n (%)	
Patients	116 (64%)	100 (46%)	
Implants			
Yes	42 (36%)	53 (53%)	
No	74 (64%)	47 (47%)	
Comorbidities			
Yes	6 (05%)	6 (06%)	
No	110 (95%)	94 (94%)	
Infection			
Yes	2 (1.7%)	1 (1%)	<i>p-value > 0.05: not statistically significant.</i>
No	113 (98.3%)	99 (99%)	
Side			
Right	63 (54.3%)	52 (52%)	
Bilateral	1 (0.8%)	1 (01%)	
Left	52 (45%)	47 (47%)	
Age in years (range)	3–69	4–73	
Sex			
Male	92 (79%)	87(87%)	
Female	24 (21%)	13(13%)	
Wound type			
Clean	6 (5%)	7 (07%)	
Clean-contaminated	100 (86%)	90 (90%)	
Contaminated	10 (9%)	3 (03%)	

variation in antibiotic use in the clinical practice. The use of antibiotic prophylaxis in hand injuries is a controversial topic. Several studies have been conducted to evaluate the use of preoperative antibiotic prophylaxis in hand injuries; however, some⁵ have not found a significant treatment effect.

One of the main arguments against the routine use of antibiotic prophylaxis in hand injuries is the low overall infection rate. Studies⁶ have shown that the rate of infection in elective soft-tissue hand procedures is low, ranging from 0.3 to 1.5%. Various reasons are described as the cause of the low infection rate. Studies from different parts of the world have concluded that the duration of surgery is one of the important factors for SSI. Most hand surgeries are short procedures.^{7,8} Another major factor is the vascularity. The hand is known to be a very vascularized structure that is resistant to infection.⁹ Unlike in other regions of the body, even the timing of the procedure had little effect on the rates of postoperative infection or SSI in hand surgeries.

In economic terms, preoperative antibiotic administration has a major influence on the health care system. For instance, approximately 1 million adults are diagnosed with carpal tunnel syndrome annually, and 200 thousand to 500 thousand patients undergo operative treatment every year. When we assume that cefazolin costs about \$33.54 per administration, this gives us a total cost of \$6.7 to \$16.8 billion for this syndrome alone.¹⁰ One more important consideration regarding the use of antibiotic prophylaxis is the growing concern of antibiotic resistance. The World Health Organization has released a Global Action Plan¹¹ to improve awareness and understanding of antimicrobial resistance and optimize antimicrobial use in humans. Antibiotic use can contribute to antibiotic resistance, which leads to increased morbidity and mortality, as well as economic costs. Another factor is the adverse reaction associated with unnecessary antibiotic treatment. Sandrowski et al¹² reported a rate of adverse reactions to a single preoperative dose of antibiotics to be of 1.5%. Moreover, the potential complications associated with prophylactic antibiotic use, such as *Clostridium difficile* colitis and allergic reactions, are some of the reasons which outweigh the benefits in cases with such a low infection rate.¹³

The evidence supporting the role of antibiotics in hand trauma is mixed and further complicated by a lack of high-quality studies and by studies with small patient populations. Therefore, the aim of the present study was to estimate the efficacy of prophylactic antibiotics use in hand trauma and support the development of clear guidelines for evidence-based antibiotic use in trauma-related hand surgery. A meta-analysis¹⁴ published in 2016 showed no difference in the use of antibiotics in preventing SSIs in simple hand injuries. Studies assessing complex hand trauma,¹⁴ such as fractures and crush injuries, have presented mixed conclusions regarding antibiotic use. A systematic review¹⁵ published in 2017 found that the use of antibiotics was associated with lower odds of infection in open fractures of the hand. A double-blinded randomized controlled trial¹⁶ showed no significant difference in the incidence of SSIs in patients receiving antibiotics compared to a placebo.¹⁶

Another double-blinded randomized controlled trial also showed that antibiotics did not significantly affect the incidence of SSI in complex hand injuries.¹⁷

Li et al.⁷ conducted a retrospective database study of clean, soft-tissue hand surgeries and found a postoperative infection rate of 1.5% in patients who did not receive antibiotic prophylaxis, and of 1.4% in those who did. Lipira et al.¹⁸ conducted a retrospective database study on more than 10 thousand patients and found that the most common complication following hand surgery was SSI, with a rate of 1.2%. Tosti et al.¹⁹ reported an infection rate of 0.66% following elective soft-tissue hand procedures. Aydin et al.²⁰ performed a prospective randomized trial, including 1340 patients, on the use of antibiotics in hand surgery, and found no difference in postoperative infection rates irrespective of the administration of preoperative antibiotics. Backer et al.¹⁰ performed a multicentre trial from 2009 to 2012 comparing the use of preoperative antibiotics based on surgical facility, similar to the current; they found no statistically significant difference in infection rates whether preoperative antibiotics were administered or not among their 434 patients, with low infection rates, of 0.006% and 0.003% in the two groups respectively.¹⁰ In the present study, 1.7% of the patients who received prophylactic antibiotics developed postoperative SSI; however, 1% patients who did not receive them also developed SSI. This finding is similar to those of other studies as well. Interestingly, neither did the infection rates vary based on duration of surgery and preoperative wound contamination. In the current study, both groups presented a greater number of clean and contaminated wounds, and they also presented similar infection rates. Hence, one can conclude that the type of the wound has less bearing on postoperative wound infection irrespective of antibiotics status, especially in hand injuries.

All of the studies included in the present review show that there is no strong evidence to support the use of prophylaxis in cases of hand surgery for the repair of lacerations, clean hand injuries, small joint replacements, and complex hand trauma. Even the pinning of fractures may not require antibiotic prophylaxis. Despite the evidence against routine antibiotic prophylaxis in hand surgery, antibiotics are still administered preoperatively in a significant percentage of clean, elective hand procedures. It is advantageous that most of the patients of hand injuries are younger, with a low rate of associated comorbidities. Hence, the use of prophylactic antibiotics has fewer implications for the development of SSI.

Conclusion

Hand trauma is more observed in the younger population. Certain characteristics of this patient profile, such as good vascularity and fewer comorbidities, are advantageous for treatment purpose and result in lower rates of postoperative infection or SSI, which in turn, are not affected whether one dose of prophylactic antibiotic was administered or not. The variables of surgical procedures, such as the use of implants, the duration of surgery, and even the type of the wound, have considerably fewer implications for the incidence of postoperative infection or SSI. Thus, we can conclude that

prophylactic antibiotics have no role in preventing postoperative infection or SSI, especially in hand injuries.

Ethical Committee Approval

Study has been approved by the institutional ethics committee under number NO-MSRMC/EC/AP-02/03-24.

Authors' Contributions

MK: study conception and design, methodology, and writing – original draft; SC: study conception and design, data collection, and investigation; SR: study conception and design, analysis and/or interpretation of data, and writing – review & editing;; and VMS: study conception and design, and final approval of the manuscript.

Clinical Trials

None.

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Conflict of Interests

The authors have no conflict of interests to declare.

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