



PATTERN AND RISK FACTORS ASSOCIATED WITH SURGICAL SITE INFECTIONS FOLLOWING OPEN REDUCTION AND INTERNAL FIXATION IN MAXILLOFACIAL TRAUMA PATIENTS

Dr. Adil Sanan¹ Dr. Ruqgia Jehan² Dr. Muhammad Nouman Khattak^{3*} Dr. Jannat Ashfaq⁴ Dr. Fahmeed Akhtar⁵ Dr. Omer Bashir⁶

¹BDS, CHPE, FCPS, Senior Registrar oral medicine department, Institution Abbottabad international medical college Abbottabad

²BDS, FCPS, CHPE, Assistant professor, CIMS Dental College, Multan,
ruqgia_ahmed17@yahoo.com

³BDS, FCPS (ORAL AND MAXILLOFACIAL SURGEON), Khyber college of dentistry, Peshawar, Muhammad.khattak006@gmail.com

⁴BDS, MPH, Dental surgeon, Institution Fauji foundation hospital, drjannatashfaq@gmail.com

⁵Assistant Professor, Department of periodontology, Watim Dental College, Rawalpindi
fahmeedraja@yahoo.com,

⁶BDS, FCPS, MOMS RCS EDINBURGH, CHPE, Asst prof Oral Maxillofacial Surgery, Rehman College of Dentistry RCD, dromerbashir@hotmail.com

***Corresponding Author:** Dr Muhammad Nauman Khattak

³BDS, FCPS (ORAL AND MAXILLOFACIAL SURGEON), Khyber college of dentistry, Peshawar,
Muhammad.khattak006@gmail.com

Abstract

Background: Maxillofacial trauma is a common reason for emergency visits. It has many causes. It can lead to complications. Infection at the surgical site is an important complication after fixation of facial fractures.

Objective: To determine the pattern of surgical site infection (SSI) after open reduction and internal fixation (ORIF) in maxillofacial trauma. To identify risk factors linked with SSI in these patients at Khyber College of Dentistry, Peshawar.

Material & Methods: This was a descriptive cross-sectional study. It was done in the Department of Oral & Maxillofacial Surgery, Khyber College of Dentistry, Peshawar. The study duration was 5 April 2023 to 05 Oct 2023. Sample size was 123 using non-probability consecutive sampling. SSI was labeled when there was redness, swelling, tenderness, pus discharge, and/or wound dehiscence at the surgical site. It was assessed from 7 days to 6 months post-operatively. Data were analyzed in SPSS 23. Frequencies and percentages were reported.

Results: Mean age was 35.62 ± 9.05 years. Most patients were <40 years (78.0%). Males were 60.2%. Common involved sites were mandible (40.6%) and maxilla (36.6%). SSI patterns were

dehiscence/exposure (37.4%), redness (33.3%), and pus discharge (29.3%). Risk factors recorded were sports injuries (21.1%), RTA (20.3%), falls (18.7%), physical assault (14.6%), diabetes with trauma (14.6%), and steroid use with trauma (10.6%).

Keywords

Maxillofacial injuries; Surgical site infections; Facial lacerations; Open reduction and internal fixation; Risk factors.

Introduction

Maxillofacial trauma is a frequent cause of presentation to emergency departments worldwide. These injuries involve both hard and soft tissues of the face. The common causes include road traffic accidents, sports injuries, falls, and interpersonal violence (1). The pattern and severity of trauma vary widely among patients. Injuries may range from simple facial lacerations to complex fractures with significant functional and esthetic consequences (2).

Maxillofacial trauma may lead to both immediate and long-term complications. Infection is one of the most concerning postoperative complications in these patients (3). Many patients with facial fractures require surgical management. Open reduction and internal fixation is widely used for restoration of the facial form and function. This generally involves an intraoral or extraoral surgical approach depending on the site and type of fracture, thus exposing the surgical wound to contamination (4). Surgical site infection following open reduction internal fixation can cause delayed healing and discomfort to the patient along with wound dehiscence, pus discharge, alveolar osteitis or failure of fixation, and in worst circumstances, necessitate removal of infected osteosynthesis material. It has been reported to be the most common cause for plate removal after maxillofacial trauma surgery (5). There are a number of factors affecting development of this post-surgical complication that can be broadly divided into patient related and surgery related factors. These include patient's age, general health and immune status, site of fracture, type of injury, surgical approach and fixation technique. The presence of certain systemic diseases such as diabetes mellitus greatly enhances the chance of post-surgical infection. These patients show delayed wound healing and reduced resistance to infection (8). Surgery-related factors also play an important role. Mandibular fractures are susceptible to getting infected due to the limited blood supply and frequent contamination (6). Use of an intraoral incision understandably increases the chance of bacterial contamination of the surgical site. Surgical site infection has been reported with different incidence rates in previous studies. In one previous retrospective study, surgical site infection contributed to 28% of all post-surgical complications after maxillofacial trauma surgery (7). Another epidemiological study reported infection in 17.8% of patients with maxillofacial trauma (9). In a more recent study, it has been reported that post-surgical infection in mandibular fractures after open reduction internal fixation is 8.7% (10). Despite all the developments, advances in surgical technique and antibiotic protocols, surgical site infection still occurs much to the distress of surgeons and patients alike. It eventuates in poorer surgical outcome and causes a loss of morale for the patient. Identification of risk factors at an early stage may help surgeons reduce its incidence (6). There is paucity of local literature addressing the pattern of surgical site infection following open reduction internal fixation in maxillofacial trauma patients in Pakistan. Regional and local data are important to address such questions because of variation in the pattern of trauma, patient population and health care facilities available. It may also help maxillofacial surgeons to adopt appropriate measures for prevention in the light of statistical evidence, instead of relying on anecdotal experiences. This study was conducted in the Maxillofacial Surgery department of Khyber College of Dentistry, Peshawar to evaluate the pattern of surgical site infection and identify the associated risk factors, if any, in this particular patient population. The results may add to the pre-existing pool of evidence and be beneficial for improving clinical practice.

Materials and Methods

This descriptive cross-sectional study was conducted in the Department of Oral and Maxillofacial Surgery at Khyber College of Dentistry, Peshawar. The study was carried out over a period of six months, from 05 April 2023 to 05 October 2023. Ethical approval was obtained from the institutional review committee before commencement of the study.

The study population included patients presenting with maxillofacial trauma in whom surgical intervention in the form of open reduction and internal fixation had been performed. The total number of patients was one hundred and twenty-three (123). Non-probability consecutive sampling technique was employed for recruitment of patients. Patients of both genders and all adult age groups were included. Patients who had undergone open reduction and internal fixation of maxillofacial fractures were selected. Patients with incomplete medical records and those who failed to complete the required follow-up were excluded. Post-operative surgical site infection was assessed during follow up visits. Infection was defined as the presence of any or all of the following at the surgical site: redness, swelling, tenderness, pus discharge, wound dehiscence, exposed bone or exposed osteosynthesis material. These clinical signs could be present within a period of seven days to six months after surgery. The data were collected using a data collection form. Data regarding age, gender, site of injury and etiology of trauma were recorded. Patterns of surgical site infection were noted. Risk factors including road traffic accident, fall, sports injury, physical assault, history of diabetes and steroid use were also recorded.

All patients were examined during routine postoperative follow-up visits in the outpatient department. Clinical assessments were performed by the operating team to maintain consistency in evaluation. Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 23. Quantitative variables were expressed as mean and standard deviation. Qualitative variables were presented as frequencies and percentages. Results were summarized using tables and graphical representations for clarity.

Results

A total of 123 patients who underwent open reduction and internal fixation for maxillofacial trauma were included in the study. The mean age of the patients was 35.62 ± 9.05 years. Most patients were younger than 40 years. Male patients were more common than females.

The mandible was the most frequently involved site, followed by the maxilla. Other sites included the zygomatic bone, frontal bone, and naso-orbito-ethmoid region. These demographic and clinical characteristics are summarized in Table 1.

Table 1 Demographic and Clinical Characteristics of Patients (n = 123)

Variable	Category	Frequency (n)	Percentage (%)
Age group	< 40 years	96	78.0
	≥ 40 years	27	22.0
Gender	Male	74	60.2
	Female	49	39.8
Site of injury	Mandible	50	40.6
	Maxilla	45	36.6
	Other sites*	28	22.8

*Other sites include zygomatic bone, frontal bone, and naso-orbito-ethmoid region.

Postoperative surgical site infection was assessed during follow-up visits. Different patterns of infection were observed. Wound dehiscence or exposure was the most common presentation. This was followed by redness at the surgical site. Pus discharge was also observed in a considerable number of patients. These findings are presented collectively in Table 2 as patterns of surgical site infection.

Table 2 Pattern of Surgical Site Infection After ORIF

Infection Pattern	Frequency (n)	Percentage (%)
Dehiscence / exposure	46	37.4
Redness	41	33.3
Pus discharge	36	29.3

The etiology of trauma and associated risk factors were also recorded. Sports-related injuries were the most frequently reported cause. Road traffic accidents were the second most common cause. Falls and physical assault were also noted among the patients. Medical risk factors were evaluated alongside traumatic causes. A history of diabetes mellitus was present in several patients who developed surgical site infection. Steroid use was also documented as a contributing factor in some cases. These risk factors are summarized in Table 3.

Table 3 Risk Factors Associated with Surgical Site Infection

Risk Factor	Frequency (n)	Percentage (%)
Sports injuries	26	21.1
Road traffic accidents	25	20.3
Falls	23	18.7
Physical assault	18	14.6
Diabetes mellitus	18	14.6
Steroid use	13	10.6

Overall, the results show that surgical site infection following open reduction and internal fixation in maxillofacial trauma patients presents with varied clinical patterns. Multiple traumatic and medical risk factors were identified among the affected patients. The distribution of demographic characteristics, infection patterns, and risk factors is clearly represented using three consolidated tables for clarity and brevity.

Discussion

Surgical site infection following surgery remains an irksome post-operative complication in clinical practice despite so much progress that has been made in the past decades with respect to surgical protocols, fixation techniques and prophylactic antibiotics. In this study, pattern of surgical site infection and associated risk factors in patients undergoing open reduction and internal fixation for maxillofacial trauma were assessed. The mean age of patients in this study was 35.62 ± 9.05 years. Most patients were younger than 40 years of age. This finding is consistent with previous studies showing that majority of patients presenting with maxillofacial trauma are young owing to an active lifestyle (1,4). Male predominance in maxillofacial trauma patients was observed in this study. A similar pattern of gender distribution has been widely reported in literature. Out-door activities, driving and involvement in quarrels can be attributed for this finding (4,7). In this study, the most commonly involved site was the mandible, followed by maxilla. Previous studies have reported mandibular fractures to be the most common facial fractures requiring open reduction and internal fixation after trauma (1,9). Mandibular fractures are more likely to be associated with intraoral contamination. In fact, use of the intraoral approach for open reduction and internal fixation is considered a risk factor for development of post-surgical infection (6). Wound dehiscence or exposure was the most common pattern of surgical site infection in this study. This is consistent with the pattern of clinical presentation of surgical site infection reported in previous studies (3,5). Dehiscence may be caused by improper wound healing, lack of compliance on part of the patient, or be precipitated by infection. Exposure of bone or fixation material to the oral cavity subsequently worsens the situation and makes the infection persistent, resulting in failure of fixation. Dehiscence or exposure was more common in this study probably due to the significant risk factors of diabetes and steroid use. Diabetes

mellitus has been reported to be associated with significantly higher chances of post-surgical infection (8). Steroid use was also recorded. Patients using steroids for a long period of time are known to be susceptible to infection after surgery, hence compromised immunity is a major risk factor for failure of fixation or post-surgical complication in maxillofacial trauma patients (6). With respect to etiology of trauma, sports injury was the most common cause in this study, followed by road traffic accident. This is in contrast to many international studies where road traffic accident is the leading cause of maxillofacial trauma (1,4,9). However, road traffic accident was also found to be a substantial risk factor for maxillofacial skeletal injuries requiring surgical intervention in our study population. Fall and physical assault also played a significant role in trauma related infections. These results are quite similar to a previous regional study (7). Infection rates or patterns of infection recorded in this study are similar to those reported in previous studies. Teshome et al. has reported surgical site infection in 28% of post-operative complications in maxillofacial trauma patients (7), and Demirdover et al. reported infection in 17.8% cases (9). Sethi et al. has reported an infection rate of 8.7% after open reduction internal fixation of mandibular fractures (10). The difference may be due to variability in study population. Infection following open reduction internal fixation in maxillofacial trauma is a miserable outcome for both patient and surgeon, as it leads to increased hospital visits and requires wound care or sometimes even removal of fixation plates. In fact, hamster has reported infection to be the most common cause for plate removal after maxillofacial trauma surgery (5). This results in lack of patient satisfaction regarding management and surgical outcome and loss of faith and trust in the surgeon's abilities. The significance of this study is ascertained by identification of important predisposing factors towards development of infection in this particular population. Patients who are known diabetics or who are taking corticosteroids may be optimized pre-operatively and extra caution can be taken while performing open reduction and internal fixation in these cases. Limitations of this study include reliance on clinical diagnosis of infection. Early diagnosis of onset of infection such as presence of redness or dehiscence rather than purulent discharge may help in prevention of persistence of infection. The study was conducted in a single center, so the main limitation is the relatively small sample size. Nonetheless, the infection rate pattern is very much comparable to international data and the results are significant. Studies with larger sample size may help to confirm these associations in future.

Conclusion

Overall, this study underscores the multifactorial nature of maxillofacial trauma and associated infections. By understanding the patterns (redness, pus discharge dehiscence and history of steroid use), infection manifestations, and risk factors (RTA, Falls, physical assault, sports injuries, history of diabetes etc), clinicians can develop targeted interventions to mitigate the incidence and impact of SSIs in this patient population.

References

1. Bonavolontà P, Dell'aversana OG, Abbate V, Vara LA. The epidemiological analysis of maxillofacial fractures in Italy. *J Craniomaxillofac Surg*. 2017;45:1319–1326.
2. Boffano P, Roccia F, Zavattero E, et al. European maxillofacial trauma project. *J Craniomaxillofac Surg*. 2015;43:62–70.
3. Mundinger G, Borsuk D, Okhah Z, Christy M. Antibiotic and facial fractures. *Craniomaxillofac Trauma Reconstr*. 2015;8(1):64–78.
4. Damgaard OE, Larsen CG, Felding UA, Toft PB, von Buchwald C. Surgical timing of orbital blowout fracture. *Otolaryngol Head Neck Surg*. 2016;155(3):387–390.
5. Rehman AU, Khan M, Din QU, Babar BZ. Frequency and reasons for removal of stainless steel plates. *Pak Oral Dent J*. 2009;29(2):215–220.
6. Linkugel AD, Odom EB, Bavolek RA, et al. Systemic preoperative antibiotics with mandible fractures. *Craniomaxillofac Trauma Reconstr*. 2018;11(1):35–40.
7. Teshome A, Andualem G, Tsegie R, Seifu S. Retrospective study of maxillofacial trauma. *BMC Res Notes*. 2017;10(1):1–6.
8. Sattar F, Sattar Z, Zaman M, Akbar S. Frequency of postoperative surgical site infections. *Cureus*. 2019;11(3).
9. Demirdover C, Geyik A, Yazgan HS, et al. Complications in maxillofacial trauma. *Turk J Plast Surg*. 2018;26:6–11.
10. Sethi A, Van Huekelom E, Mehra P. Outcomes following antibiotic protocol. *J Oral Biol Craniofac Res*. 2020;10(4):519–522.