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Alveolar Osteitis of Right Third Molar - A Cross-Sectional Study

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Abstract: ***Alveolar osteitis is the most common early complication for dental extraction. The etiology of alveolar osteitis is complex and multifactorial. It is a painful self-limiting local condition. This cross-sectional study aims to measure the prevalence and associated factors of alveolar osteitis after extraction of the right third mandibular molar in the dental clinics at the Royal Medical Services of Jordan. A total of 513 adult patients between the age of 20 and 50 years participated in this observational study. The overall prevalence of alveolar osteitis was 15% among all study participants. Surgical extraction had a significantly lower prevalence of alveolar osteitis compared with simple extraction, 2% and 28%, respectively, (p-value < 0.001). These findings revealed a high prevalence of alveolar osteitis between Jordanian patients even after the exclusion of tobacco smokers. Therefore, these findings could be used in the guidance of informed consent by explaining this possible frequent complication and its cost and quality of life impact. Encouraging surgical extraction by experienced surgeons could decrease the prevalence of alveolar osteitis. Further interventional research is needed to explore the possible effects of surgical extraction on preventing alveolar osteitis.***

Keywords: Alveolar Osteitis, Dry Socket, Extraction, Prevalence, The Royal Medical Services of Jordan.

1. Introduction

Alveolar osteitis is the most common early complication for dental extraction [1]. Unfortunately, many dentists started to think of it as an unavoidable local complication [2]. The first description of alveolar osteitis goes back to the nineteenth century by an American scientist called James Young Crawford [3]. Dentist could refer to alveolar osteitis by several other names such as dry socket, necrotic socket, alveolitis sicca dolorosa, or localized osteomyelitis [1], [4]. Blum wrote the first standardized clinical description of the term 'alveolar osteitis' in 2002. Blum defines alveolar osteitis as a pain in and around the dental extraction site, which usually increases in severity several days post-extraction, it is associated with a degenerated blood clot within the dental alveolar socket, and halitosis could be present along with the pain, or absent [3], [5].

The prevalence of alveolar osteitis varies tremendously in published articles, ranging between 0 and 68% [3]. However, the most common prevalence of alveolar osteitis is between 2 and 4% for all extraction types [2]. It is more common in mandibular molars compared to the maxillary molars, and the third mandibular molars have a ten times higher risk to develop a alveolar osteitis complication compared with other teeth [3], [6], [7].

This study aims to measure the prevalence of alveolar osteitis after extraction of the right third mandibular molar in the dental clinics at the Royal Medical Services of Jordan and it aims to identify associated factors with alveolar osteitis between Jordanian patients.

2. Literature Survey

Several etiological factors for alveolar osteitis were reported in scientific literature. The etiological factors could be classified as vascular or bacteriological factors [4]. Bowe et al. reported the theory of fibrinolysis, which indicates that the plasminogen is converted to plasmin and that prevents fibrin cross formation and leads to clot dissolution [5]. Additionally, Nusair & Younis reported defects in granulation formation and disruption in vascular supply as etiological factors for alveolar osteitis [8]. On the other hand, several articles reported bacteriological factors such as the presence of certain Pseudomonas species or the presence of anaerobic Treponema denticola bacteria as causative factors for alveolar osteitis [9].

Furthermore, enzymatic defects or defects in immune response, herpes simplex infection, and lack of appropriate leukocytes response were all reported etiological factors for alveolar osteitis [10]–[12]. Also, trauma-induced inflammation cascade and the release of localized tissue activation inflammatory factors could be linked with the etiology of alveolar osteitis [1]. In general, there is a consensus between researchers that the etiology of alveolar osteitis is complex and multifactorial in nature [13].

Clinical presentation of alveolar osteitis usually starts with immediate relief of pain after extraction, followed onset of sever continuous throbbing pain on second or third postoperative day [8]. The pain could be localized, or it could radiate to the ear, neck and temporal area. Pain threshold varies between patients but it is common to see negative nutritional and sleeping effects of the pain and sometimes it cannot be controlled even with the use of most potent painkillers [10], [14]. Halitosis, as a result of food fermentation in the empty socket, is another common presentation of alveolar osteitis in addition to exposed tender bone or bone tissue covered with yellow-grayish necrotic tissue, empty socket, red edematous gingiva around the extraction site, and regional lymphadenopathy [5], [10]. It is quite uncommon to have patients with alveolar osteitis complaining of systematic manifestation such as fever, paresthesia or generalized headache [11], [14]. However, around 60% of alveolar osteitis patients complain of multiple symptoms. Nevertheless, pain is the main and chief

complaint [2].

Previous research articles have identified several common risk factors for alveolar osteitis. The most common were tobacco products smoking, female gender, poor oral hygiene, and traumatic or difficult molar extraction [1]. Besides, having a history of surgical site infection, preexisting local infection, and inadequate intraoperative irrigation of the surgical site were also common contributing factors for the development of alveolar osteitis [1], [9, p. 1]. Additionally, Khan reported poor compliance with postoperative instructions, inexperienced surgeon, and the use of contraceptives as risk factors for alveolar osteitis [1], while Daly et al. reported systematic diseases such as diabetes mellitus, increased age, and the use of local anesthesia with vasoconstrictors as risk factors for alveolar osteitis [8], [14]. Moreover, other rare risk factors were reported in the literature such us the use of mental health medications, the month of the year when the extraction is conducted, the day of the menstrual cycle, dominant hand of the extractor (the dentist), alcohol consumption, and vitamin deficiencies [2], [4], [11].

This study aims to find the specific risk factors for the development of alveolar osteitis complications after the right third molar extraction. By sharing these potential risk factors with the patient, the dentist and maxillofacial surgeons will help their patients become more informed about their clinical condition and possible dental care complications. Therefore, patients will be better informed before consenting for the procedure and certain risk factors could possibly be controlled, such as avoiding cigarette smoking 48 hours before the surgery and 24 hours after the surgery [5], [6]. Similarly, a Nigerian study reported a reduction in the incidence of alveolar osteitis when the procedure was performed on women between the first day to the twenty-second day after their menstrual cycle [5]. However, the evidence for implying these prevention measures is still weak.

3. Methods

This study was approved by the ethical committee at the Royal Medical Services of Jordan. All study participants provided voluntary verbal consent, and study protocols were in accordance to the Helsinki declaration of clinical research involving human participants. A convenient sample was selected from dental patients at the Royal Medical Services of Jordan. All adult patients between 20 and 50 years old with planned right third mandibular extraction at the dental clinics were eligible for inclusion in this study. Exclusion criteria were current smokers, periapical infection at the extraction site, history of using anti-inflammatory medications at the extraction day, history of fracture at the extraction site, or patients with cystic lesions.

Data were collected on paper forms. Primary investigators developed the study questionnaire based on previous studies (Table 1). The questionnaire included demographic questions (gender and age), a question about the type of extraction (surgical or simple extraction), and a question about the development of alveolar osteitis post-extraction. All patients were asked to come back for a checkup visit within a week post-extraction. Study investigators filled out the questionnaire for all participants. Data were collected between January and June 2020.

Table 1: Study questionnaire

Patient number	
Gender	Male
	Female
Age	20 – 29
	30 – 39
	40 – 49
Type of mandibular third molar extraction	Simple extraction
	Surgical extraction
Alveolar osteitis	Yes
	No

Alveolar osteitis was defined according to Blum's definition. Surgical extraction was defined as a dental extraction that included the reflection of a mucoperiosteal flap of mandibular third molar, which might or might not involve bone removal while a simple extraction was defined as a separation of root or simple elevation without the use of mucoperiosteal flap.

All collected data was entered into an excel sheet (Microsoft Excel®). After data cleaning, the data were imported to SPSS (IBM SPSS® software 'Statistical Package for the Social Sciences' version number 25). Study variables were analyzed using bivariate analysis. Pearson's chi-square ($\chi 2$) statistical test was used for data analysis and a p-value less than 0.05 was considered statistically significant.

4. Results & Discussion

Five hundred and thirteen patients agreed to participate in this study and came back for the checkup visit after the third mandibular molar extraction. Half of the participants were female patients. Patients were almost equally divided between simple and surgical extraction method.

The overall prevalence of alveolar osteitis was 15.2% between all study participants. Seventy-eight patients out of 513 developed this local complication. Table 2 describes the characteristics of study participants according to their alveolar osteitis status. Although female patients had a higher prevalence of alveolar osteitis compared to male patients, 17.4% and 13.0%, respectively, this deference was not statistically significant (p-value 0.167). Similarly, the older age group (40 – 49 years old) had the highest prevalence of alveolar osteitis (18.8%) but this difference was not statistically significant. On the other hand, patients who had simple third mandibular molar extraction had a prevalence of 27.9% compared to 2.4% between patients who had surgical extraction and this difference was statistically significant (p-value < 0.001).

Table 2: Study participants' characteristics according to their alveolar osteitis status

Variable		Total no. of extractions	No of alveolar osteitis (%)	p-value
Gender	Male	254	33 (13.0)	0.167
	Female	259	45 (17.4)	
Age	20 – 29	186	27 (14.5)	0.227

	30 – 39	157	19 (12.1)	
	40 - 49	170	32 (18.8)	
Type of extraction	Simple	258	72 (27.9)	< 0.001
	Surgical	255	6 (2.4)	

The prevalence of alveolar osteitis between our study participants was higher than the finding of a previous Jordanian study that identified an overall prevalence of 8% for all mandibular extraction [8]. However, the scope of this study was only the right third mandibular molar extraction, and this could explain the difference in prevalence. On the other hand, similar to this study findings Fridrich & Olson and Larsen articles reported a 20 to 30% prevalence range after third mandibular extraction [10], [15]. Furthermore, a 2017 cross-sectional study in Pakistan identified a 40% prevalence of alveolar osteitis after mandibular third molar extraction [1]. These differences in prevalence could be explained by research methodology differences and by the inconstancy in alveolar osteitis definition.

According to this study findings, female gender was not a risk factor for alveolar osteitis. This is in agreement with Halabí et al. [11]. However, the literature is full with studies that reported the female gender as a risk factor for alveolar osteitis. For example, Qadus et al. and Lilly et al. reported a higher prevalence between female patients on a ratio 3 to 2 and they linked this gender difference with hormonal causes and with oral contraceptives effects [4], [8], [16]. One possible explanation for not identifying female gender as a contributing factor for alveolar osteitis in this study is due to the lower oral contraceptive utilization in Jordan compared with other countries [17].

The age group was also not a risk factor for alveolar osteitis between study participants. This is inconsistent with the 2019 study in Oman, which identified 30 to 39 age group as a risk factor for alveolar osteitis [18]. Reports regarding age as a risk factor are inconsistent and several other research studies failed to find the age as a significant factor [10], [15].

The only significant factor that was associated with alveolar osteitis in current study was the simple removal of right third mandibular molar. This significant finding could be explained by trauma-induced during the simple removal, which could increase the release of local tissue activators or could be explained by dentist experience [1], [4]. At the dental clinics of the Royal Medical Services, it is a protocol that only experienced and highly qualified dentist are allowed to perform surgical removal of the third mandibular molars. This standardized procedure might have contributed to minimizing the trauma during third molar extraction and thus reducing the prevalence of alveolar osteitis [13]. The positive effect of the dentist or maxillofacial surgeon experience on decreasing the alveolar osteitis was also reported by Bowe et al., Larsen, and Qadus et al. [4], [5], [15].

Several management methods for alveolar osteitis were described in the literature [13]. The general theme of recent management guidelines is patient reassurance because this is a self-limited condition [5]. Aggressive pain management approach was recommended [14]. In addition, randomized control trials and meta-analysis results have revealed encouraging evidence for the use of chlorhexidine of any concertation as local management for alveolar osteitis but the benefit of chlorhexidine needs to be balanced with the possible effect of a hypersensitivity reaction [3], [6], [19]. Although the use of local or systematic antibiotics to treat or prevent alveolar osteitis was prevalent in the past, recent guidelines discourage this practice to avoid the development of resistant organisms and thus harming the patient for a self-limiting condition [9], [20]–[22]. Finally, scheduling frequent follow-up visits with socket irrigation and local packing were all part of recent management guidelines for alveolar osteitis [1], [5], [14].

The convenient sample methodology limits the generalization of current study findings. However, using a standardized definition for alveolar osteitis and controlling the effect of smoking are two important strengths points for this study.

5. Conclusion

Alveolar osteitis is a common complication for right third mandibular molar extraction. It increases dental care expenses and leads to patient loss of productivity due to the tremendous amount of pain. The findings of this study showed a high prevalence of alveolar osteitis between Jordanian patients, even after the exclusion of tobacco smokers. Therefore, these findings could be used to improve informed consent by explaining the possible frequent complications of right third mandibular extraction and its impact on the quality of life. Encouraging surgical extraction by experienced surgeons could decrease the prevalence of alveolar osteitis. However, further interventional research is needed to explore the effects of surgical extraction on preventing alveolar osteitis.

6. Future Scope

Recent studies have revealed interesting findings regarding prevention and management of alveolar osteitis. For example, a 2020 study in United Arab Emeritus have shown positive effects for a low-level laser intervention [23]. On the other hand, also low tech, low cost, and simple intervention such as pre-operative oral rising with chlorhexidine might also element the pathological microorganisms and prevent alveolar osteitis [6]. Therefore, researchers are encouraged to study the effects of these innovative prevention methods especially in developing countries were poor oral hygiene is fairly common [24], [25]. Although it is widely perceived that alveolar osteitis is an inevitable complication, yet minimizing the local trauma, proper prevention measures, and educating the patient could decrease the incidence of this painful self-limiting condition.

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