The role of prophylactic antibiotics in compound facial fractures treated by closed and open reduction

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ABSTRACT

Background: The role of prophylactic antibiotics remains controversial. It is clear that actively facial fractures are considered as clean contaminated and should be treated with therapeutic antibiotics; however, there is widespread variability in the use, type, timing, and duration of prophylactic antibiotic administrated in practice today. There is an adverse effect of increased antibiotic resistance, as well as costs, it is important to review the current evidence for the role of prophylactic antibiotics in compound facial fractures.

The purpose of this study is to evaluate the role and significance of preoperative, perioperative and postoperative antibiotic prophylaxis for patients when there is already an infective focus, such as compound facial fracture.

Materials and methods: A total of 70 Iraqi patients aged 4-65 years, 50 males and 20 females who met the eligibility criteria were enrolled in this study to evaluate the infection rate in patients who have sustained compound facial fractures treated by open or closed treatment.

The patients were divided into two groups, **Group A** included 50 patients who received pre, peri and post-operative antibiotics. Postoperatively the antibiotics utilized in two different regimen timing. In **Group B** antibiotics were administrated peri and post-operatively for 20 patients. They were then followed up to 4 weeks for any sign or evidence of infection such as pus discharge.

Results: There was no significant association (p=0.664) between the incidence of post-operative infections and pre-operative administration of antibiotics. Significant association p.Value (**0.032**) between prevalence of postoperative infection and type of surgery.

Conclusion: Perioperative prophylactic antibiotics have been proven to lower infection rates postoperatively. Open reduction presented with significant complication (infection) than closed reduction modality of treatment.

key words: Compound facial fractures, Prophylactic antibiotics. **(Received 20/12/2018; Accepted 21/1/2019)**

INTRODUCTION

Maxillofacial injuries are a serious public health and economic problem as their treatment time spent in hospital, and off work is expensive. They are also often associated with severe morbidity, disfigurement, and psychological problems. Their epidemiology may vary widely from country to country (and even within the same country) and it is dependent on several factors, including culture, socioeconomic background, and population density (1).

In an era of increased antibiotic resistance, as well as greater focus on evidence-based medicine and reducing health care costs, it is important to review the evidence for prophylaxis antibiotics in facial fractures (2). The use of antibiotics in facial fractures is not without its problems.

It can be associated with allergic or toxic reactions, other adverse effects, drug interactions; and it contributes to increasing bacterial resistance. In addition, some authors think that a prolonged course of antibiotic might increase the risk of complications from superinfection (3).

The duration of therapy is important in order to gain maximum treatment benefit while minimizing the development of resistance and other adverse effects. As far as possible, antibiotics should be administered for the shortest duration possible and many studies showed that short-duration therapy is as effective as longer durations and helps to minimize inadvertent sequelae of antibiotics (4).

A good prophylaxis happens when there are effective serum concentrations of the drug since the opening of the skin or mucosa until its closure. Due to this fact, the antibiotic should be used in the hour previous to the incision (5). The antibiotic prescribing practice of surgeons managing facial fractures remains elusive. This field is relatively unexplored for nonoperative facial fractures (6).

The purpose of this study was to evaluate the role and significance of preoperative, perioperative and postoperative antibiotic

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prophylaxis for patients undergoing surgical treatment of compound facial fractures to prevent postoperative infections utilizing ceftriaxone as the drug of choice.

MATERIAL AND METHODS

A total of 70 Iraqi patients aged 4-65 years; 50 males and 20 females attended to the Oral and Maxillofacial Surgery Unit at Al-Yarmouk Teaching Hospital, Baghdad from January 2017 to July 2018 and who met the eligibility criteria were enrolled in this study to evaluate the infection rate of patients who sustained with compound facial fractures. The patients were allocated into two groups**, Group A** in which the patients administrated pre, peri and post-operative antibiotics. Postoperatively the antibiotics were utilized in two different regimen timing. In **Group B** antibiotics were administrated peri and post-operatively.

The distribution of patients in the two groups is illustrated in table (1).

Table (1): Study sample

70 Patients	
Group (A)-50 patients	Group (B) -20 patients
Received pre, peri and postoperative antibiotics: Subgroup (1): 25 patients, the antibiotics were administrated for 3 days postoperatively. Subgroup (2): 25 patients, the antibiotics were administrated for 7 days postoperatively.	Received peri and postoperative antibiotics for 7 days

Eligibility criteria

1. Patients with facial compound fractures to be treated by closed or open reduction.
2. Patients with good compliance to cooperate for follow up.
3. Civilian injuries.

Exclusion criteria:

1. Patients with comminuted fractures.
2. Patients with grossly contaminated fractures.
3. Patients who are already on antibiotics.
4. Polytrauma patients.
5. Patients who need intensive care.
6. Acutely infected wounds and fractures.
7. Gunshot wounds.
8. Pathological fracture (as a result of cysts, or tumor metastases, for example).
9. Fracture of the skull base.
10. History of malignancy or active radiation to the head and neck.
11. Compromised host defense (immunosuppression, malabsorption, etc…).

Surgical procedures

The procedures were undertaken under general anesthesia or local anesthesia, there were two lines of treatment for facial bone fractures.

A. Closed reduction:

Was achieved by Erich arch bars or eyelet wires as a method of fixation, immediately was secured with the use of stainless tie wire between the upper and lower jaws

B. Open reduction:

Through an extraoral or intraoral approachs according to fracture site and displacement, the fracture was reduced manually under direct vision. Fixation was done by miniplates or wiring.

Antibiotic regimen

Patients were divided or categorized into 2 groups based on the duration of antibiotic prophylaxis.

Group (A):

In group (A) 25 patients received antibiotics preoperatively at time of admission, perioperatively at day of surgery and post operatively. The patients in this group were subdivided into two sub groups, based on the duration of receiving postoperative antibiotics:

Subgroup 1: Patients received only ceftriaxone (1g) intravenously (IV) 12 hourly and Metronidazole (500 mg) IV 8 hourly for 3 days postoperatively.

Subgroup 2: Patients received ceftriaxone (1g) IV and metronidazole (500 mg) IV 8 hourly for 7 days postoperatively.

Group (B):

The patients in this group received perioperative and postoperative antibiotics or 7 days without preoperative dose.

Perioperative prophylaxis of ceftriaxone IV was administered 1-2 hour prior to surgery in both groups of patients.

Follow up

All patients were instructed for oral hygiene measure using 0.2 % chlorhexidine mouth wash at least twice daily for 10 days.

All patients are evaluated for 4 weeks postoperatively for infection according to the criteria for infections of the surgical site published by the Centers for Disease Control and Prevention (CDC).These include:

1. Purulent discharge from the site of fracture.
2. Wound dehiscence.
3. Abscess formation.
4. Presence of signs and symptoms of infection such as localized pain, tenderness or fever (>38◦C)

Statistical Analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS) version 25. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Pearson's Chi–square test was used to assess statistical association between prevalence of postoperative infection and certain variables. A level of P value less than 0.05 was considered significant.

RESULTS

There was no significant association ($P \geq 0.05$) between prevalence of infection and both of age and gender as in table (2). In this study postoperative infection developed in 7 patients (10%) as illustrated in figure 1. the most common cause of fractures was RTA 47.1%, while the least etiological factor was crush injury in this study, the most common site of infections was the mandible (Table 3).

Table (2): Association between incidence of postoperative infection and demographic data

Clinical information	Postoperative Infection		Total (%) n= 70	P- value
	Yes (%) n= 7	No (%) n= 63		
Cause of Fracture				
RTA	5 (15.2)	28 (84.8)	33 (47.1)	0.394
FFH	0 (0)	18 (100.0)	18 (25.7)	
Assault	1 (10.0)	9 (90.0)	10 (14.3)	
Crush Injury	1 (11.1)	8 (88.9)	9 (12.9)	
Site of Fracture				
Mandible	4 (8.3)	44 (91.7)	48 (68.6)	0.67
Midface	3 (13.6)	19 (86.4)	22 (31.4)	

Table (3): Association between incidence of postoperative infection and certain clinical information

Demographic data	Postoperative Infection		Total (%) n= 70	P- value
	Yes (%) n= 7	No (%) n= 63		
Age (Years)				
< 20	1 (4.3)	22 (95.7)	23 (32.9)	**0.247**
20 – 39	6 (17.1)	29 (82.9)	35 (50.0)	
40 – 59	0 (0)	11 (100.0)	11 (15.7)	
≥ 60	0 (0)	1 (100.0)	1 (1.4)	
Gender				
Male	7 (12.5)	49 (87.5)	56 (80.0)	**0.331**
Female	0 (0)	14 (100.0)	14 (20.0)	

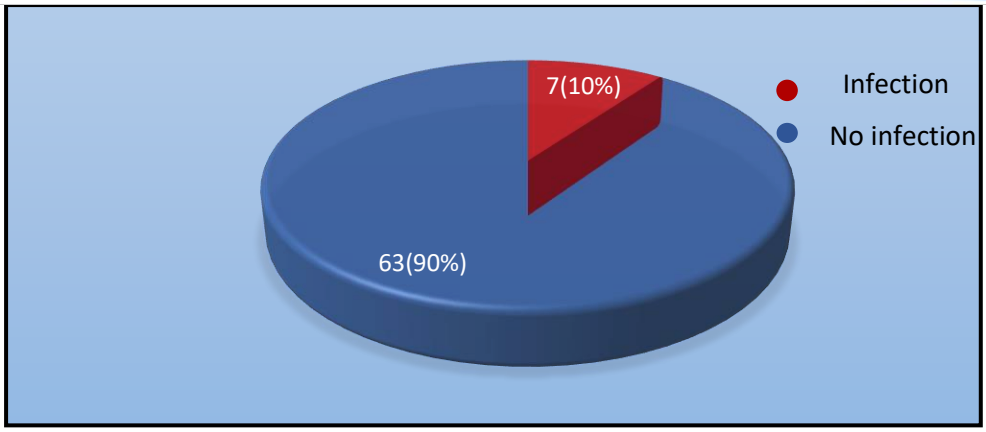

Fig.(1): Distribution of study patients by postoperative infection.

In group **A** the infection rate was 12% (6 out of 50) of patients whereas in group **B** the infection rate was 5% (one case out of 20) of patients. The difference was statistically non-significant (p=0.664%) as in table (4). Also there was no significant difference between the two subgroups**;** the infection rate in subgroup 1 was 4% (1 of 25 patients) while in subgroup **2** the infection rate was 20% (5 of 25) as in table (5). The incidence of post-operative infections with patients treated by open reduction surgery was 23.5% (4 of 17) compared with 5.7% (3 out of 53) patients treated by closed reduction with significant difference (p=**0.032**) as shown in table(6).

Table (4): The association between antibiotic administration regimen (Group A & B) and postoperative incidence of infection.

Antibiotic administration regimen	Postoperative Infection		Total n= 50 (%)	P- value
	Yes n= 6 (%)	No n=44 (%)		
Subgroup 1 (3 Days)	1 (4.0)	24 (96.0)	25 (50.0)	0.189
Subgroup 2 (7 Days)	5 (20.0)	20 (80.0)	25 (50.0)	

Table (5): Association between antibiotic administration regimen (three or seven days postoperatively) and incidence of postoperative infection.

Type of surgery	Postoperative Infection		Total n=70 (%)	P- value
	Yes n=7 (%)	No n=63 (%)		
Closed Reduction	3 (5.7)	50 (94.3)	53 (75.7)	0.032
Open Reduction	4 (23.5)	13 (76.5)	17 (24.3)	

Table (6): Association between the incidence of post-operative infection in closed and open reduction.

Antibiotic administration regimen	Postoperative Infection		Total n= 70(%)	P- value
	Yes n= 7 (%)	No n=63 (%)		
Group A	6 (12.0)	44 (88.0)	50 (71.4)	0.664
Group B	1 (5.0)	19 (95.0)	20 (28.6)	

DISCUSSION

In this study which investigated the incidence of infection following ceftriaxone administration for patients who have sustained compound facial fractures, males were subjected to fractures more than female with a ratio of 4:1 and the difference owing to occupations and outdoor activities which is in line with **Lauder et al** [7]. Most of the patients (50%) were aged between 20-39 years (3rdand 4th decades) and this was similar to the result reported by **Mamthashri and Reddy** where the majority of their patients (75%) were between 21 – 40 years this maybe also attributed to the fact that People in these age groups are more prone to trauma due to more outdoor activities [8].

In the present study, the most common cause of fractures was RTA 47.1%, while assault occupied only. The least etiological factor was crush injury, this is in agreement **Boffano et al** who reported that in low-income and middle-income countries, road traffic accidents and interpersonal violence are the main cause of maxillofacial fractures, they reported that the most common cause of facial bones fractures in Turkey was RTA 144 out of 216 (67.1%) and Saudi Arabia was also RTA 122 out of 200 (61%) [9].

The highest number of fractures was seen in the parasymphyseal regions (34.3%), which is close to the study performed by **Boffano et al** (30%); and **Mamthashri and Reddy** (35%) [1,8]. **Adalarasan et al** reported that symphyseal region was a common site of fracture (45%) [10].

Abubaker et al reported that most of the infections occurred in the mandible [11].

Also **Schaller et al** stated that fractures involving the tooth-bearing regions of jaw have greater chance for infections when compared with other locations for example angle fracture[3].

In this study, the most common site of infections was the mandible; parasymphyseal region was 4 of 7 infected patients which was also not significant in both groups.

In this study there is no association between the incidence of postoperative infection & antibiotics administration regimen in group A & B (p=0.664).

The study was in the line with **Lauder et al** Who found that 8% of patients that received peri- and postoperative antibiotics had post-operative infections compared to 9% of patients who received pre- peri- and postoperative antibiotics with non- significant difference between both options[7].

In this study there was no significant difference between the two subgroups1 and 2. In subgroup 1 the infection rate was 4% (1 of 25 patients) while in subgroup 2 the infection rate was 20% (5 of 25 patients). This was similar to **Zix et al** who reported that there was no significant difference in rate of infection for more than 24 hours with post-operative antibiotic prophylaxis for overall patients the rate of infection was 5% (3 of 60) [12].

This study showed the men age of the patients were males from 20 to 39 years (50%) with a mean age 20 years in relation to the infection rate which was 17.1%, this might be due to the fact that most age decades of the study was young males.

Adalarasan et al stated that the highest percentage of infections was 11% were associated with 20-39 years old patient [10]. This was similar to this study 17.1%. In the study the association between postoperative infection and type of surgery (closed or open reduction) was high incidence of post-operative infections with patients treating by open reduction surgery 23.5% (4 of 17) compared with 5.7% (3 out of 53 patients) treated by closed reduction.

The higher incidence of postoperative complications with open reduction may due to the fracture site communication to the oral cavity. Extensive periosteal stripping may decrease the resistance to infection, decreases vascularity through periosteal elevation and increases the possibility of infections.

Shridharani et al stated that in mandibular fracture management one must consider is whether to employ surgical therapy. Open reduction and internal fixation (ORIF) procedures have been shown to have up to a fourfold increase in infection rates compared to closed reduction[13]. The result of this study was in line with **Schaller et al** who claimed that antibiotic prophylaxis is part of the standard treatment of mandibular fractures treated by open reduction and internal fixation[3].

CONCLUSIONS

1. Young males were more affected than female in compound facial fracture.
2. RTA was the most common etiology of facial fractures.
3. Dentated regions of the upper and lower jaws were subjected more too postoperative infection.
4. Open reduction presented with significant complication (infection) than closed reduction modality of treatment.
5. The use of more than 3 days of postoperative prophylactic antibiotics did not have a

statistically significant effect on postoperative infection rates in the surgical management of facial fractures.

6. Perioperative prophylactic antibiotics have been proven to lower infection rates postoperatively.

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الخلاصة

الخلفية: لا يزال دور المضادات الحيوية الوقائية مثيرًا للجدل. تختلف كسور الوجه في موقعها وشدتها ويمكن أن تمتد إلى مدى تصنيفات الجرح بما في ذلك النظيفة ، والملوثة النظيفة والملوثة والقذرة / المصابة. من الواضح أن كسور الوجه النشطة تعتبر ملوثة نظيفة ويجب معالجتها بالمضادات الحيوية العلاجية ؛ ومع ذلك ، هناك تباين واسع في استخدام ونوع وتوقيت ومدة المضادات الحيوية الاتقائية تدار في الممارسة اليوم. هناك تأثير سلبي لزيادة مقاومة المضادات الحيوية ، وكذلك التكاليف ، من المهم مراجعة الأدلة الحالية لدور المضادات الحيوية الوقائية في كسور الوجه المركبة.

الهدف: الهدف من هذه الدراسة هو تقييم دور وأهمية العلاج الوقائي بالمضادات الحيوية قبل الجراحة قبل وبعد العملية الجراحية للمرضى عندما يكون هناك بالفعل تركيز معدي ، مثل كسر الوجه المركب.

المواد وطرق العمل: تم تسجيل ما مجموعه ٧٠ مريضا عراقيا تتراوح أعمارهم بين ٤-٦٥ سنة ، و ٥٠ من الذكور و ٢٠ من الإناث الذين استوفوا معايير الأهلية في هذه الدراسة لتقييم معدل الإصابة من المرضى الذين تعرضوا لكسور الوجه المركبة المعالجة من قبل جراحة التخفيض المفتوحة أو المغلقة . تم تقسيم الحالات إلى مجموعتين ، المجموعة (أ) شملت ٥٠ مريضا تدار من قبل والمضادات الحيوية وبعد العملية الجراحية. بعد العمل الجراحي ، استخدمت المضادات الحيوية في نظامين مختلفين للتوقيت. في المضادات الحيوية من المجموعة (ب) تدار حول وبعد الجراحة ل ٢٠ مريضا. ثم تمت متابعتهم لمدة ٤ أسابيع للحصول على أي علامة أو دليل على الإصابة مثل إفراز القيح.

النتائج: لم يكن هناك ارتباط معنوي (P=٠,٦٦٤) بين حدوث العدوى بعد العمليات الجراحية وإعطاء المضادات الحيوية قبل العملية الجراحية. ارتباط كبير القيمه المعنويه (P=٠,٠٣٢) بين انتشار عدوى ما بعد الجراحة ونوع الجراحة.

الاستنتاج: ثبت أن المضادات الحيوية الوقائية المحيطة بالجراحة تقلل من معدلات الإصابة بعد العمل الجراحي. خفض مفتوح مع مضاعفات (العدوى) كبيرة من طريقة التخفيض المغلقة للعلاج.