

The Evaluation of Efficacy of Post-Operative Antibiotics in the Open Reduction of the Zygomatic and Mandibular Fracture: A Prospective Trial

Shridhar D. Baliga · Abhinaba Bose · Saurabh Jain

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Abstract

Introduction The administration of pre and post-operative antibiotics for open reduction and internal fixation of facial fracture is the usual norm followed. Although the benefit of antibiotic has been established in the literature, the value of post-operative administration has been questioned and yet not extensively studied or investigated. There are rising concerns over the duration and undesired effects of antibiotics. The purpose of the study was to evaluate necessity and/or efficacy of post-operative antibiotics in the open reduction of zygomatic and mandibular fracture.

Methods Sixty patients who underwent open reduction and internal fixation were divided into two groups for the trial. Ab group (30 patients) received pre, intra and post-operative antibiotics. Non-Ab group (30 patients) did not receive post-operative antibiotics though pre and intra-operative antibiotics were administered. Patients were evaluated for post-op infection at the end of 1st and 3rd week after operation.

Results Among 60 patients, 2 patients (1 from Ab group and 1 from non-Ab group) were infected; so statistically no significant difference in result was obtained (Fisher's exact test, P value = 1).

Conclusion In this trial, the use of post-operative antibiotics in the open reduction and internal fixation of facial

fracture was shown to confer no benefit/efficacy in reducing the chances of infection.

Keywords Post-operative antibiotic · Trauma · Zygoma · Mandible · Infection

Introduction

In a developing country, rapid urbanization and increase in motor vehicles with poor road conditions in many places have added to increased number of road traffic accidents. The overall numbers of maxillofacial injuries are alarming. Statistics show that maxillofacial injuries make up to 42 % of all injuries. Zygomatic fracture represents either the most common facial fracture or the second in frequency after nasal fractures. According to some studies, the rate of mandibular fracture also may be as high as 70 %. It makes no doubt that zygomatic maxillary complex (ZMC) and mandibular make bulk of facial fracture.

Most studies indicate a male predilection, with a ratio of ~4:1 over females [1].

In the open reduction and internal fixation of facial fracture, prevention of infection is one of the primary aims of treatment. Therefore strict asepsis and sterilization protocol is mandatory. Also antimicrobial agents can be given to try to prevent post-operative infections [2].

The accepted post-operative infection rate in open reduction and internal fixation of mandibular fractures is ~6.1–6.78 % [3]. The benefit of pre and peri operative antibiotics in the treatment of open fracture (of mandible) has been established in the literature [4, 5]. At the same time there are rising concerns over the adverse effects of antibiotics viz. toxicity, impairment of immune defense mechanism, reactions to normal gut flora, resistance and

S. D. Baliga (✉) · A. Bose · S. Jain
Department of Oral and Maxillofacial Surgery, K.L.E.S. V.K.
Institute of Dental Sciences, Nehru Nagar, Belgaum 590010,
India
e-mail: baliga1974@rediffmail.co.in

A. Bose
e-mail: abhinaba.maxs@gmail.com

S. Jain
e-mail: dr_saurabhjain@yahoo.com

their duration of administration. Emphasis has been laid on shortening the duration to no longer than necessary period.

The necessity of post-operative antibiotics has not been extensively studied or investigated in the literature (except one noted study) when treating facial fracture (by open reduction and internal fixation). Additionally, if antibiotics are indicated post-operatively, no clear data has been produced to establish a guideline for duration of administration [6].

Excessive, prophylactic and/or over durated use of antibiotics in current clinical practice needs to be investigated and addressed to reduce cost and adverse reactions such as toxicity, impairment of immune defense mechanism, adverse reaction to normal gut flora and induction of resistance or selection of resistant bacteria. In addition, following benefits may be realized; [a] reduced drug administration and handling time, [b] reduced adverse drug reactions and interactions, [c] reduced therapeutic agents, [d] reduced medical and legal liability for surgery associated drug or infectious morbidity in the current practice environment, which is sensitive to adverse clinical outcome [7].

Materials and Methods

Among the cases who reported from 2008 to 2010, for operative treatment of facial fractures ZMC and mandibular fracture were taken in this study as representative of facial fractures as they are most commonly found); those who met the inclusion criteria and who gave consent by own free were included in this study. Thirty patients who were diagnosed to have sustained zygomatic maxillary complex fractures and 30 who were having mandibular fracture were selected.

Institutional review board approval was obtained. All data were analyzed by a biomedical statistician.

Inclusion Criteria

1. Patients above 15 years and below 65 years of age.
2. Open reduction and internal fixation of either mandibular (at least 1 fracture) or ZMC fracture with or without minimally displaced other facial bone fracture which requires intervention
3. Patients reporting for follow-up till at least 3 weeks post-operatively
4. Patients with controlled hypertension/diabetes mellitus.

Exclusion Criteria

1. Fractures infected at the time of treatment.
2. Severely displaced/or comminuted zygomatic fracture
3. Severely comminuted mandibular fracture
4. Patients failing to report for follow-up till 3 weeks post-operatively
5. Patients with immuno-compromising status
6. Fracture purely pathologic (pathologic fracture)

The patients meeting the inclusion criteria were divided into two groups, both groups received pre and intraoperative antibiotics. One surgeon operated all the cases.

- a. Ab-group: receiving post operative antibiotics.
- b. Non-Ab group: not receiving post-operative antibiotics.
 - Patients having zygomatic fracture and mandibular fracture were assigned randomly to the Ab and non Ab groups (Tables 1 and 2).

Table 1 Master chart for group Ab

Patient no	Age	Sex	Fracture location	Medical co-morbidity	Interval between injury and operation	Approach	Infection
1	22 years	M	Lt ZMC	None	7 days	Intraoral	No
2	33 years	M	Lt ZMC	None	8 days	Intraoral + extraoral	No
3	28 years	M	Lt ZMC + orthopaedic	None	2 days	Intraoral	No
4	23 years	M	Rt ZMC	HBSAg positive	2 days	Intraoral	No
5	27 years	M	Lt ZMC	None	1 day	Intraoral	No
6	45 years	M	Lt ZMC + Lt parasymphysis	None	4 days	Intraoral + extraoral	No
7	32 years	M	Lt ZMC + Lt frontal bone + dentoalveolar	None	6 days	Intraoral	No
8	43 years	M	Rt ZMC + orthopaedic	None	4 days	Intraoral	No
9	25 years	M	Rt ZMC	None	5 days	Intraoral + extraoral	No
10	23 years	M	Rt ZMC	None	3 days	Intraoral + extraoral	No
11	28 years	M	Lt ZMC	None	7 days	Intraoral + extraoral	No
12	46 years	M	Lt ZMC	None	5 days	Intraoral + extraoral	No
13	30 years	M	Lt ZMC	None	1 day	Intraoral	No
14	20 years	M	Rt ZMC	None	1 day	Intraoral + extraoral	No
15	25 years	M	Lt ZMC	None	27 days	Intraoral	No

Table 1 continued

Patient no	Age	Sex	Fracture location	Medical co-morbidity	Interval between injury and operation	Approach	Infection
16	22 years	F	Parasymphysis	None	3 days	Intraoral	No
17	24 years	M	Parasymphysis	None	5 days	Extraoral	No
18	28 years	M	Parasymphysis	Asthma	8 days	Intraoral	No
19	47 years	M	Parasymphysis	DM	5 days	Intraoral	No
20	36 years	M	Parasymphysis	HTN	7 days	Intraoral	No
21	28 years	M	Parasymphysis + Angle	None	1 day	Intraoral + extraoral	No
22	28 years	M	Parasymphysis + subcondylar	None	3 days	Intraoral + extraoral	Yes
23	40 years	M	Parasymphysis	HTN	6 days	Extraoral	No
24	19 years	M	Parasymphysis	None	4 days	Intraoral	No
25	28 years	M	Body + angle	None	3 days	Intraoral	No
26	32 years	M	Parasymphysis	DM	2 days	Intraoral	No
27	33 years	M	Parasymphysis	DM	6 days	Intraoral	No
28	22 years	M	Parasymphysis + angle	None	3 days	Intraoral	No
29	42 years	M	Parasymphysis	None	3 days	Intraoral	No
30	38 years	M	Parasymphysis + subcondylar	None	4 days	Intraoral	No

Patient no.	Age/sex	1st week follow-up				3rd week follow-up			
		Fever	Swelling	Purulent discharge	Fistulae	Fever	Swelling	Purulent discharge	Fistulae
1	22/M	No	No	No	No	No	No	No	No
2	33/M	No	No	No	No	No	No	No	No
3	28/M	No	No	No	No	No	No	No	No
4	23/M	Yes	No	No	No	No	No	No	No
5	27/M	No	No	No	No	No	No	No	No
6	45/M	No	No	No	No	No	No	No	No
7	32/M	No	No	No	No	No	No	No	No
8	43/M	No	No	No	No	No	No	No	No
9	25/M	No	No	No	No	No	No	No	No
10	23/M	No	No	No	No	No	No	No	No
11	28/M	No	No	No	No	No	No	No	No
12	46/M	No	No	No	No	No	No	No	No
13	30/M	No	No	No	No	No	No	No	No
14	20/M	No	No	No	No	No	No	No	No
15	25/M	No	No	No	No	No	No	No	No
16	22/F	No	No	No	No	No	No	No	No
17	24/M	No	No	No	No	No	No	No	No
18	28/M	No	No	No	No	No	No	No	No
19	47/M	No	No	No	No	No	No	No	No
20	36/M	No	No	No	No	No	No	No	No
21	28/M	No	No	No	No	No	No	No	No
22	28/M	No	Yes	Yes	No	No	No	No	No
23	40/M	No	No	No	No	No	No	No	No
24	19/M	No	No	No	No	No	No	No	No
25	28/M	No	No	No	No	No	No	No	No
26	32/M	No	No	No	No	NO	No	No	No
27	33/M	No	No	No	No	No	No	No	No
28	22/M	No	No	No	No	No	No	No	No
29	42/M	No	No	No	No	No	No	No	No
30	38/M	No	No	No	No	No	No	No	No

Table 2 Master chart for group non Ab

Patient no	Age	Sex	Fracture location	Medical co-morbidity	Interval between injury and operation	Approach	Infection
1	28 years	M	Lt ZMC	None	2 days	Intraoral	No
2	32 years	M	Rt ZMC + Lt parasymphysis	None	2 days	Intraoral + extraoral	No
3	32 years	M	Lt ZMC	None	2 days	Intraoral	No
4	22 years	M	Lt ZMC	None	5 days	Intraoral	No
5	20 years	M	Lt ZMC	None	1 day	Intraoral + extraoral	No
6	35 years	M	Rt ZMC	None	5 days	Intraoral + extraoral	No
7	25 years	M	Rt ZMC	None	23 day	Intraoral	No
8	38 years	M	Lt ZMC	None	2 days	Intraoral	No
9	18 years	M	Rt ZMC + B/L nasal bone	None	2 days	Intraoral	No
10	42 years	M	Rt ZMC	None	1 day	Intraoral	No
11	28 years	M	Lt ZMC	None	3 days	Intraoral	No
12	34 years	M	Lt ZMC	None	1 day	Intraoral + extraoral	No
13	32 years	M	Rt ZMC	None	2 days	Intraoral	No
14	30 years	F	Lt ZMC	None	5 days	Intraoral + extraoral	No
15	28 years	M	Rt ZMC	None	1 day	Intraoral	No
16	35 years	M	Parasymphysis + subcondylar	None	3 days	Intraoral	No
17	18 years	F	Body	None	2 days	Intraoral	No
18	34 years	M	Parasymphysis	DM	4 days	Extraoral	No
19	30 years	M	Parasymphysis + subcondylar	DM	4 days	Intraoral	Yes
20	23 years	M	Parasymphysis + angle	None	1 day	Intraoral + extraoral	No
21	23 years	M	Parasymphysis + angle	None	2 days	Intraoral + extraoral	No
22	42 years	M	Parasymphysis	None	9 days	Intraoral	No
23	35 years	F	Parasymphysis	None	6 days	Extraoral	No
24	21 years	M	Angle	None	5 days	Intraoral	No
25	24 years	M	Parasymphysis + angle	None	3 days	Intraoral + extraoral	No
26	25 years	M	Angle	None	1 day	Intraoral + extraoral	No
27	28 years	M	Parasymphysis	None	3 day	Intraoral	No
28	34 years	M	Angle	HTn	5 days	Intraoral	No
29	27 years	M	Parasymphysis	None	2 days	Intraoral	No
30	35 years	M	Parasymphysis + angle	None	3 days	Intraoral	No

Patient no	Age/sex	1st week follow-up				3rd week follow-up			
		Fever	Swelling	Purulent discharge	Fistulae	Fever	Swelling	Purulent discharge	Fistulae
1	28/M	No	No	No	No	No	No	No	No
2	32/M	No	No	No	No	No	No	No	No
3	32/M	No	No	No	No	No	No	No	No
4	22/M	No	No	No	No	No	No	No	No
5	20/M	Yes	No	No	No	No	No	No	No
6	35/M	No	No	No	No	No	No	No	No
7	25/M	No	No	No	No	No	No	No	No
8	38/M	No	No	No	No	No	No	No	No
9	18/M	No	No	No	No	No	No	No	No
10	42/M	No	No	No	No	No	No	No	No
11	28/M	No	No	No	No	No	No	No	No
12	34/M	No	No	No	No	No	No	No	No
13	32/M	No	No	No	No	No	No	No	No
14	30/F	No	No	No	No	No	No	No	No
15	28/M	No	No	No	No	No	No	No	No

Table 2 continued

Patient no	Age/sex	1st week follow-up				3rd week follow-up			
		Fever	Swelling	Purulent discharge	Fistulae	Fever	Swelling	Purulent discharge	Fistulae
16	35/M	No	No	No	No	No	No	No	No
17	18/F	No	No	No	No	No	No	No	No
18	34/M	No	No	No	No	No	No	No	No
19	30/M	No	No	No	No	No	Yes	Yes	No
20	23/M	No	No	No	NO	No	No	No	No
21	23/M	No	No	No	No	No	No	No	No
22	42/M	No	No	No	No	No	No	No	No
23	35/F	No	No	No	No	No	No	No	No
24	21/M	No	No	No	No	No	No	No	No
25	24/M	No	No	No	No	No	No	No	No
26	25/M	No	No	No	No	No	No	No	No
27	28/M	No	No	No	No	No	No	No	No
28	34/M	No	No	No	No	No	No	No	No
29	27/M	No	No	No	No	No	No	No	No
30	35	No	No	No	No	No	No	No	No

Table 3 Location of fractures

Location of fracture	No. of cases in Ab group	No. of cases in non-Ab group	Total no. of fractures	No. of infections
Parasymphysis	14	11	25	1 (Ab) + 1(non-Ab)
Body	1	1	2	0
Angle	3	7	10	0
Condyle	2	2	4	0
Total	20	21	41	2
(Zygomatic fracture)				
Lt ZMC	10	8	19	0
Rt ZMC	5	7	11	0
Total	15	15	30	0

- Sample size was 30 for each group (each group consisted of 15 zygomatic fractures +15 mandibular fractures)
- Patients shall be evaluated for post-op infection at the end of 1st and 3rd week after operation.

Criteria for infection include:

1. Purulent drainage from surgical or fracture site
2. Increased facial swelling beyond post-op day 7
3. Fistula formation at surgical or fracture site with evidence of drainage/pus accumulation
4. Fever/malaise associated with local evidence of infection viz. swelling, erythema, tenderness or foul smell, etc.

Patients with any of these criteria were considered infected (though post-op swelling beyond day 7 could be due to non-infective reason rarely, which was ruled out if at all).

Patients were randomly assigned to both groups.

The selected cases were treated by open reduction and internal fixation with titanium miniplate, using intraoral/extra oral approach or through existing lacerations or combination of the above.

Antibiotics administered were:

1. Inj. Cefotaxime 1 g/IV/BD
2. Inj. Metronidazole 100 ml (500 mg)/IV/TID

Method

Case History Review

A standard proforma was used to collect necessary information regarding each case.

Table 4 Any habits

Habit	No. of cases in Ab group	No. of cases in non-Ab group	No. of infections
Cigarettes smoking	3	1	0
Tobacco chewing	2	2	1
Alcohol intake	4	2	0
More than 1 habit	9	9	1
None	12	16	0

Photographic Records

Photographic record was maintained for all patients by taking pre operative photograph of facial profile, fracture site, intra operative photographs, immediate post operative photograph of suture line, photograph of suture line at the end of the 1st and 3rd week after operation.

Radiographic Records

Pre operative para-nasal sinus (PNS) view and sub-mento vertex (SMV) view for evaluation of fracture segment and its displacement were taken. Immediate post-operative PNS radiograph was taken to evaluate the fracture reduction and the position of the plate(s) (Table 3).

Examination of the Patient

- Complete case history, neurological evaluation to rule out head/cervical spine injury (Table 4)
- General physical examination to ascertain the absence of any associated injury of thorax, abdomen, genitourinary tract or long bones

Local Examination

Inspection and palpation of the soft tissues followed by examination of the underlying hard tissue (Table 5).

- Presence of oedema, ecchymosis, hematoma
- Presence of extra or intra oral wounds

Table 5 Teeth involved in line of fracture (for mandibular)

Nature of injury	No. of cases in Ab group	No. of cases in non-Ab group	No. of infections
Avulsion	2	2	1 (Ab) + 1(non-Ab)
Tooth fracture	1	1	0
Fracture line between 2 teeth	15	16	0
Total	18 of 20 fractures	19 of 21 fractures	2 of 41 fractures

- Jaw opening/tenderness at injury site
- Ocular/orbital findings
- Presence of infection/facial asymmetry if at all

Investigations

- PNS, SMV radiograph
- PA mandible/OPG
- PA view of chest radiograph

Apart from these, routine blood and urine investigations, electrocardiogram and all standard investigations required for general anaesthesia were done.

Surgical Protocol

Surgical Technique

Nasotracheal intubation, opposite to the fracture side, was carried out. The patients were painted and draped according to standard aseptic protocol. Surgical approaches for all the fractures were either through intra oral/extra oral/through existing lacerations/combination of above.

Extra oral Approach

First the site was cleaned using betadine solution and was infiltrated with 2 % xylocaine with 1:80,000 adrenaline. Adequate exposure of the fractured segment was done by appropriate incision in the F-Z (fronto-zygomatic) region or sub-mandibular or pre-auricular or other areas including existing CLW (contused lacerated wound) as required. The segments were manipulated, properly reduced and cheek fullness/prominence (for ZMC#), occlusion (for mandibular #) were checked. Intimate adaptation of the miniplate was done and plate(s) was/were fixed with 2 × 6 mm/2 × 8 mm titanium screws.

Intra oral Approach

First the site was cleaned and infiltrated as mentioned above. Standard intra oral upper/lower vestibular incision was given, adequate dissection carried out and fracture site was exposed. Intimate adaptation of the plate was done to the underlying bone and the plate(s) was/were fixed using 2 × 6 or 2 × 8 mm screws.

Care was taken to remove loose bone fragments (where necessary) and not injure the infra orbital neurovascular bundle. After adequate fixation, the area was irrigated thoroughly with betadine and saline. After haemostasis, the wound was closed with 4-0 vicryl (continuous suture) and

Table 6 Approach to the fracture site

Approach	No. of cases in Ab group	No. of cases in non-Ab group	Total no. of cases	No. of infections
Intraoral approach	19	19	38	1(Ab) + 1 (non-Ab)
Extra oral	2	2	4	0
Combined intra and extraoral/CLW approach	9	9	18	0
Total	30	30	60	2

the skin with 5-0 ethilon (extra orally, where required). An adhesive pressure bandage was given. (Table 6).

Post Operative Care

Thorough irrigation was done intraorally with betadine and normal saline and/or standard cleaning of extra oral wound post operatively. Patients were advised to be on liquid/semi-solid protein rich diet for 1 week with maintenance of meticulous oral hygiene.

Patients of group Ab were kept post operatively on the following regimen:

1. Injection cefotaxime 1 g/IV/BD 5 days
2. Infusion metronidazole 100 ml (500 mg)/IV/TID 5 days
3. Injection diclofenac sodium 3 cc/IM/BD 3 days
4. Injection dexamethasone 8 mg/IV stat dose intra-op followed by 4 mg/IV/TID on 1st post operative day and tapered thereafter
5. Injection ranitidine 2 cc/IV/BD
6. Chlorhexidine mouthwash QID for 15 days
7. Injection ondansetron 2 cc/IV/SOS

Patients of group non-Ab were kept in the same regimen but cefotaxime and metronidazole were not administered post-operatively.

During post operative evaluation, patients were examined thoroughly for any sign of infection at the end of 1st and 3rd weeks (Tables 1, 2).

Statistical Analysis

Statistical analysis of obtained data was carried out by Fisher's exact test. One infection in either group was seen. Both infections were seen in the mandibular fracture patient. Statistically no significant difference was obtained. (Fisher's exact test, P value = 1).

Result

Sixty patients were enrolled in the study, 30 patients having zygomatic maxillary complex fracture (ZMC) and 30 having mandibular fracture(s) (Figs. 1, 2). All patients were followed-up for a minimum of 3 weeks post-operatively. In Ab group 13 patients had additional fracture/more than one fracture (8 ZMC patients had additional fracture elsewhere in the body and 5 patients had more than one fracture of mandible). In non-Ab group, 6 patients had more than one fracture of mandible (all ZMC fracture cases in non-Ab group had no other additional fracture).

The age range was 18–47 years with a mean age of 30 years (Table 7). There were 56 male and 4 female patients (Table 8). The total time taken was <3 h for all cases. There were 2 infections (1 in group Ab and 1 in group non-Ab). Since the number of post-operative infection was found to be same in both the groups, no statistically significant difference was obtained. (Fisher's exact test, P value = 1).

Both the infections occurred in males (incidentally both were smokers). Purulent drainage from surgical site and increased facial swelling were observed in both the infected cases. Infection was noted in group Ab at 1st week post-op whereas in group non-Ab it was noted at 3rd week post-op. Both the infected patients had parasymphysis and subcondylar fracture, in both of them closed reduction was done for condylar fractures and only parasymphysis region was exposed which subsequently got infected. The infected surgical sites were successfully treated with local incision and drainage and proper antibiotic therapy. None of the infected patients required hospitalization or hardware removal.

Another unexpected finding was that in 3 patients of group Ab, (all mandibular fracture case) wound gaping was seen at 1st week post-op. No such problem was observed in group non-Ab. For all these cases resuturing was performed after thorough irrigation and the wounds subsequently healed uneventfully. Also noted during follow-up period was evidence of fever at the end of 1st week in 2 patients, 1 each from Ab group and non-Ab group (both ZMC # case). There was no other finding in both the patients that could be indicative of infection; they were treated symptomatically with paracetamol. No antibiotics were given to both of them and they were recalled for observation. It subsided after 1 day.

Discussion

The fast, modern and mechanical life nowadays has led to an increase in the incidence of trauma including that of maxillofacial skeleton significantly (Table 9).

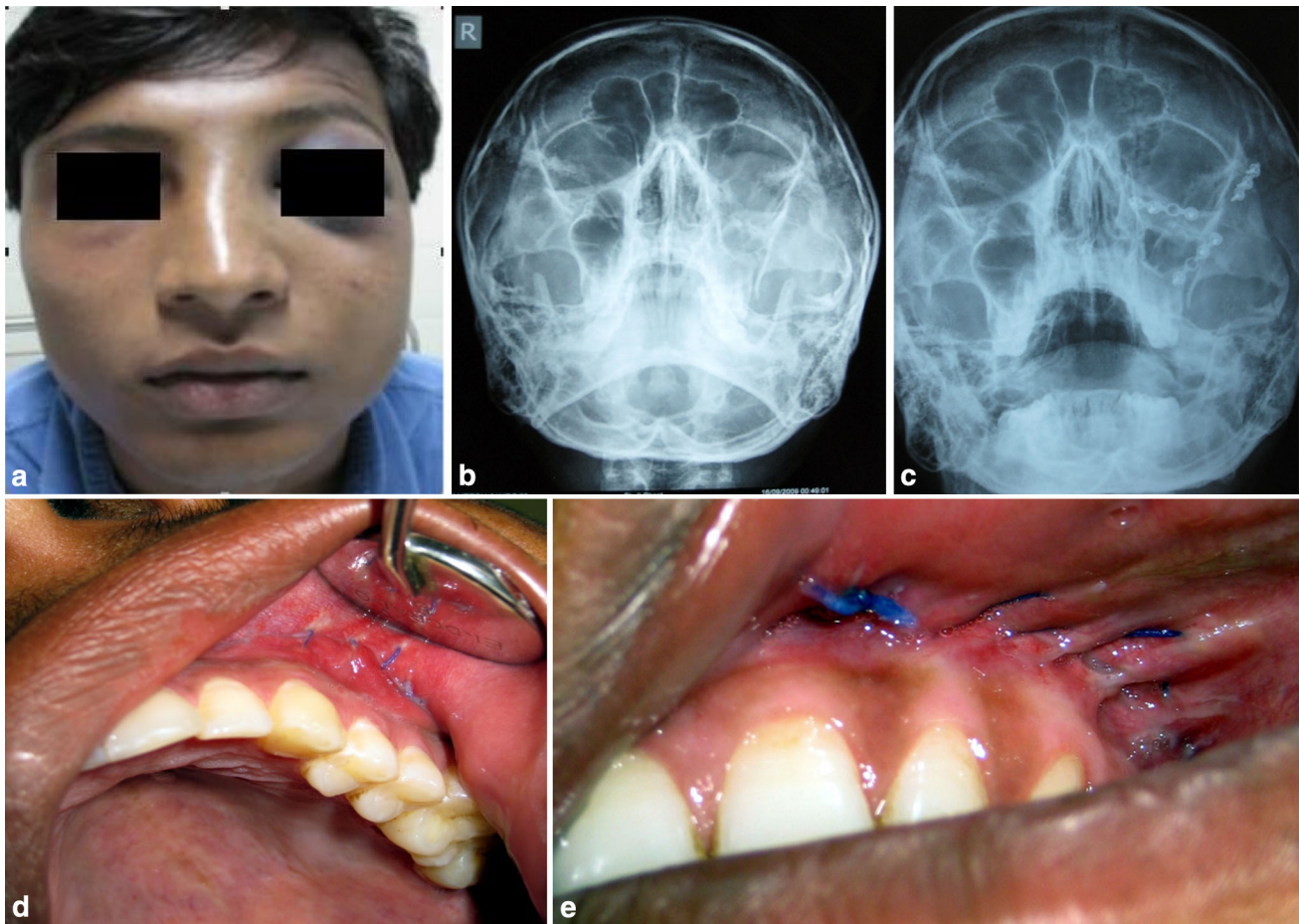


Fig. 1 Patient 1 (ZMC fracture) group non-Ab, **a** preoperative photograph, **b** preoperative and postoperative PNS radiograph, **c** postoperative follow-up intraoral photograph, **d** at the end of 1st week, **e** at the end of 3rd week

In order to achieve satisfactory function and cosmesis, open reduction and internal fixation is often necessary. If not carried out properly, this is associated with significant morbidities including infection, non-union, mal-occlusion, plate fracture, orbital complication, etc. [8]. Out of the various noted complications, post-operative infection has generated concern and controversy and has been investigated again and again throughout world literature [9]. Serious infective complication such as orbital cellulitis has also been reported after ZMC fracture [10].

Routine application of standard surgical principle and strict sterilization will result in low infection rate that are acceptable for most surgical procedures. However, there are surgical procedures that, in spite of strict adherence to surgical protocol, have an unacceptably high incidence of post surgical infection. In these situations, the prudent use of antibiotic prophylaxis will lower the level of infection to acceptable levels [5].

It is important to remember that the establishment of an infection depends upon a balance between the bacterial challenge and the host defences. Inoculation of a surgical

wound by a large number of virulent bacterias will result in the establishment of an infection, even when the host defences are intact. Several well known factors, such as prolonged operation time, advanced age, malnutrition and a prolonged preoperative hospital stay causes increased infection rates. The use of short term antibiotic prophylaxis eliminates their influence on the incidence of post-operative infections [5].

The use of antibiotics to control post-operative infection has to be based on sound scientific rationale. Concerns regarding the adverse effects need to be addressed. Question also arises whether these antibiotics are really necessary or not.

Carefully controlled studies in animals and humans initially defined the principles of antibiotic prophylaxis and divided the surgeries on the basis of risk of infection as:

CLASS 1 surgery—clean surgery—has an infection rate of $\sim 2\%$

CLASS 2 surgery—clean-contaminated surgery—trans-oral surgeries are considered to be in this class, expected infection rate is 10–15 %



Fig. 2 Patient 2 (mandibular fracture) group Ab, **a** preoperative photograph, **b** preoperative intraoral photographs, **c** preoperative OPG, **d** 1st week postoperative, **e** 3rd week postoperative, **f** 5th week postoperative

Table 7 Age incidence

Age group	No. of cases in Ab group	No. of cases in non-Ab group	No. of post-operative infections
15–20	2	3	0
21–30	16	14	1(Ab) + 1(non-Ab)
31–40	7	11	0
41–50	5	2	0
Total	30	30	2

Table 8 Sex incidence

Sex	No. of cases in Ab group	No. of cases in non-Ab group	Total no. of cases	No. of infections
Male	29	27	56	1(Ab) + 1 (non-Ab)
Female	1	3	4	0
Total	30	30	60	2

Table 9 Etiology

Cause of injury	No. of cases in Ab group	No. of cases in non-Ab group	Total no. of cases	No. of infections
RTA	24	26	50	1(Ab) + 1 (non-Ab)
Work related/fall	4	1	5	0
Assault	2	3	5	0
Sports injury	0	0	0	0
Miscellaneous	0	0	0	0
Total	30	30	60	2

CLASS 3 surgery—contaminated surgery—fractures of the mandible involving the tooth bearing region. Infection rate here is 20–30 %.

CLASS 4 surgery—dirty surgery—if the patient presents with evidence of infection of the fracture or the fracture treatment, is delayed in receiving treatment, the wound

can be classified as a class 4 (infected wound). Infection rate here is nearly 50 %.

Various studies suggested that use of good surgical technique reduces incidence of infection in class 1 to <1 % and excellent technique and prophylactic antibiotics can reduce the incidence of infection in class 2 to 1 % and in class 3 to <10 % [11–13]. A review article states that shortening of antibiotic prophylaxis and therapy needs to be addressed, which is in accordance to our findings; however it also states that it is entirely not clear whether fewer adverse reactions would occur with shorter courses of antibiotic therapy [14].

The reasons for excessively prolonged antibiotic administration could be due to failure to identify and eliminate the foci of infection, failure to appreciate pharmacodynamics, impact of antibiotic trials on duration, limitations of antibiotic studies as cause for overuse, failure to distinguish between contamination, infection, and inflammation [14].

Recommendations for shorter duration of antibiotic administration were given by the Discussion Forum for various general surgical procedures. According to it, conditions representing contamination do not require postoperative administration since the infectious site is dealt with operatively, and bacteria are effectively removed by host's defenses, wound irrigation, pre and intraoperative administration of prophylactic antibiotics. The forum also stated that the practice to continue antibiotics blindly as long as temperature is elevated or WBC count is high should be abandoned [15]. In our study also we found it true as we encountered the problem of elevated temperature in two patients successfully treated without antibiotic administration.

Even if we think of the cost factor, according to an estimation, antibiotic prophylaxis given for 1 or 3 days is 4 or 12 times more expensive than a single dose prophylaxis [14]. Studies recommend that in minor surgeries like removal of impacted molar tooth, prophylactic antibiotics should not be routinely given [16]. Although facial fractures like ZMC fractures are rarely complicated by orbital infection, again there is evidence like case of orbital subperiosteal abscess (SPA) and blindness complicating minimally displaced zygomatic complex fracture [17].

The basic question still remains to be answered—whether these antibiotics are necessary or not? Despite the documented benefit, the use of prophylactic antibiotics to prevent post-operative infection in head and neck surgery, in general and in oral and maxillofacial surgery, in particular, has and continues to be the subject of controversy. In fact, many believed that prophylactic antibiotics increased the incidence of suprainfection of surgical sites. After reviewing 131 studies published over 16 years, it was

concluded that antibiotic prophylaxis was of value only in certain procedures. However, as majority of these studies were retrospective and a wide variety of procedures, different antibiotics, and various durations of therapy were used, the criteria used for diagnosing an infection were mostly subjective and not well defined.

In our study, as we stated earlier, thorough aseptic procedures were followed during the surgery as well as during the post-operative period which is considered an important factor in reducing the chance of infection.

Both the infections were found in parasymphysis region, both the post-operative infection cases were operated within 4 days of injury whereas no post-operative infection was seen in those who were operated after 4 days of injury. Similarly the duration of surgery for all cases was <3 h, so role of prolonged operation time in increasing rate of infection cannot be commented upon based on our study.

The results of our study show that the number of infection is equal in either group, thus statistically no difference or significance was obtained. This indicates that there is no benefit/efficacy of post-operative antibiotics to control/reduce the infection in open reduction and internal fixation of facial fracture. Our result is in accordance with those studies done previously by Abubaker and Rollert [18] and by Miles et al. [6].

Even avoidance of post-operative antibiotic administration reduces hospitalization of patient preventing complication like development of MRSA strain.

Though in our study, two patients, 1 from Ab group and another from non-Ab group had fever at the end of 1st week postoperatively, there were no other signs or symptoms that could indicate the presence of an infection. Both were managed conservatively (with administration of paracetamol alone) and the fever subsided next day. Also the unexpected finding of wound gaping in 3 cases in Ab group could be due to tension in suture line, hematoma formation or mutilation of flap margins prior to suturing. This finding highlights the importance of suturing procedure and hence it should be carried out meticulously.

The statistical analysis by Fisher's exact test shows the value of $P = 1$ which is statistically insignificant. This questions the need for administration of post-operative antibiotics in open reduction and internal fixation of facial fracture.

Because of the relatively small sample size, the results need to be supported by further studies using a larger sample size and providing more data on various confounding variables before we can finally recommend not using post operative antibiotics in the open reduction and internal fixation of facial fracture.

Conflict of interest None.

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