



The Preference Treating of Comminuted Mandibular Fractures by The Close Reduction Over the Open Reduction Technique in Iraq Soldiers War Under Specific Factors

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Abstract

Iraq becomes as square fight for the war and terrorist before 17 years ago and still until now. Mandible is the mainly fractured bone after the nasal bone in the face comminuted fracture has multiple fracture lines resulting in many small pieces within the same area of the mandible.

Aim of the study: The preforming study tended to point the using close reduction Inter maxillary fixation (CRIMF) as definite treatment for comminuted fracture of the mandible under certain conditions for managing same types of mandibular fractures with the evaluating and comparing the outcome and complications between two techniques.

Materials and methods: (CRIMF) and (ORIF). A total of 51 patients with comminuted mandibular fractures, aged between (17-45) years. All patients were examined clinically,

radio graphically (OPG) and some of them computed tomographically (CT3D) before and after treatment to evaluate the regions fracture position, and assessed the complication resulted post operatively. Patients were divided into 2 groups: Group A (n=30) patients with 36 fractures had managed by close reduction and indirect fixation using intra maxillary fixation (CRIMF). Group B (n= 21) patients with 24 fractures operated by open reduction internal fixation (ORIF) using reconstruction plates. Group A managed by maxilla mandibular fixation MMF were performed for 28 cases under general an anesthesia (GA) and only 2 patients fixed under local anesthesia. In the group B, all surgical operations of ORIF were done under GA.

Results: Both groups had appeared nearly the same in incidence rating, the Avulsed wounds registered the greatest incidence, more less proportion of incidence in both groups were the perforating wounds and finally, the laceration wound were noted the least proportions. Statistically there was no significant differences in the presence of soft tissue types injuries among two groups in war. The result appeared that the most common frequently fractured region of mandible in the patients of group(CRIMF) and group (ORIF) was the body of mandible 15(41.6%) and 13(54.1%) fractures respectively. In this comparative study, the incidence of infection complication were considered as major complications in both groups, but it noticed the proportion of infection among the open reduction are superimposed in comparison with close reduction group, which were 4(26.6%) and 5(38.7) respectively, leading to the failure of treatment, that demined surgical interference to plate removal. There was significant difference in the complications types incidence postoperatively among both groups $X^2 = 4.628$ $P < 0.05$. War wounds were common among men in this study with ratio men to women 8.6:1. The soft tissue wounds happened in war among the two groups.

Conclusion: The open reduction internal fixation super imposed in their complications in compare to close reduction technique. Can be managed safely with IMF of close reduction, Awareness on good oral hygiene adopting healthy life style practices achieved by educating the patient's provident instructions to enhanced post-operative care to improve infection control.

Key words: Comminuted mandibular fracture / open reduction / close reduction IMF / complications

Introduction

Mandible is the mainly fractured bone after the nasal bone in the face. It's represented 50% of all facial bone fractures. Lower jaw fractured may be unfavorable or favorable, compound or simple, displaced or no displaced, linear or comminuted, impacted and green stick fractures. Comminuted fracture has multiple fracture lines resulting in many small pieces within the same area of the mandible (symphysis, body, ramus and angle) ⁽¹⁾. While In extensive comminuted fractures, multiple sites (more than one region and including the neighboring regions) of the mandible are crushed, or broken down into several pieces ⁽²⁾. Major cause of facial bones fractures is trauma and in time of war and conflict injuries result from blasts high velocity/ high-energy missiles and even low velocity missiles⁽³⁾.The purposes of mandibular fractures treatment are to reinstate anatomy, function, and esthetic⁽⁴⁾.Comminuted fracture mandible are the most complicated among all fractures in most cases ⁽⁵⁾ has been considered to be indications for closed reduction but in the last decades there was a change in the treatment sight of such fractures motivated by the advent in rigid fixation techniques and materials. Some authors suppose that open

reduction and rigid fixation (ORIF) is a superior treatment option and causes lower complication rates than closed reduction in comminuted mandibular fractures ⁽⁶⁾. When the comminuted fractures of the mandible do not meet the criteria of definite indication for ORIF which are displacement or loss of bony segments, absence of the occlusal guide and accompany of multiple facial bones fractures, and to overcome the possible issues associated with ORIF there will be a chance for conservative treatment by closed reduction and indirect fixation. The aim of this work was to evaluate and compare the outcome and complications of using close reduction Inter maxillary fixation (CRIMF) as definite treatment for comminuted fracture of the mandible under certain conditions and ORIF for managing same types of mandibular fractures.

Materials And Methods

The retrospective and comparative study was carried out on 51 patients with 60 fractures in mandibles, their age range between 17-45 years they admitted to maxillofacial department in AL-shaheed Ghazi ALHariri specialized surgeries hospital during the period 2013- 2018. This study was approved by the scientific

committee of the Department of Oral and Maxillofacial Surgery, College of Dentistry, Mustansiriyah University. All patients suffered from comminuted and extensive comminuted fractured mandible were resulting from blast war injuries. Cases selected under certain criteria which are no loss of soft tissue, no displacement of fracture bone. According to the method of treatment the sample study divided into 2 groups:

- 1- Group A: 30 patients with 36 fractures had managed by close reduction and indirect fixation using intra maxillary fixation (CRIMF).
- 2- Group B: 21 patients with 24 fractures operated by open reduction internal fixation (ORIF) using reconstruction plates.

Group A managed by maxilla mandibular fixation MMF were performed for 28 cases under general anesthesia (GA) and only 2 patients fixed under local anesthesia. In term of patients' injuries for same group including 29 cases associated with soft tissue trauma. The material used for fixation in this group were arch bars and eyelets for all cases except one case who owns denture used as splints. The maxilla mandibular fixation lasted about 1 hour

segments and with enough dentition to save as occlusal guides in fixation. All patients were examined clinically, radiographically (OPG) and some of them computed tomographically (CT3D) before and after treatment to evaluate the regions fracture position, and assessed the complication resulted post operatively.

more or less, tie wires or elastics were applied post operatively. Nasal gastric tubes were introduced for 9 patients associated with gross oral laceration.

While the group B, all surgical operations of ORIF were done under GA, for all group. Wound injury of soft tissue present with 21 patients. Material used for maxilla mandibular fixation with same group were using arch bars and eyelets at first stage and guide elastic to establish. occlusal reference for reduction the fracture sites were accessed through submandibular and sub mental approach or by exit wound itself, dissection, exposure of alignment of proximal segment and application of reconstruction plates performed all to put the teeth in optimal occlusion.

Post operatively intra venous Antibiotic cover prescribed to all patients, good oral hygiene instructions and perfect regime of diet were given

estimated period of healing was 60 days for MMF.

The protocol followed to treat wounds was as stipulated in the new literatures. Only wounds that have no gross contamination or deep extension closed primarily. If the viability of tissues is in doubt, they packed open, sequentially derided and closed in delayed manner. Deep wounds explored and foreign body that appeared in the field removed in emergency or immediate phase. The former reasons in addition to general condition of the patient estimated time-lapse for surgery which ranged from 3 to 7 days. Each patient was observed in a follow up period no less than 6 months. All the complications in fracture sites of patients was assessed statistically and compared between 2 groups according to the procedures methods. Statistically, data were subjected to analyze and assess our result. Descriptive and comparative statistics which include, tables, pie and bar chart, mean standard deviation, chi – square, comparative percentages were calculated for study variables.

Results

A total of 51 patients with comminuted mandibular fractures were ranged their age in both group A and B

between (17-45) years. The group A were 30 (58.8%) patients and group B were 21(41.1%) patients with slightly higher mean in group B patients compared to group A patients. The mean \pm SE of group B to group A were 33.33 ± 1.392 and 32.06 ± 1.311 respectively. Statistically noted that the differences between the two groups patients numbers that having mandible fractures was significant, with $P < 0.05$ and $T.test = 2.919$. as in table (1).

The figure (1) reveals that, the most of 51 patients were males. The males to female's ratio was 8.6:1. The group A were registered 28(93.30%) were males and 2(6.60%) were females, while the group B, males comprised 18(85.90%) and females recorded 3(14.20%).

Table (2) shows the incidence comparison of 36 fractures regions in 30 patient's mandibles who were group A and the same 24 fractures regions in 21 patient's mandibles of group B were distributed.

The result appeared that the most common frequently fractured region of mandible in the patients of group A and group B was the body of mandible 15(41.6%) and 13(54.1%) fractures respectively as in figure (2).The followed frequent by the parasymphysis regions in

both groups A and B were 9(25%) fractures and 5(20.8%) fractures respectively. The symphysis and angle with ramus of mandible fractures in group A had rated the same percentage of incidence 5(13.8%) fractures for each regions. The same group the coronoid and sub condylar sites were the last commonly fractured of mandible 1 (2.71%) fractures for each compare to the group B which the symphysis regions were the least commonly fractured in mandible 2 (8.33%) fractures. The both regions of coronoid and subcondylar of mandible noted no cases of fractures in group B. Statistically, there was no significant differences in the sites fractures of mandible among both groups. $X^2 = 0.018$, $P > 0.05$.

Concerning of complications incidence caused postoperatively by close and open reduction internal fixation in both groups A and B, diagnosed clinically, Radiographic ally and tomographic ally less of them. It reveals in table (3), infection due to malunion or nonunion registered the greatest incidence proportion in both groups A and B where 4(26.6%) and 5(38.7) of complications respectively.

In the group A the limitation opening of mouth was recorded 3(20%), a slight

less the same incidence percentages comprised by the occlusal upset and wound dehiscence were 2(13.3%) for each types of complications.

Referring to group B the occlusal upset and nerve injuries had rated the same incidence percentages were 2(15.35%) for each, the followed frequent were wound dehiscence, facial a symmetry, extensive of plate and pain surgical site had noted the same and least percentages of incidences 1(7.67%) for each complications. Statistically, there was significant difference in the complications types incidence postoperatively among both groups. $X^2 = 4.628$, $P < 0.05$.

Figure (3) Illustrates the soft tissue wounds happened in war among the group A and group B. it appears that both group had nearly the same in incidence rating the Avulsed wounds registered the greatest incidence 19 (65.51%) and 17(80.95%) respectively. More less proportion of incidence in both groups were the perforating wounds were recorded 8(27.58%) and 3(14.28%) respectively as in figure (4), finally, the laceration wound were noted in 2(6.89%) and 1(4.76%) respectively in group A and group B. Statistically there was no significant differences in the presence of

soft tissue type's injuries among two groups in war.

Discussion

Iraq becomes as square fight for the war and terrorist before 17 years ago and still until now. War wounds are common among men in our study 46 men and 5 women with ratio men to women 8.6:1. This result is nearly similar that concluded by (7, 8) and slightly less ratio than (9) who confirmed male to female ratio 10.4:1.

Exposed parts of body faced all most to many injuries. There is in agreement between this research and those authors' studies (10) in observing that unguarded area of body exposed for extensive injuries. Various wars subsuming facial and cervical wounds incident, and coincide with (11,12) who mentioned that insufficient protection of the head and neck supplied by the body armor recently used by soldiers in the filed leading to aggressive trauma wounds.

Fractured mandible bone was rationalize half proportion out of all maxilla facial region fractures. This confirms with (1) who spotted the lower Jaw injuries was evaluated for almost 65/136 fractures of all lesion to the lower third of face. (13) Registered the highest

number of patients 298 / 518 had mandible fractures. (14) Mandible bone fractured comprised 84.4% which participated in 223 out of 264 patients among (zygoma , maxilla , mandible) fractures . (15) Numbered 137 mandible fractures.

Our opinion is that mandible is one of the prominent UN supported face designed portions with the frontal and zygomatic bone which must be appreciated with protective military helmet in war fields.

Pertaining to the fractured regions. Our research detailed frequently fracture regions of mandible. The body of mandible rated the highest percentage. This in line with (14) who had been concluded that the body of mandible is the most area faced to fracture in 30.3% within 80/264 patients. In any events disagreement with (16) who reported that the greatest proportion mandibular fracture part was condylar fracture that recorded 17.5% - 52% of all mandible fracture.

The period hospitalized by patients was 3 -11 days. (17) Demonstrated an average of 3 – 5 days admission for IMF. Patients at hospital, which slightly more than those with plates. There is evidence that that patients make a slower recovery

with their function reduced by IMF. In spite of ⁽¹⁸⁾ observed for good long – term concludes with usual treatment with closed reduction fixation but may include and lasting more time for recovering. ⁽⁸⁾ Explicated that 3 month to 24 months follow of needing period in ORIF. Our transformation is ORIF need more recurrent visits from patients to recover the area of fracture under certain criteria's.

Concerning to the soft tissue wound injuries in our study it clarified that both groups had nearly the same incidence rating. The avulsed wounds were rated the greatest and the laceration wounds were comprised the Least incidence. This conformed with ^(19,20,21) who researched that the severity of these wounds differs depending to the weapon , gauge and its target distanced which leading for penetration , perforation or avulsion of aimed parts of tissues . Our study harmonized with ^(9, 21, 22, 23, 24) who explained that mainly the high velocity missile causing trauma in comminuted facial skeleton which is devised to initial surgery depending to the degree of soft tissue injuries which can be closed after extensive irrigation and conservative debridement to neighboring wounds edges to guarantee bone , plate , internal soft tissue coverage with exception of

dissecting the devitalized and infected tissues. From our experiences, there is no specified surgical approaches stepped for management the penetrating, perforating and avulsed soft tissue injuries due to each injurie route to other vital sections, so it requires for expert surgeon skills. This is reconciling with ^(9, 25) who presented that successful techniques obligated for primary closure of aggressive cervicofacial war injuries with late cavietary necrosis which is accountably.

In our comparative study, the infection complication were considered as major complications in both groups, but it noticed the proportion of infection among the open reduction are superimposed in comparison with close reduction group, which leads to the failure of treatment that demined surgical interference to plate removal .This is concurs with Chowdhury ⁽¹⁵⁾ Who stated that because of pull action muscle effect with unfixed plate screws firmly, leading to movement of plate postoperatively causing infections .

The solution in this study, that intra maxillary fixation should be restored to, due to shock effect this in agreement with ^(26,27) who reporting that the greatest

60 – 72 % complication rates being contaminating in nature with open reduction technique and corresponds with many studies (26, 27, 28, 29, 30, 31, 32,33, 34, 35) Who presented that mandibular bone fracture be related with the highest rate of infection when compared with other maxilla facial regions and commonly with ORIF .

The potential causes of infection in this study was complication that open reduction add risk factors to the essential contaminated wounds, by dirt shells, and oral flora which the main reasons for infection in effected cases. This consent with previous studies (8,36) that detected insufficient awareness with inadequately of oral hygiene status of patients because of their suffering from pain, difficult chewing, edema, so they try to mitigate against discomfort restricting mandible movement with repetition or absence of oral hygiene configurations, encouraging the infection complication presenting. In other hand our study is not correspond with Malanchuk (37) who displayed that a low frequency of postoperative infection in severe traumatic injuries were successfully managed in one study.

Our management, the postoperative infection accedes with Abdelfadil (33) who followed that essential antibiotic and

adjunctive instruments with extreme oral hygiene criterions combine with mouth wash of chlorohexidine solution have been their influences effects in prohibition of postoperative infection.

Obviously in our research, All types of complications approximately stepped within the open reduction technique group, except, limitation of mouth opening and disfigurement of soft tissue were not present compared with close reduction technique group. This compact with Zachariades (38) who stated that in ORIF with no exactable alignment of fracture bone pieces leads in asymmetrical face and occlusal disturbances and Ahmed (39) who mentioned that ORIF conclude malocclusion. In addition, a previous study (8) showed the frequent of occlusal disturbance was 7.3 % and distorted plate was 1 % which is nearly registered a half less than our study percentage. In this study, the management for occlusal disturbance was equilibration of occlusal surface by selective grinding or used the aids of elastic attraction in few cases.

The maxillary mandibular fixation (MMF) time operating averaged rationally shorter than that with ORIF. The MMF is required evaluated criteria's to aid manual reduction and occlusal

guidance this dispute with Koshy ⁽⁴⁰⁾ who performed that there is no relation between time of surgery and infection or non-union complication but technical convolution was more complicated after this time.

The limitation of mouth opening only seen in closed reduction techniques group in this study. This can be explicated by disuse atrophy, muscle spasm and scar formation. This type of complication was managed by their quick response to the physiotherapy. This result is supported by Prabhu ⁽⁴¹⁾ who documented that the presenting of mouth opening limitation within average in 97% of his fractured mandible patients managed by close reduction techniques.

The nerve injuries evaluated in 15.35% of ORIF group in our study. This confirmed by ⁽⁴²⁾ who listing with lower lip paraesthesia due to severed the mental nerve, while in compare to our study the CRIMF. Announced no cases of nerve injuries due to our conservative works.

Wound dehiscence was tabled nearly in twice proportion among CRIMF group in compare to those in ORIF group in our research. This result has nearly less rate with Stojanovic ⁽⁴³⁾ who registered 14(3.1%) persons with

wound dehiscence , and nearly within the occurrence of ⁽³⁵⁾ accounted wound dehiscence was 8.9% however much less than Anyanechi ⁽⁴⁴⁾ who scheduled 31.9% was wound dehiscence . Our study ordered with previous studies ^(45,46) that established the most common post-operative complication was wound dehiscence complication. Our explanation is clarified to the minor oral infection causing by stranger mechanical and chemical contaminating material with insufficient skin, mucosa and soft tissue coverage with wound closure tension leading to wound hernia. The above explanation is supported by Frykberg ⁽⁴⁷⁾ who cleared that the sequence of events is modified by changeable factors in wound adhesion including the circumstances of external mechanical trauma, type of injuries, and size average of defected area. All these interfering within the successful heading of wounds.

Our treatment can be summarized by successful debridement with previous research^(44 , 48, 49) that further debridement wounds are required with warm saline, accelerating blood flow to injured regions with mouth wash cleaning agents .

Conclusion

Mandible management injuries and fractures require essential attention, early and skilled treatment of these injuries fractures at primary stage is critical to resulting proper acceptable esthetic and long term function, so the close reduction in comminuted mandible fractures lasting short time management but more follow-up visits and off work than open reduction internal fixation, in addition the beginner is lower cost and no need more hardware like the latter's. Minimally displaced comminuted fractures without tissue loss, can be managed safely with IMF of close reduction rather than open reduction internal fixation. The frequency

of complications related to the injuries participating factors effects and treatment modalities .The open reduction internal fixation super imposed in their complications in compare to close reduction technique. Awareness on good oral hygiene adopting healthy life style practices achieved by educating the patients provident instructions to enhanced post-operative care to improve infection control, however other complication were least encountered were reduced with surgeon's experiences.

Conflicts of Interest

The authors reported that they have no conflicts of interest

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Table (1): The Descriptive statistical results of patient's ages in two groups.

Group	Patients		Maximum	Minimum	Mean	SE
	%	.N				
Group A	58.8%	30	40	18	32.06	1.311
Group B	41.1%	21	42	17	33.33	1.392
Total	100	51				

significant $P < .001 = P = 2.919 T =$

Table: (2) the incidence comparison of the fractures according to the distribution regions between the Group A and Group B.

Regions	Fractures incidence of Group A		Fracture incidence of Group B	
	No.	%	No.	%
Body	10	33.33%	13	41.94%
Symphysis	0	0%	2	6.19%
Para symphysis	9	29.03%	0	0%
Angle and Ramus	0	0%	4	12.62%
Coronoid	1	3.23%	0	0%
Sub condylar	1	3.23%	0	0%
Total	26	81.19%	24	74.81%

$X^2 = 0.018$ $P \text{ Value} = 0.987$ $\text{Non sign} = P > 0.05 \text{ non}$

Table: (3) the comparison complications after treatment in both Group A and group B.

Type of complications	Group A incidence		Group B incidence	
	%	.No	.No	%
(Infection (malunion , nonunion	۲۶.۶	۴	۵	۲۳.۸
Occlusal upset	۱۳.۳	۲	۲	۹.۵
Limitation opening of mouth	۲۰	۳	۰	۰
Wound dehiscence	۱۳.۳	۲	۱	۴.۷۶
Facial asymmetry	۰	۰	۱	۴.۷۶
Nerve injury	۰	۰	۲	۹.۵
Obvious disfigurement of soft tissue	۲۶.۶	۴	۰	۰
Extensive of plate	۰	۰	۱	۴.۷۶
Pain surgical site	۰	۰	۱	۴.۷۶
Total	۱۰۰	۱۵	۱۳	۱۰۰

$X^2 = 4.628$ P value = 0.042 significant P < 0.05

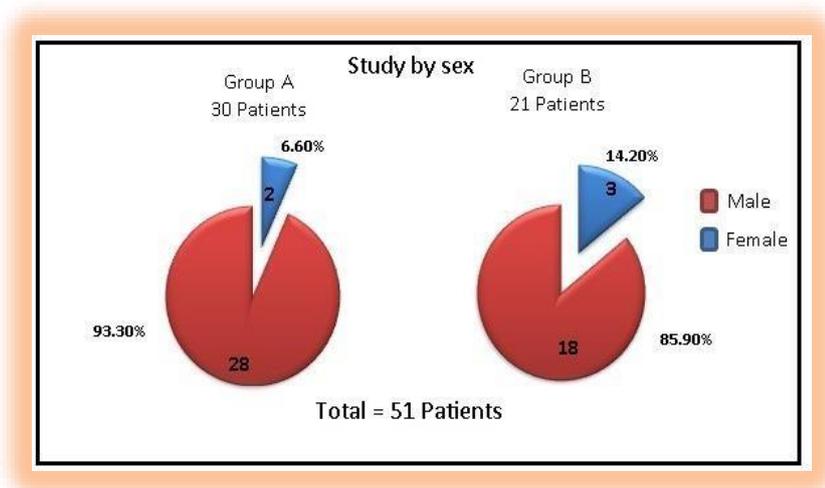


Figure (1): Distribution of 51 Patients of this study according to sex for both groups A and B.

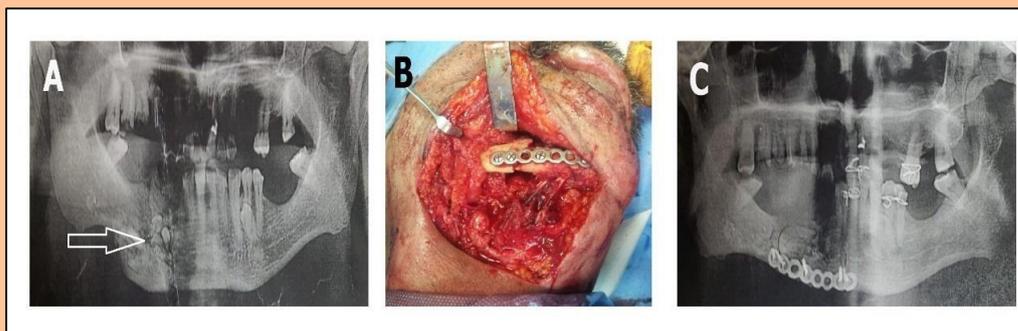


Figure (2): A. OPG shows the comminuted fracture in the body of mandible at the left site (white row), B. OPG shows close reduction IMF of comminuted fracture in the body of mandible at left site (white row).

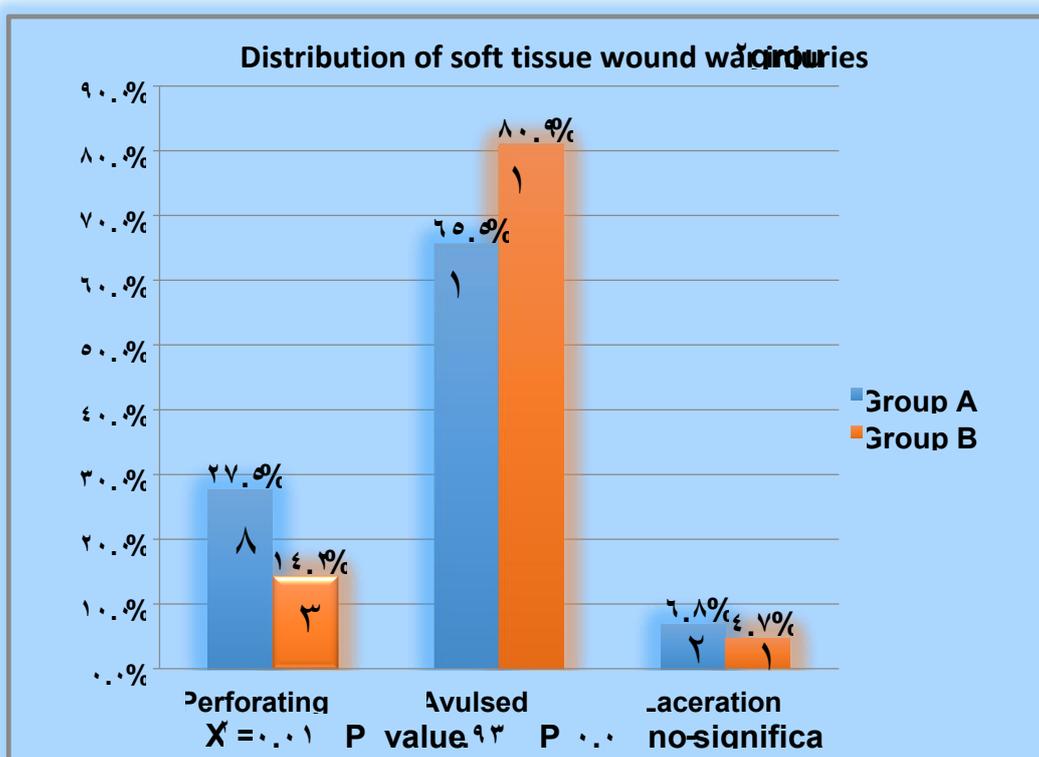


Figure (3): Distribution of soft tissue wound war injuries in group A: n= 29 and group B: n =21 injuries .

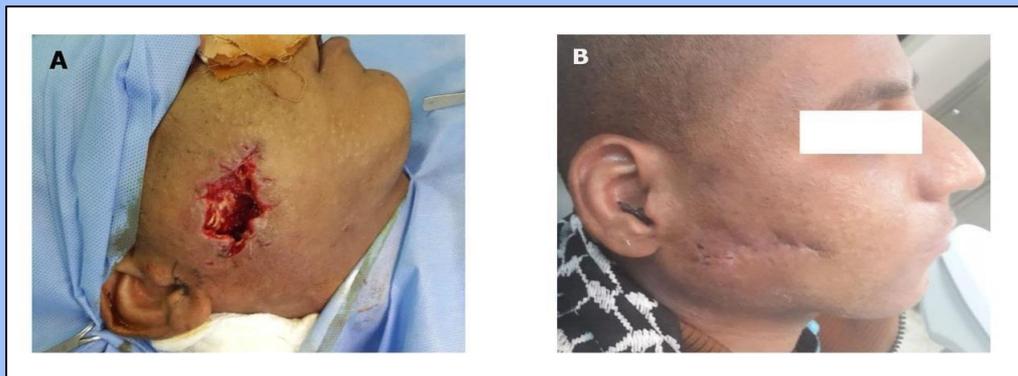


Figure (4): photographs, **A.** a perforating facial war injury at the right cheek, **B.** Repaired war injury with tissue and micro vascular reconstruction.