ANNALI ITALIANI DI CHIRURGIA

Digital Edition
e-publish on-line
ISSN 2239-253X
Direttore Nicola Picardi

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A step-by-step multidisciplinary approach

Ann Ital Chir, Digital Edition 2020, 9
pii: S2239253X20033125 - Epub, Nov. 30
free reading: www.annitalchir.com

Ludovica Cellini*, Anna Vaiano*, Giacomo Tiezzi*, Giuseppe Oliveri*, Giovanni Di Pietro*, Biagio Roberto Carangelo*, Guido Gabriele**, Federico Zerini**, Flavia Cascino**, Davide Luglietto*

Azienda Ospedaliera Universitaria SeneseAOU "Le Scotte", Siena, Italy
**Department of Neurosurgery*
***Department of MaxilloFacial Surgery*

Complex craniomaxillofacial gunshot wounds. A step-by-step multidisciplinary approach

BACKGROUND: *Gunshot injuries of the viscerocranium are rarely reported. Penetrating wounds to the cranio-maxillofacial region pose a significant challenge for surgeons as they often comprise serious soft tissue, bone and cerebral defects. We present a case report of a 42-year old female with a gunshot wound to the viscerocranium after suicidal attempt. Series of image of the disease course are available.*
CASE DESCRIPTION: *A 42-year-old female presented with gunshot wound to the viscerocranium after a suicidal attempt. At the arrival GCS was 8/15 and general examination showed the inlet wound in the submental region whereas the outlet one in the left temporal skull area. After first rescue procedures, ICP was monitored before proceeding surgically. Due to massive hemorrhage, embolization of ianternal maxillary artery was performed. Afterwards, tracheostomy, surgical reduction of multiple maxillo-facial fractures and ocular avulsion were performed. In a second time, ICP monitoring and CT scan revealed ICH signs due to intraparenchimal injures. The patient underwent to a second surgical procedure, consisting of bifrontal decompressive craniectomy. The patient was discharged on 20th post-op day to a rehabilitation center. She returned to our department after 4 months to perform a craniomaxillofacial recostruction. She presented 15 in GCS, left ptosis, left VII cranial nerve deficit, decannulated, KPS 100%.*
CONCLUSION: *A step-to-step multidisciplinary approach both with Neurosurgeons and Maxillo-facial surgeons is mandatory in Cranial Gunshot Injuries where extensive damage is linked to a higher mortality.*

KEY WORDS: Cranial gunshot inuuries, Cranial reconstruction, Maxillofacial reconstruction

Introduction

Gunshot injuries of the viscerocranium are rarely reported. Penetrating wounds to the cranio-maxillofacial region pose a significant challenge for surgeons as they often comprise serious soft tissue, bone and cerebral defects. Less prevalent than closed head trauma, penetrating brain injury carries a worse prognosis [1]. Craniocerebral Gunshot Injuries (CGI) are the most lethal of all firearm injuries, with reported survival rates of only 7% to 15% [2]. With regard to mortality CGI can have a mortality rate after penetrating craniocerebral injury varying from 23% to 92%, with higher mortality rates in patients with poor neurologic status on presentation. After surgical interventions mortality rates of CGI have been reported to be about 20% in earlier studies and 7.4% to 18.7% in recent studies.

Pervenuto in Redazione Aprile 2020. Accettato per la pubblicazione, Giugno 2020
Correspondence to: Davide Luglietto MD, Viale Mario Bracci, 53100, Siena, Italy (e-mail: davideluglietomd@gmail.com)

ABBREVIATION

CGI: Craniofacial gunshot injuries
GCS: Glasgow Coma Scale
ICP: Intracranial Pressure
ICH: Intracranial hemorrhage

Case Report

We present a case report of a 42-year-old female with gunshot wound to the viscerocranium after suicidal attempt. GCS score at the arrival was 8/15 (E2 V1 M5). Classification of the wound as for Matson CGI was class IV [3,4]. The inlet wound was in the submental region whereas the outlet one was in the left temporal skull area (Figs. 1, 2).
Firstly, before the maxillofacial surgical treatment, an internal maxillary artery embolization was performed to avoid risk of excessive bleeding.

Fig. 1: Inlet wound.

Fig. 2: Outlet wound.

Secondly, tracheostomy, surgical reduction of multiple maxillo-facial fractures and ocular avulsion were performed by the maxillofacial surgeons. More specifically, an orbito-zygomatic complex fracture was found on the left, therefore an orbital roof reconstruction was performed. Contention and reduction of left maxillary fractures were also performed. Eventually, hemostasis and suture of the buccal floor, tongue and mucosa of the hard and soft palate were also achieved.
In a second time, ICP monitoring revealed elevated values of intracranial pressure not responsive to hyperventilation, mannitol and hypertonic solution. After 6 hours, due to increased ICP and a CT scan which revealed ICH signs due to intraparenchimal injures, the patient

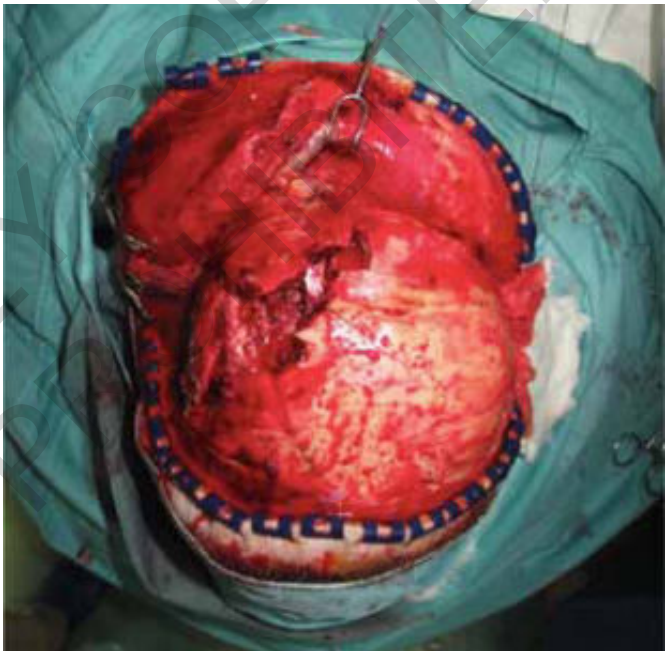

Fig. 3: Intraoperative image after bicoronal approach.

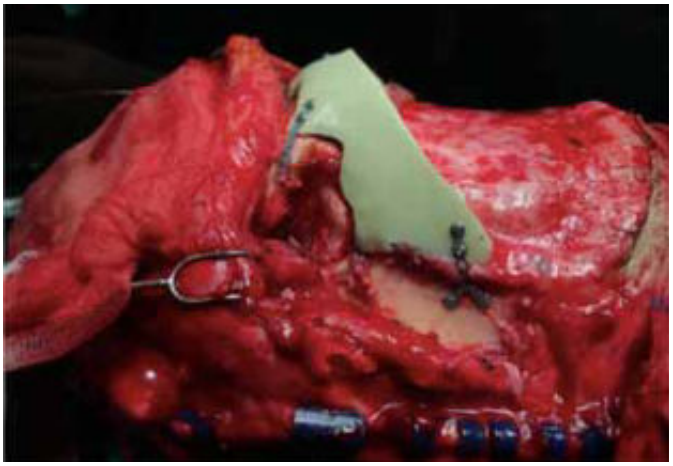

Fig. 4: Intraoperative image of the cranioplasty. Reconstruction of the orbital roof with a PMMA prosthesis.

underwent a second surgical procedure. After a bicoronal incision the pericranial tissues were unglued with preservation of the aponeurotic galea, thereafter used to cranialize the frontal sinus. Bone fragments were removed and a bifrontal decompressive craniectomy was done (Figs. 3, 4).
The patient was discharged on day 20 post-op to a rehabilitation center.
According to the internal guidelines of our department reposition of the autologous bone cap or customized cranioplasty is performed approximately one month after discharge from the rehabilitation center in order to avoid an increased risk of nosocomial infections.
As for the complexity of the case and the operative risks, we chose to utilize a two-pieces-custom-made PMMA implant.
Due to a socio-economical adverse situation she returned for the reconstruction to our department only 4 months later. Neurological examination at the admission was GCS 15/15, left ptosis, left VII cranial nerve deficit, decannulated, Karnofsky Performance Score (KPS) 100%.
After re-opening the previous surgical wound, the orbital prosthesis was placed at first; then the orbital roof was removed in order to avoid reopening of the dura mater and complications such as CSF leakage. Eventually the double-pieces prothesis was placed thus obtaining an excellent result (Figs. 4, 5, 6).
No post-surgical complication was observed. A good esthetic outcome was obtained with complete functional autonomy in activities of daily living.

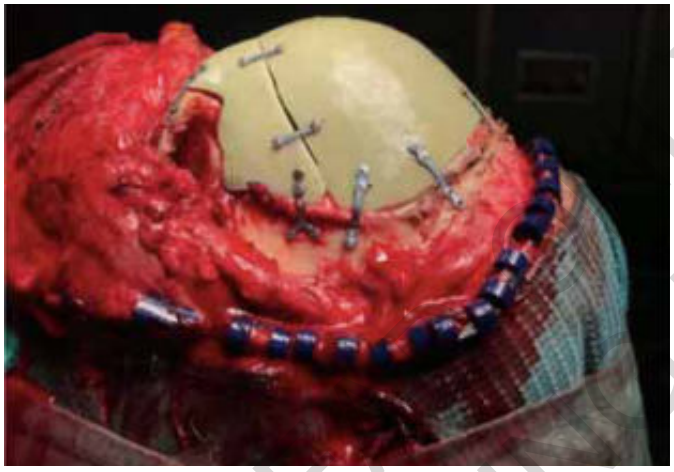

Fig. 5: Intraoperative image after repositioning of the double-piece prosthesis.

Fig. 6: Intraoperative image after repositioning of the double-piece prosthesis.

Discussion

CGI is identified as a highly lethal or devastating violent condition, able to produce marked consequences to the affected individual, the family and the health system itself. It is important to recognize the role of vigorous and intense resuscitation but should always be evaluated together with predictors of mortality, to provide an individualized treatment approach, especially because injuries as each projectile are different and unique.
Graham et al. [5] recommend no treatment in patients presenting with GCS 3-5 after resuscitation unless there is an associated operable haematoma. In fact, the economic and psychosocial burden of caring for these disabled survivors would be immensely expensive. On the other hand, patients with a GCS ≥8 should be treated aggressively [5].
There have been few recent studies involving penetrating craniocerebral injuries and most of them were restricted to small numbers of patients. Therefore, they failed to plan a definitive management protocol for prediction of mortality. Moreover, modern craniofacial surgery offers effective reconstructive strategies to treat defects resulting from gunshots including custom-made prosthesis and microsurgical technique which have been extensively reported in literature [6,7,8].

Conclusion

A step-to-step multidisciplinary approach was essential in this case to obtain a good outcome. As a result the patient has had a complete recovery of autonomy in the activities of daily living.
Therefore, it is heightened urgency to continue promoting research in a neurocritical care such as CGI in order to produce positive impact on the quality of life of CGI survivors [9].

Riassunto

Raramente vengono riportate in letteratura lesioni da arma da fuoco del viscerocranio. Le ferite penetranti nel-

la regione cranio-maxillo-facciale rappresentano una sfida significativa per i chirurghi in quanto spesso comprendono gravi difetti dei tessuti molli, ossei e cerebrali. Presentiamo un caso clinico di una donna di 42 anni con una ferita da arma da fuoco al viscerocranio dopo un tentativo di suicidio. Sono disponibili serie di immagini del decorso della malattia.

DESCRIZIONE DEL CASO: Una donna di 42 anni si è presentata con una ferita da arma da fuoco al viscerocranio dopo un tentato suicidio. All'arrivo il GCS era 8/15 e l'esame obiettivo mostrava la ferita in ingresso nella regione submentale mentre quella in uscita nella zona temporale sinistra. Dopo le prime procedure di salvataggio, prima di procedere chirurgicamente, è stata monitorata la pressione intracranica (ICP). A causa dell'emorragia massiva, è stata eseguita l'embolizzazione dell'arteria mascellare interna. Successivamente, si è proceduto alla tracheostomia, alla riduzione chirurgica delle fratture multiple del mascellare e ad avulsione oculare. In un secondo tempo il monitoraggio della PIC e la TAC hanno rivelato segni di emorragia intracranica (ICH) per lesioni intraparenchimali. La paziente è stata sottoposta a una seconda procedura chirurgica, consistente in craniectomia decompressiva bifrontale. La paziente è stata dimessa il 20° giorno post-operatorio ed affidata ad un centro di riabilitazione. È tornata nel nostro dipartimento dopo 4 mesi per eseguire una ricostruzione cranio-maxillo-facciale. Si presentava con un GCS di 15/15, ptosi sinistra, deficit del VII nervo cranico di sinistra, senza tracheostomia e con KPS (Karnofsky Performance Score) del 100%.

CONCLUSIONE: Un approccio multidisciplinare graduale sia con i neurochirurghi che con i chirurghi maxillo-facciali è obbligatorio nelle lesioni craniofacciali da arma da fuoco in cui un danno esteso è correlato ad una mortalità più elevata.

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