Gunshot Injuries of the Brain

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ABSTRACT

Missile injuries of the head account for the majority of penetrating wounds of the brain and are responsible for a significant number of deaths. During the period 1998-2004, 200 patients with gunshot brain injuries, 189 males and 11 females were treated at Sana'a University Hospitals, aged 2-65 years, the follow up continued from 5 months - 6 years. 162 patients were operated. 24 died before operations, 13 of them due to non early management in spite of their mild to moderate initial injuries. 14 patients treated conservatively by just suturing and cleaning of the wound. 92 patients got good outcome, 23 patients with moderate disability, 20 patients with severe disability and 27 died. Anti epileptics couldn't be stopped in 44 patients. We concluded that in addition to well known factors affecting morbidity and mortality, early management with less aggressive neurosurgical technique can reduce mortality and morbidity in these cases. (Egypt J. Neurol. Psychiat. Neurosurg., 2006, 43(1): 201-206)

INTRODUCTION

In Yemen there are about 5,000,000 firearms owned by ordinary persons. They consider them as parts of their personalities. Gunshot injuries of the brain have been changed from one uniquely military to broadly civilian concern. Gunshot wounds are the primary cause of PBI. Military PBI differs from civilian PBI in the mechanism of injury and severity. The injury of the brain is a function of release over time. In the military setting, penetrating injuries that reach emergency medical attention are predominantly caused by shells and shrapnel injuries. Because of the extremely damaging nature of the cerebral injuries inflicted by the high velocity of bullets commonly found in war injuries, the majority of those suffering battlefield gunshot wounds to the head presumable never reach medical care. Although evacuation times from the front line to military hospitals has been considerably improved in the past two decades, the average time to arrival at the hospital is considerably longer than the reasonable time. Nevertheless, there have always been many problems associated with the transport and treatment of war casualties. Medical care should be started at the front lines as soon as possible.

In civilian injuries, the average time from injury to hospital is less than that of military. Gunshot injuries of the brain may be tangential, perforating (through and throw, has inlet and outlet), or penetrating (with inlet only).

MATERIALS AND METHODS

During the period (1998-2004) 200 patients with brain injuries by gun shots 189 males, 11 females, aged 2-65 years, Their Glasgow coma scale were (3-8=90, 8-12=82 and 13-15=18). They classified into four groups according to time of arrival to the hospitals.

Initial, resuscitation and neurosurgical evaluation, according to G.C.S pupillary size. X-Ray Skull was done in all cases, CT-scan (Fig. 3) was done in 192 patients and MRI was done in 29 cases.

162 patients were operated depending on clinical evaluation and radiological findings. The operative procedures composed of debridement of
the scalp wounds, incision and dissection of the skin and the Gallia according to size of damage following by craniectomy or craniotomy. Removal of all necrotic tissues, evacuation of hematomas if the shifting of Medline >0.5 cm, accessible foreign bodies, movable bullets, washing of the track of the bullet by saline with local anti biotics (gentamycin). This helps bone fragments and foreign bodies to be removed out without destruction of brain tissues, hemostaisis, repair and water tight closing of dural defect (dura plasty) was done by precranial flab of temporal fascia or from the thigh, extra-dural vacuum drain. Non assessable, non migrating bullets were left without removal. In cases of movable bullets, we let the patient to lie in position which brings the bullet more surfacing. Cranioplasty has been done for 53 patients after 6-12 months of the first operation. Anti Biotic (triple). Anti epilepsy given for patients with cortical damage, artificial respiration when required and management of associated injuries. Follow up was done by clinical, ESR and radiological examination for period ranging from 3 months to 6 years. 14 patients were treated by just debridement and closing of the skin due to absence of criteria of more surgical procedures.

Table 1. Classification of patients.

<table>
<thead>
<tr>
<th>Groups</th>
<th>No. P.</th>
<th>Time of Arrival</th>
<th>Ass. Injuries</th>
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<tbody>
<tr>
<td>Group 1</td>
<td>80</td>
<td>Minutes to 24 h</td>
<td>45</td>
</tr>
<tr>
<td>Group 2</td>
<td>45</td>
<td>24-48 h</td>
<td>14</td>
</tr>
<tr>
<td>Group 3</td>
<td>47</td>
<td>48-72</td>
<td>11</td>
</tr>
<tr>
<td>Group 4</td>
<td>28</td>
<td>More than 72 h</td>
<td>2</td>
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</tbody>
</table>

RESULTS

There were associated injuries in 72 patients, spinal cord injuries in 11 cases, skeletal injuries in 28 patients, abdominal gun shots in 9 cases and thoracic in 7 cases other remaining with superficial injuries at different sites. 38 patients with retained intracranial bullets, inlets and outlets were clear in 112 cases, in-driven bone fragments were present in 45 patient. 53 patients had hemorrhagic contusion with in-driven bones, 15 patients with cortical contusion without in-driven bones or fragments, 105 patients with large hematomas and mass effect, 14 patients with distant contusion, intra-ventricular hemorrhage in 43 patients and multi-lobar injuries in 48 patients. MRA and MRI revealed no aneurismal complication. 24 died before surgery, 13 of them due to non-specific early management, in spite of their mild to moderate initial injury (G.C.S more than 10). The remaining 11 had multiple injuries.

162 cases operated final outcome (Fig. 1), 5/9 patients developed brain abscess were group 3, 2/9 group1 had CSF leaks and 2 group 4, one after 12days and one after 28 days. 15 patients with wound sepsis 3 group 1, 4 group 2, 6 group 3, 2 group 4. 19 patients with hydrocephalus distributed on different groups as follow 8, 2, 6, 3, 27 patients died distributed on groups as follow 6, 11, 7, 3 of the six died at group one, 4 had abdominal gunshot, one fracture femur and one with hemothorax. Anti epileptics cannot be stopped in 44 patients distributed on groups as follow 15, 12, 10, 7. There were 38 retained intracranial bullets (Fig. 2) distributed on groups as follows 20, 3, 9, 6. CT-scan examination is more accurate for localization of retained bullets. These retained bullets removed from 32 patients and not removed from 6 patients with non-migrating bullets and stable condition.
Fig. (1): Final outcome.

Fig. (2): Retained migrating bullet.
Fig. (3): CT Scan is the modality Fig.2 Of choice for diagnosis.

DISCUSSION

Harvey Cushing was the first who recommended early and definitive surgical interference for these injuries\textsuperscript{15}. During the Vietnam War aggressive initial debridement of missile track was advocated to reduce the rate of infections, abscess formation and decrease mortality rate\textsuperscript{7,9}. The reduction of the rate of mortality according to Arabia, 1987, was due to the early surgical management, mean time was 49 hours\textsuperscript{3}. The range for others was (7-450 hours)\textsuperscript{4,9}. The results of this work are in agreement with suggestion of Gonul et al. (1997), who found that lower mortality rate and survivability decision reflect as much as treatment effectiveness and with others that the time factor and accurate management are prognostic factors\textsuperscript{2,3,7,11,19,20}. Amir jamshidi et al. (2003) concluded that not only is re-operation for retained bone or fragment unnecessary but the modern neurosurgeons have the recent facilities to know the cause of change of (G.C.S.)\textsuperscript{11}. Until the end of Vietnam War, the aggressive procedures were the rule\textsuperscript{7,9}. No aggressive procedures or repeated surgery used to remove non accessible bone fragments or shrapnel\textsuperscript{2,3,4,9,12,13,28,16}. Due to the use of umbrella of broad spectrum anti biotic, shared in lowering of infections and abscess formation leading to improving of morbidity and mortality rate\textsuperscript{2,3,8,17}. In our study of the 24 cases, 13 died pre-operative due to non early management in spite of their moderate injuries and the others due to multiple injuries. These results are comparable with that of
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REFERENCES


Arendall and Meirowsky (1983) reported of an infectious rate of 5% for patient underwent surgery within 12 hours as compared with 38% for those their surgery delayed more than 12 hours17. The highest incidence of hematomas occurrence is between 3-8 hours11. We found that also the highest percentage of infection and mortality rate occurred with delayed definitive surgery. Non curable epilepsy existed in 44 cases. Prophylactic anti-epilepsy medication was given to all patients, 17 patients with dilated pupils improved after application of anti-epilepsy. The results of this study are in the range of other studies8,10,12. But we found 31 cases among patients with delayed management improved after application of anti-epilepsy. Mortality and morbidity can be significantly reduced by early debridement, removal of all in-driven debris and meticulous dural and scalp closure15,17.

Extensive debridement of the in-driven bone, shell fragments, and debrises, the completely as well as the partially devitalized adjacent brain tissue would also be removed. This might have led to additional neurological deficit or lesser degree of recovery of functions1,2,8,14,18,19.

During the recent war in Lebanon- at one hospital one fifth of all casualties admissions were patients with skull injuries associated with penetrating brain damage. Wounds inflicted by high velocity missiles carried the greatest mortality. The patient's state of consciousness afforded the best guide to prognosis. Thorough debridement and complete homeostasis are essential and when these have been accomplished, deeply placed bony fragments may be left in situ with impunity. Traumatic aneurysms develop22. No cases of traumatic aneurysms in our study. We agree with Hammon7 that cranioplasty must be delayed for one year.

Conclusion

Early meticulous neurosurgical management of gunshots brain injuries with less aggressive technique gives less complication and better neurological results.