Original Article

Gunshot Injuries to Brain

Factors Predicting Poor Outcome in Gunshot Injuries to Brain

Muhammad Yousuf Shaikh, Muhammad Aamir Saghir, Salman Sharif and Samir Irfan

ABSTRACT

Objective: In view of the recent rise in the incidence of gunshot injuries, it is quite mandatory for scientific studies evaluating the prognostic factors contributing to the outcome of such patients. This study aims to identify such factors and evaluate them clinically

Study Design: Retrospective study

Place and Duration of Study: This study was conducted at the Department of Neurosurgery, Liaquat National Hospital & Medical College, Karachi from July 2012 to July 2017.

Materials and Methods: All patients that suffered gunshot injury from July 2012 to July 2017 were included in the study. Exclusion criteria included all patients that were brought dead or expired within two hours of surgery. Duration of stay, CT scan findings and GOS (Glasgow outcome score) were used to evaluate the prognosis of the patients. The prognostic factors evaluated in the study included age, sex, time of presentation and GCS on presentation.

Results: This study included a total sample size of 45 patients after inclusion and exclusion based on established criteria. The average age of the patients was 32 years. About 15% of them were female while 85 % were male. Majority of the patients presented more than 24 hours after the incident (71%). Overall mortality was 6 %(3 patients). On further analysis, higher GCS was associated with a better outcome (<0.05). Our study also showed that extensive brain injury was associated with a poor outcome with a statistically significant difference (<0.05)

Conclusion: Gunshot injuries to brain represent a high mortality and neurosurgical emergency. Admitting GCS and number of lobes involved were identified to be the most important predictors of poor outcome but if managed aggressively will have favorable outcomes.

Key Words: Firearm, head injuries, multilobar, Glasgow Outcome Scale

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INTRODUCTION

Gunshot injuries to brain are relatively rare but recently there has been a significant increase in the number of cases being reported. Overall, there has been a global increase in firearm injuries across America, Europe, UK and Asia[1]. Firearm injuries to head are not only fatal but occasionally result in severe morbidity, both physical and psychological for the patient and family[2]. Mortality rate of up to 88% has been reported in some studies and majority of them die in the first 48 hours[3,4]. Since majority of the victims are male and bread earners of their families, the economy of the country suffers greatly. In 1996, World Health Organization declared Violence as one of the leading concerns of public health and proposed to take appropriate actions in order to prevent them[5].

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Pakistan is no different and suffers a similar fate. However, due to poor law and order situation and increasing crime rates, gunshot injuries to head are becoming increasingly common. One of the studies indicates that firearms are a common cause of violent deaths in young males of Pakistan with death rates estimated to be 4.22/100,000 per year[6]. Managing patients with Gunshot injuries to brain pose a treatment challenge. The extent of brain damage caused by a bullet is dependent upon the energy of the bullet. Since majority of civilian gunshot injuries are caused by low velocity bullets, less brain destruction is produced as a result. Therefore, using aggressive resuscitation measures, more lives can be saved and much of the neurological function preserved[7]. The objective of our study is to identify the prognostic factors that lead to poor outcome.

MATERIALS AND METHODS

This study was conducted at the Department of Neurosurgery, Liaquat National Hospital & Medical College, Karachi from July 2012 to July 2017.

Inclusion Criteria: All patients presenting with gunshot injuries to head in past 3 months

Exclusion Criteria: Patients who were brought dead. Patients who expired within 2 hours of presentation

This retrospective study was conducted in Liaquat National Hospital, Karachi which is a level 2 Trauma centre. The hospital is situated in the middle of city which caters to the needs of many patients. It is a 750 bedded hospital with 50 ICU beds availability with ventilator support. The Emergency Department is well equipped with all life saving modalities and 3 ventilators. All gunshot patients are managed according to ATLS protocol and are responded by a Trauma team. All the patients who presented with Gunshot injuries to Head in Emergency and OPD from July 2012 to July 2017 were recruited in the study.

Information was gathered from the patient's case files which included the GCS at arrival, time of arrival since injury, surgery performed, CT scan findings and outcome with GCS on discharge and Glasgow outcome score (GOS) with 5 = good recovery, 4 = moderate disability, 3 = severe disability . 2 = persistent vegetative state and 1 = death. For statistical analysis, patients were categorized in to 2 groups; poor outcome (GOS 1-2) and satisfactory outcome (GOS 3-5). Similarly, based on admitting GCS, patients were classified into 4 groups; minimal or no neurological deficits (GCS 14-15), significant deficits without coma (GCS 9-13), comatose but not moribund (GCS 5-8) and moribund (GCS 3-4) Inclusion criteria were all patients who sustained gunshot injury to head in past 3 months. Exclusion criteria were patients who were brought dead or expired within 2 hours of injury. All the data was manually checked and entered to be analyzed using SPSS version 16. Pearson's Chi-squared test was used to analyze the relationship between GCS score on admission and GOS. The Ethical committee approval was taken prior to conducting the study.

RESULTS

A total of 45 patients fulfilled the inclusion criteria and were enrolled in the study. The demographics of the patients were as such that 7(15%) patients were female while the remaining 38 (85%) patients were male. Majority of the patients were aged between 20 to 40 years, the mean age being about 32 years. This included 37 patients representing (82%) of the study group. 4(8%) patients were aged below 20 and 4(8%) above 40 years

Time of presentation after the incident was also recorded along with the presenting GCS. Out of the 45 patients, 13(29%) patients presented within 24 hours of the incident while remaining 32(71%) patients presented after a variable period of 1 - 90 days.

All such patients were managed according to ATLS protocol and trauma team was activated to resuscitate all patients. Once stable, CT scan was performed in all patients prior to planning any surgical intervention. Overall mortality was 3 (6%) while all the remaining 42(94%) patients survived.

35 (77%) patients underwent surgery, while the remaining 10 (23%) were managed conservatively. Of the 42 survivors at discharge, 25 (59%) had good recovery, 6 (14%) had moderate disability and 9 (21%) had severe disability. 2 (4%) patients were in persistent vegetative state.

Outcome Analyses: 24 patients with a GCS Score of 14-15 had satisfactory outcome while 1 patient had poor outcome. 11 patients with a GCS of 9-13 had satisfactory outcome while 1 had poor outcome. All 5 patients with GCS of 5-8 had satisfactory outcomes while all 3 Patients with GCS 3-4 had poor outcomes. Our statistical analysis reveals that a higher admitting GCS was associated with significantly higher number of satisfactory outcome. (Pearson's -X2 test, P Value < 0.05).

Table No.1: GCS Scores and Outcome

GCS Score	Glasgow outcome score					Total
	Poor Outcome		Satisfactory outcome			
	1	2	3	4	5	
14-15	1		4	3	17	25
9-13		1	3	2	6	12
5-8			1	2	2	5
3-4	1	2				3
Total	2	3	8	7	25	45

Table No.2: CT findings and GOS

CT Scan findings	Glasgow outcome score					Total
	Poor outcome		Satisfactory outcome			
	1	2	3	4	5	
Limited injury	1	1	4	6	20	32
Extensive Injury	1	2	4	1	5	13
Total	2	3	8	7	25	45

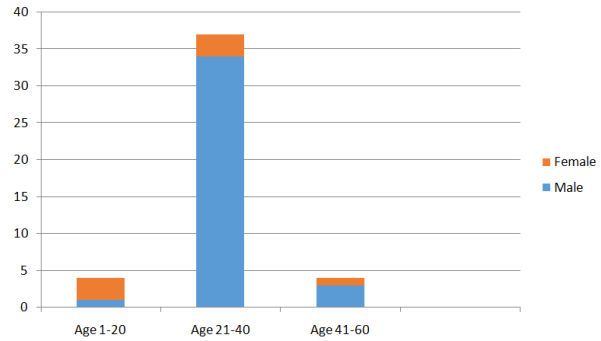

Figure No.1: Demographics of study group

CT scan was performed for all 45 patients which demonstrated 7 (15%) patients with bullet tract involving the scalp and soft tissue with no penetration of bone or Dura. 25 (55%) patients had involvement of one lobe while the remaining 13 (29%) patients had multilobar injuries. Patients with single lobe injuries and non penetrating dural injuries were included in the

limited brain injury group while the multilobar injuries were included in extensive brain injuries group. Of the 32 patients with limited brain injury, 30 (93%) had satisfactory outcomes while 2 (6%) patients had poor outcome. Among the 13 patients with extensive brain injury, 10 (77%) patients had satisfactory outcome while 2 (15%) had poor outcome and one patient (7%) expired. Statistical analysis revealed that there is correlation between extent of brain injury and outcome with extensive brain injuries having a higher chance of leading to a poor outcome. (Fisher's exact test, P value < 0.05)

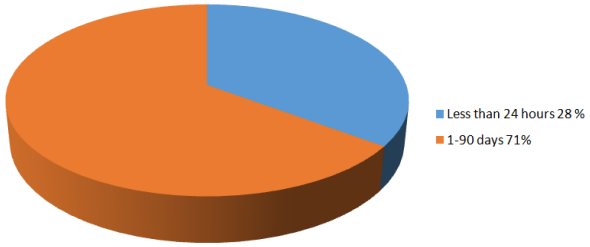

Figure No.2: Presentation times of patients

DISCUSSION

Firearm injuries are generally classified in to two groups, high velocity and low velocity with the demarcation of 600 meter/second between the two groups. Since majority of civilian firearm injuries are caused by low velocity projectiles, the extent of brain damage is relatively less compared to military weapons. Majority of deaths occur in the first 3 hours of injury[9]. Therefore all such injuries require aggressive management and resuscitation. Patients with stable vital signs and Pupil reactivity are potentially salvageable patients. These are the patients who will benefit greatly from immediate resuscitation and surgical intervention if warranted with the objective of preventing secondary brain injury. Bizhan Arabi et al reported a mortality rate of up to 91% in cerebral gunshot injuries[9]. They also reported as presenting GCS is the most important predictor of outcome. Another study conducted by Bellal Joseph et all reported a survival rate increment from 10% to 46% by adopting aggressive resuscitation measures[10]. However our study had dramatically better outcome and survival rates of up to 94%. This could be related to the fact that more than half of the patients in our study sample presented after 24 hours of injury and patients which expired within the first 2 hours or were brought dead on arrival were excluded from the study. These appear to be the two factors that show better survival rates in our study. It is also worth noticing that some of our patients 15 (33%) were from Afghanistan who had gunshot injuries to various parts of the body including brain and after surviving the initial injury, came to Pakistan for further management. These were mostly civilians who were shot during the ongoing war in their country. Majority of such patients had CSF leak or abscess and required through wound debridement and duroplasty with antibiotics. The theory that the bullet injuries are sterile due to the heat of the bullet is completely false because the bullet draws in foreign material including clothing and hair in to the wound which acts as a foreign material triggering an inflammatory reaction. Since all cases of Dural penetration will lead to some CSF leakage, the risk of meningitis and cerebritis remains which emphasizes the importance of administering prophylactic antibiotics. In our setting, antibiotics were given to all patients considering the poor wound hygiene of patients and bullets being impacted in brain parenchyma. Carlos Mari et al reported that passage of bullet trajectory through sinuses and presence of metallic fragments are independent risk factors of causing infection[11]. In our study, patients underwent surgery for the purpose of wound debridement, removal of space occupying hematoma or abscess, in driven accessible bone fragments and bullet. No attempt was made to retrieve all bone fragments or explore deep seated impacted bullets.

Another important observation from our study was that majority of the victims (82%) were aged between 20 to 40 with male predominance. This represents the working class of society; hence having these patients bed bound leads to significant loss of productivity and burden on a struggling economy.

CONCLUSION

Gunshot injuries to brain represent a high mortality neurosurgical emergency. Admitting GCS and number of lobes involved were identified to be the most important predictors of poor outcome. All patients particularly those with admitting GCS of more than 8 if managed aggressively have improved outcome, hence surgical treatment of all such injuries should never be delayed.

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Author's Contribution:

Concept & Design of Study:	Muhammad Yousuf Shaikh
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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