Original Research Article

DOI: http://dx.doi.org/10.18203/2349-2902.isj20184083

Outcome of traumatic Extradural Hematoma (EDH) using Glasgow Outcome Scale (GOS)

Dixit V. Prajapati*, Nimish J. Shah

Department of Surgery, Government Medical college, Vadodara, Gujarat, India

Received: 25 July 2018 Accepted: 29 August 2018

*Correspondence: Dr. Dixit V. Prajapati,

E-mail: dixitprajapati72@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Outcome in patient with EDH depends on various factors like GCS at presentation, Volume of hematoma, time of intervention, age, location of hematoma, etc. This study was carried out to find out correlation (if any) between outcome and various factors affecting it. Aim and objectives of this study were to study outcome of patients with traumatic EDH in terms of poor outcome (GOS score 1,2,3), Good outcome (GOS Score 4,5)

Methods: This study was carried out in 91 patients having positive CT Head for EDH. Follow up was done every monthly up to 3 months. GOS was recorded at each follow up.

Results: Road traffic accident was the most common mode of trauma. 16 patients were operated. Four patients died immediately after diagnosis of traumatic EDH, before doing any intervention. One patient died on 1st post-operative day. After one month, two patients were lost to follow up, 80 patients had GOS 5, four patients had GOS 4. At 2nd and 3rd month, 83 patients had GOS 5, one patient had GOS 4. 17 patients had GCS 3-8, among them, 11 patients had GOS 5, one patient had GOS 4 and five patients died (GOS 1). 15 patients had GCS 9-12, among them, 15 patients had GOS 5. 57 patients had GCS 13-15, among them, 54 patients had GOS 5. 69 patients had EDH volume <30 ml and all patients had GOS 5. 20 patients had EDH volume ≥30 ml, among them, 14 patients had GOS 5, one patient had GOS 4 and five patients died.

Conclusions: GOS in EDH patient is affected by GCS and EDH volume at presentation. Lower GCS and larger EDH volume have poor outcome. Surgical intervention in larger EDH volume improves outcome.

Keywords: Extradural hematoma, Glasgow coma scale, Glasgow outcome score

INTRODUCTION

Head injury is a frequent cause of emergency department attendance, accounting for approximately 3.4% of all presentations, with an incidence of around 450 cases per 100000 population per year. Head injury associated with traumatic brain injury (TBI) occurs with an incidence of 20-40 cases per 100000 population per year. It is the most common cause of death in young adults (age 15-24 years) and is more common in males than females. Road

traffic accidents (RTAs) are the most common cause of TBI in the UK, followed by falls and assaults.¹

- Extradural haematoma occurs in approximately 2% of all patients with head injuries and 5–15% of patients with fatal head injuries.
- EDH is considered to be one of the most serious complications of head injury, requiring immediate diagnosis and surgical intervention.
- EDH may be acute (58%), subacute (31%) or chronic (11%).

- It usually occurs in young adults and is rare in children below 2 years of age (due to the plasticity of the immature calvarium) or after age 60 (because the dura is adherent to the overlying bone).²
- The incidence of delayed extradural haematoma (DEDH) following an initially negative CT scan is reported in 10-30% cases.

At the time of impending of the skull or a fracture line crossing the groove of middle meningeal vessels may tear the trunk or branches of middle meningeal artery, diploic vein, or dural venous sinus would result in EDH. Rupture of arterial wall results in rapid expansion of hematoma and rapid deterioration of conscious level, while bleeding from a vein or diploic channels develop EDH after some time. Frequent neuro-observation should be done in such cases and GCS should be monitored. Deterioration of conscious level and developing focal signs like ipsilateral pupil dilatation and contralateral hemiplegia, and up going planters signify a rapidly expanding EDH.³⁻⁵

An urgent Computed Tomography (CT) scan in such cases will reveal biconvex hyperdense, extradural lesion causing effacement of ventricle and midline shift. Craniotomy and evacuation of hematoma is the only way to save the life of these patients from a potentially fatal benign lesion.

Early definitive diagnosis and management of extradural hematoma decrease morbidity and mortality as well as achieving maximal functional and aesthetic rehabilitation. Outcome in patient with EDH depends on various factors like GCS at presentation, Volume of hematoma, time of intervention, age, location of hematoma, etc. There were 5 types of outcome of EDH patients we have measured in our study, good recovery, moderate disability, severe disability, vegetative state and death. This study was carried out to find out correlation (if any) between outcome and various factors affecting them at various extent.

METHODS

This study was carried out in SSG Hospital, Baroda from November 2015 to November 2016. The total number of patients were 91. Patients having Head Injury with EDH on CT Head were included. Patients who had history of pre-existing Neurological deficit and Intracranial lesion other than EDH were excluded.

After selecting patient for study on positive CT head for EDH, mode of injury, time of injury, time of presentation, time of CT head, time of operation, GCS on presentation, pupillary reaction, neurological deficit, location and volume of EDH on CT head were noted.

The volume of EDH was calculated using the Peterson and Epperson equation $a \times b \times c \times 0.5$, where a, b, and c represent diameter of the hematoma in the sagittal, axial and coronal planes respectively.

Volume of EDH and dealing with bony defect were noted in patients who were operated. GCS, fresh symptoms, pulse rate, blood pressure, neurological examination were noted daily who were kept conservatively till discharge and who were operated. GOS was noted at Discharge Patients were followed up every month for 3 months and were monitored for neurological examination and GOS.

RESULTS

There were 91 patients who had traumatic extradural hematoma, diagnosed on CT Head, from November 2015 to November 2016 in SSG Hospital, Baroda.

There were 81 males (89.01%) and 10 females (10.98%) patients with mean age of 37.74 years (range 10 years to 86 years) (Figure 1).

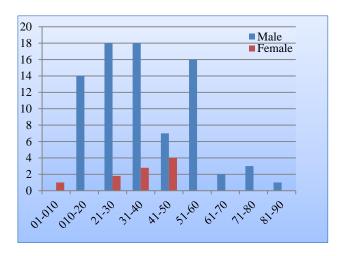


Figure 1: Age and sex distribution.

Road traffic accident was the most common mode of trauma accounting for 82.42% patients, among them 75.82% were male and 6.6% were female patients. Assault and fall constituted about 17% of cases as mode of trauma (Figure 2).

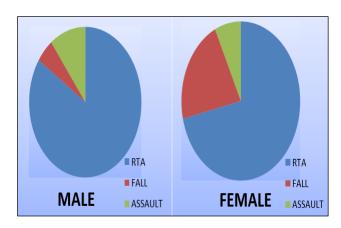


Figure 2: Mode of trauma.

On admission, 57 patients (62.64%) had a GCS of 13-15, 15 patients (16.48%) had GCS of 9-12, and 19 patients

(20.88%) had GCS of 3-8. Thus, majority of patients (~79%) had GCS of >8 on presentation (Figure 3).

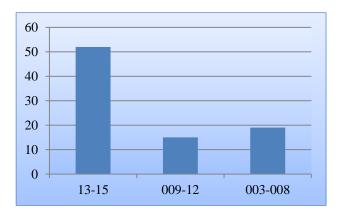


Figure 3: GCS on presentation.

Among 91 patients, 34 patients had EDH in frontal region instead of on Frontal region (F), 7 patients had in frontoparietal region, 3 patients had in occipital region, 11 patients had in parietal region, 12 patients had in parietotemporal region, 21 patients had in temporal region, one had frontoparietotemporal region, two patients had in bilateral frontal region. The most common site for EDH was frontal region (37.4%) followed by temporal region (23.1%) (Figure 4).

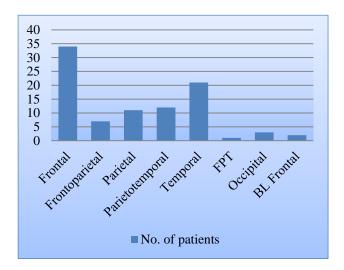


Figure 4: Location of EDH.

Among 91 patients, 69 patients (75.8%) had volume of EDH on CT Head <30 ml, while 22 patients (24.2%) had EDH volume ≥30 ml. Among study patient's minimum volume of EDH was 10 ml and the maximum volume of EDH was 89 ml. Mean volume was ~24 ml (Figure 5).

Surgical intervention (craniotomy and evacuation of hematoma) was carried out in 16 patients. The decision for intervention was taken considering the volume of EDH on CT head, presence of focal neurological signs and detoriation of neurological status. One patient had EDH volume 23 ml, but GCS was detoriating so surgical

intervention was done while three patients had EDH volume \geq 30 ml but they had given negative consent for surgical intervention.

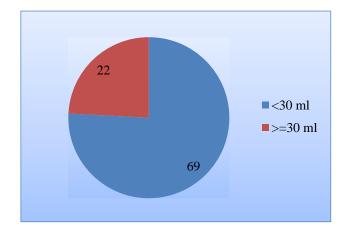


Figure 5: Volume of EDH.

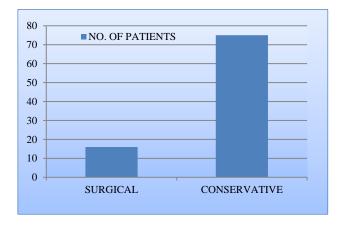


Figure 6: Management.

16 patients (17.6%) were managed surgically, craniotomy and evacuation of extradural hematoma. 75 patients (82.4%) were managed conservatively. Most of the patients (82%) were managed conservatively (Figure 6).

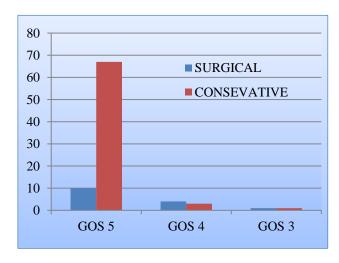


Figure 7: Patients' outcome at discharge (n = 86).

Four patients died immediately after diagnosis of traumatic EDH on CT Head, before doing any intervention. One patient (52 years old male) died on 1st post-operative day who had GCS 3/15 on admission. Mode of injury was fall from height, CT head showed 40 ml EDH on Right Parietal region. Intra operatively, 50 ml hematoma evacuated from Right pariertal region, source of bleeding was meningeal artery. So total 86 patients were discharged. 89.5% patients had good outcome (GOS 5) at discharge, among them, 77.9% patients were managed conservatively, and 11.6% patients were operated. 8% patients had moderate (GOS 4) and 2.4% patients had poor outcome (GOS 3) (Figure 7).

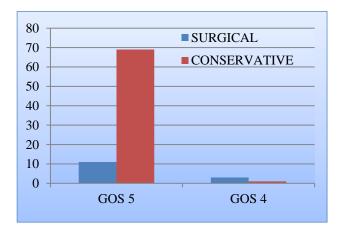


Figure 8: Patients' outcome at 1st month (n=84).

All discharged patients were examined after 1 month in follow up, amongst them, two patients were lost to follow up after discharge from hospital. The patients who were lost to follow up had GOS of 3 and 4 at the time of discharge. 80 patients (95.2%) had GOS 5 (Good outcome), amongst 11 patients (13.1%) were operated and 69 patients (82.1%) were managed conservatively. Four patients (4.8%) had GOS 4 (Moderate outcome), among them, three patients (3.6%) were operated and one patient (1.2%) was managed conservatively (Figure 8).

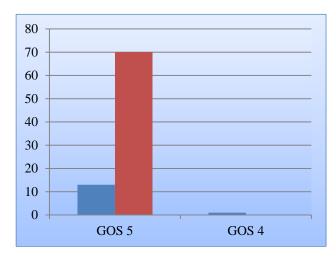


Figure 9: Patients' outcome at 2^{nd} and 3^{rd} month (n = 84).

At 2nd and 3rd month, 84 patients came for follow up. 83 patients (98.8%) had GOS 5 (good outcome), among them, 70 patients (83.3%) were managed conservatively and 13 patients (15.5%) were operated. One patient (1.2%) had GOS 4 (moderate outcome) who was operated. 3 patients who had moderate outcome on 1st month follow up had good outcome on 2nd and 3rd month follow up (Figure 9).

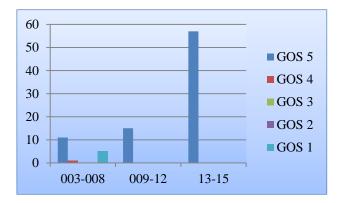


Figure 10: GCS on admission and outcome (at 3rd month) (n=89).

91 patients were admitted, amongst four patients died immediately after CT head during management, one patient died post operatively. Overall 86 patients were discharged. All discharged patients were examined after every month till 3 months, amongst them, two patients were lost to follow up after taking discharge from hospital. 17 patients had GCS 3-8/15, among them, 11 patients (12.4%) had good outcome (GOS 5), one patient (1.1%) had moderate outcome (GOS 4) and five patients (5.5%) died (GOS 1). 15 patients had GCS 9-12/15, among them, 15 patients (16.9%) had good outcome (GOS 5). 57 patients had GCS 13-15/15, among them, 54 patients (59.3%) had good outcome (GOS 5) (Figure 10).

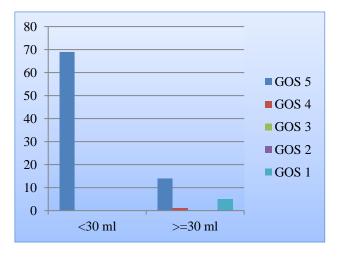


Figure 11: EDH volume and outcome (at 3rd month) (n= 89)

69 patients (77.6%) had EDH volume < 30 ml and all patients had good outcome (GOS 5). 20 patients had

EDH volume \geq 30 ml, among them, 14 patients (15.7%) had good outcome (GOS 5), one patient (1.2%) had moderate outcome (GOS 4) and five patients (5.6%) died (GOS 1). Two patients were lost to follow up after discharge (Figure 11).

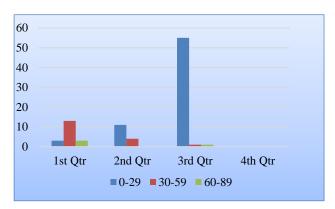


Figure 12: EDH volume on CT head and GCS at presentation (n=91).

19 patients had GCS 3-8/15, among them, 3 patients(3.3%) had EDH volume <30 ml, 13 patients(14.3%) had EDH volume 30-59 ml. 3 patients had EDH volume 60-89 ml. Majority of patients who had lower GCS , had EDH volume \geq 30 ml. 15 patients had GCS 9-12/15, among them 11 patients (12.1%) had EDH volume <30 ml, and 4 patients (4.4%) had volume 30-59 ml. 57 patients had GCS 13-15/15, among them, 55 patients (60.4%) had volume <30 ml, one patients (1.1%) had volume 30-59 ml and one patients (1.1%) had volume 60-89 ml. Majority of patients (16 patients) who had GCS 3-8 at presentation, had EDH volume \geq 30 ml on CT Head (Figure 12).

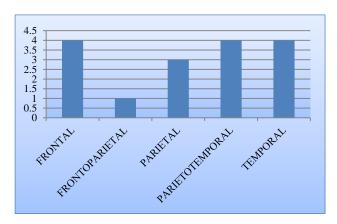


Figure 13: Intraoperative site of EDH (n=16).

Among 16 operated patients, 4 patients, each had EDH located in frontal, temporal and parietotemporal region. One patient had EDH located in frontoparietal region (Figure 13).

Minimum EDH volume was 30 ml and maximum EDH volume was 90 ml among operated patients. Mean

volume was ~51 ml. Five patients had volume between 50-59 ml (Figure 14).

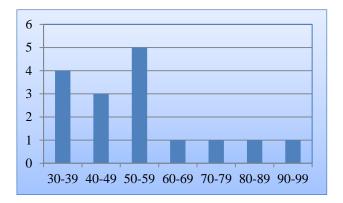


Figure 14: Intraoperative volume of EDH (n = 16).

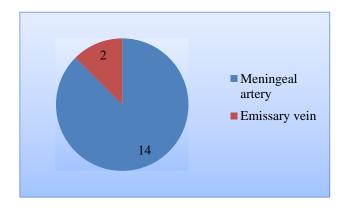


Figure 15: Intraoperative source of bleeding (n = 16).

The most common source of bleeding was meningeal artery in operated patients (87.5%). Source of bleeding was controlled by using bipolar cautery, bone wax on the foramen spinosum where the vessel enters the cranium and application of absorbable gelatin sponge (Figure 15).

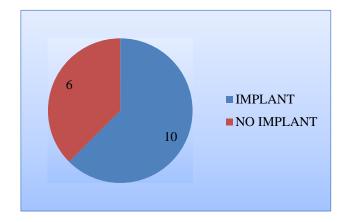


Figure 16: Intraoperative method of dealing with bony defect (n = 16).

Implant was used for bony defect in 10 patients (62.5%) who were operated. Bony flap without using implant was used for bony defect in 37.5% patients (Figure 16).

DISCUSSION

This age of multisystem injury among multiple injuries, extradural hematoma (EDH) is potentially dangerous. Extreme urgency in management is necessary in severe head injury with extradural hematoma (EDH).

As male is more mobile universally, being more prone to accidents and more exposed to fights and assaults, in each study group, male cases are high. As far as, age is concerned, in Phoebe et al, mean age was 37.7 years (range 1 month to 87 years) and in present study mean age is 37.7 years (range 10 years to 86 years). Head injury is more common in males than females.

According to Cheung et al.⁹ There were 78.7% male and 21.3% female patients. In a study by Knuckey et al.¹⁰ Male to female ratio was 3.4:1 and age range was 1-71 years. In this study, male to female ratio was 8.1:1. Similar observations were found in other studies.^{11,12} The reason for this difference may be that males are more prone to trauma as they are more mobile and travel more for their day-to-day activities than females. Most common age group was found to be 20-30 years followed by 30-40 years. Elderly patients having adherent meninges are less prone to extradural hematomas (Table 1).

Table 1: Sex distribution.

	Present study	Phoebe et al ⁶	Rehman et al ⁷	Islam et al ⁸
Male	81(89%)	70 (79%)	35 (92%)	94 (92%)
Female	10 (11%)	19 (21%)	3 (8%)	8 (8%)

Road traffic accidents were the commonest (82.4%) cause of extradural hematoma in all the studies. However, the relative proportions of RTA as mode of trauma is quite high (82.4%) in present study compared to other studies where the relative proportions range from 56% Phoebe et al to 65% Islam et al.^{6,7}

The incidence of assaults was relatively less common in present study as compared with various studies, Rehman et al (21%), Islam et al (20%). Fall accounted for a smaller number of cases in most studies including the present study except in study by Phoebe et al in which it constituted for about 30% of cases (Table 2).8

Table 2: Mode of injury.

Mode of injury	Present study	Phoebe et al ⁶	Rehman et al ⁷	Islam et al ⁸
Road traffic accident	75 (82.4%)	50 (56%)	24 (63%)	66 (65%)
Fall	7 (7.6%)	27 (30%)	6 (16%)	12 (12%)
Assaults	9 (10%)	10 (11%)	8 (21%)	24 (20%)
Others	0	2 (3%)	0	0

Location of EDH on CT Head, the most common site for EDH in present study was frontal region 37.3% (34/91). In other study Phoebe et al, Rehman et al and Islam et al, the most common site for EDH was temporal region. Location of extradural hematoma is very important for both patient and the surgeon. It determines the prognosis as well as ease for the surgeon to operate. Its location is more common in the distribution of middle meningeal artery and its branches. According to one study, (13) the site of extradural hematoma was parietooccipital in 24, posterior fossa in 11, frontal in 06, and temporal in 03 patients. Posterior fossa extradural hematomas are less common than supratentorial extradural hematomas. The incidence of posterior fossa extradural hematomas among intracranial extradural hematomas has been reported to be 4-7% and all cases had occipital fracture. 14 Most frequent location of extradural hematoma was found to be frontal area in this study, consistent with some other studies. There were three cases with posterior fossa extradural hematoma comprising 3.3% of the patients. Some studies have shown temporal and temporoparietal areas to be common areas of extradural hematoma. Hence, location of extradural hematoma is not consistent to one specific region. However, posterior fossa EDH is less common (Table 3).

Table 3: Location of EDH.

	Present study	Phoebe et al ⁶	Rehman et al ⁷	Islam et al ⁸
Frontal	36	15	7	22
	(39.6%)	(16.9%)	(18%)	(21.6%)
Temporal	21 (23.1%)	24 (27%)	12 (33%)	42 (41.2%)
Parietal	11	12	10	18
	(12.1%)	(13.5%)	(26%)	(17.6%)
Occipital	3 (3.3%)	5 (5.6%)	2 (5%)	4 (3.9%)
Multiple	20	34	7	16
	(21.9%)	(38.2%)	(18%)	(15.7%)

On comparing outcome in patients having GCS 13-15, in present study 64.0% patients had Good outcome scale (GOS), (GOS 5), in Phoebe et al and Rehman et al, 58.9% and 38.6 % patients had Good outcome (GOS 5) respectively. 15 patients having GCS 9-12, in present study 16.9% patients had Good outcome (GOS 5), in Phoebe et al and Rehman et al, 6.7% and 31.6 % patients had Good outcome (GOS 5) respectively.

Patients having GCS 3-8, in present study 12.4% patients had Good outcome (GOS 5), in Phoebe et al and Rehman et al, 7.8% and 5.3 % patients had Good outcome (GOS 5) respectively. In present study among GCS 3-8, 5.6% patients had GOS 1, in Phoebe et al and Rehman et al, 9.0% and 1 % patients had GOS 1 respectively. Those who had GCS 13-15 at presentation, had good outcome, compared to GCS 3-8 at presentation (Table 4).

On comparing, patients who had EDH volume <30ml, 77.6% patients had Good outcome (GOS 5), compared to

Rehman et al, 7.8 %. Among group of patients who had EDH volume ≥30 ml, 15.7% patients had Good outcome (GOS 5), while in study Rehman et al, it was 65.7%. It clearly showed patients who had <30 ml EDH volume, had good outcome. Rivas et al also found an unfavorable outcome in deteriorating patients and a hematoma volume of more than 50 ml. ¹⁶ Lobato, Lee and Servadi et al also reported the similar result. ¹⁷⁻¹⁹ In contrast, Van den Brink et al, found no correlation between EDH volume, GCS and outcome at 6 months, important to note that how in the above-mentioned studies directly correlated GCS and volume of EDH. ²⁰

Table 4: GCS at presentation and outcome.

GCS	GOS	Present study (n = 89)	Phoebe et al ⁶ (n = 89)	Rehman et al ⁷ (n = 38)
	5	57 (64.0%)	53 (58.9%)	14 (36.8%)
12	4	0	6 (6.7%)	1 (2.6%)
13- 15	3	0	1 (1.1%)	0
13	2	0	1 (1.1%)	0
	1	0	1 (1.1%)	0
	5	15 (16.9%)	6 (6.7%)	12 (31.6%)
	4	0	1 (1.1%)	2 (5.3%)
9-12	3	0	2 (2.2%)	0
	2	0	0	0
	1	0	0	0
3-8	5	11 (12.4%)	7 (7.8%)	2 (5.3%)
	4	1 (1.1%)	0	2 (5.3%)
	3	0	3 (3.3%)	3 (7.9%)
	2	0	0	1 (2.6%)
	1	5 (5.6%)	8 (9.0%)	1 (2.6%)

Table 5: Volume of EDH and outcome.

Volume	GOS	Present study (n = 89)	Rehman et al ⁷ (n =3 8)
	5	69 (77.6%)	3 (7.8%)
	4	0	0
<30 ml	3	0	1 (2.6%)
	2	0	0
	1	0	0
	5	14 (15.7%)	25 (65.7%)
	4	1 (1.1%)	5 (13.1%)
≥30 ml	3	0	2 (5.3%)
	2	0	1 (2.6%)
	1	5 (5.6%)	1 (2.6%)

So, the present study shows that if a patient has a good GCS, the hematoma volume is expected to be small and vice versa. Dubey A et al, found a positive correlation at volume of only 30 ml above or below group but we found a positive correlation in all our groups and they measured the outcome in terms of favorable or unfavorable at 2 weeks but we measured the outcome in terms of Glasgow Outcome Score at 3 months.²¹ So we were able to

compare various groups of outcome in a better way (Table 5).

Table 6: Outcome in surgically managed patients.

GOS	Outcome	GCS 3-8 (n=13)	GCS 9-12 (n=1)	GCS 13- 15 (n=2)
5	Good	8 (50%)	1 (6.3%)	1 (6.3%)
4	Moderate	3 (18.7%)	-	1 (6.3%)
3	Poor	1 (6.3%)	-	-
2	Vegetative	-	-	-
1	Death	1 (6.3%)	-	-

Data in study shows, those patients having GCS 3-8/15 at presentation having good outcome after surgery. It clearly shows outcome influenced by surgical intervention in GCS 3-8 (Table 6). In the present study, 16 patients were operated for evacuation of EDH.

Among them, 14 patients had bleeding from meningeal artery while two patients had bleeding from emissary vein. Bony defect of 10 patients was repaired by using implants.

Table 7: Mortality comparison.

	Present study (n = 89)	Phoebe et al ⁶ (n = 89)	Rehman et al ⁷ (n = 38)	Islam et al ⁸ (n = 102)
Survivors	86 (94.5%)	80 (90%)	36 (94.7%)	86 (84.7%)
Dead	5 (5.5%)	9 (10%)	2 (5.3%)	16 (15.7%)

In this single centre study in SSG Hospital, Vadodara, survival from traumatic extradural hematoma was 94.5% (86/91). Our mortality of 5.5% seems quite low when compared to Mortality rate of another study by Islam et al (15.7%), Phoebe et al (10%) (Table 7).^{8,6}

CONCLUSION

Among GCS 3-8, 12.4% patients had good outcome (GOS 5), 1.1% patient had moderate outcome (GOS 4) and 5.5% patients died (GOS 1). Among GCS 9-12, 16.9% patients had good outcome (GOS 5). Among GCS 13-15, 59.3% patients had good outcome (GOS 5). It showed, those patients had GCS 13-15 at presentation, had good outcome (64%).

77.6% patients had EDH volume < 30 ml and all patients had good outcome (GOS 5). Among patients who had EDH volume ≥30 ml, 15.7% patients had good outcome (GOS 5), 1.2% patients had moderate outcome (GOS 4) and 5.6% patients died (GOS 1). There was good outcome among patients who had EDH volume <30 ml. Survival from traumatic extradural hematoma was 94.5% (86/91).

ACKNOWLEDGEMENTS

Authors would like to thank their Head of Department Dr. D. D. Duttaroy, their guide Dr. Nimish J. Shah, their colleague Dr. Krunal, their seniors and juniors. Authors are also thankful to all patients.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- 1. Williams N, O'Connell PR. Bailey and love's short practice of surgery. 25th edition. CRC Press. 2008:299.
- 2. Greenberg MS. Greenberg's neurosurgery. 7th edition. Thieme. 2010;27:894-896.
- 3. Mahapatra AK, Vaidya VK. Extradural hematoma. Rajkumar Ramamurthi and Tandon's Manual of Neurosurgery. Jaypee Brothers Medical Publishers. 2014;34:274-276.
- 4. Sankar SK, Mahadevan A. Pathology. Ramamurthi and Tandon's Manual of Neurosurgery. Jaypee Brothers Medical Publishers. 2014;24:198.
- Halpern CH, Grady MS. Schwartz's principles of Surgery. 10th edition. McGraw Hill Education. 2014;42:1719.
- 6. Cheung PS, Lam JM, Yeung JH, Graham CA, Rainer TH. Outcome of traumatic extradural haematoma in Hong Kong. Injury. 2007;38(1):76-80.
- 7. Islam MJ Saha SK, Elahy MF, Islam KMT, Ahamed SU. Factors influencing the outcome of patients with acute extradural hematomas undergoing surgery. Bangladesh J Med Sci. 2011;10:112-20.
- 8. Rehman L, Khaleeq S, Zaman KU. Association of outcome of traumatic EDH and Glasgow Coma Scale and hematoma size. Ann Pak Inst Med Sci. 2010;6(3):133-8
- 9. Cheung PS, Lam JM, Yeung JH, Graham CA, Rainer T. Outcome of traumatic extradural hematoma in Hong Kong. Injury. 2007;38:76-80.
- 10. Knuckey NW, Gelbard S, Epstein MH. The management of asymptomatic epidural hematomas: a prospective study. J Neurosurg. 1989;70:392-6.

- 11. Hamid AN, Main JM. Factors affecting mortality in extradural hematoma. Pak J Neurol. 1998;4:30-4.
- Vilalta J, Bosch J, Castaño CH, Poca MA, Rubio E, Godet C, et al. Epidemiology of head traumas. Barcelona database. Objectives, design and analysis of 584 cases. Rev Esp Anestesiol Reanim. 1992;39:277-81.
- 13. Pillay R, Peter JC. Extradural hematomas in children. S Afr Med J. 1995;85:672-4.
- 14. Dirim BV, Oruk C, Erdogan V, Gelal F, Uluc E. Traumatic posterior fossa hematomas. Diagn Interv Radiol. 2005;11:14-8.
- 15. Jennet B, Snoeck B, Bond MR. Neurosurgery and psychiatry, disability after severe head injury, observation on the use of GOS. Neurosurg Psych. 1981;44:285-93.
- 16. Rivas JJ, Lobato RD, Sarabia R, Cordobes F. Extradural hematoma: analysis of factors influencing the courses of 161 patients. Neurosurg. 1988;23(1):44-51.
- 17. Lobato RD, Rivas JJ, Cordobes F, Alted E, Perez C, Sarabia R, et al. Acute epidural hematoma: An analysis of factors influencing the outcome of patients undergoing surgery in coma. J Neurosurg. 1988;68:48-57.
- 18. Lee EJ, Hung YC, Wang LC, Chung KC, Chen HH. Factors influencing the functional outcome of patients with acute epidural hematomas. J Trauma. 1998;45(5):946-52.
- 19. Servadei F, Faccani G, Rocella P. Asymptomatic extradural haematomas. Results of a multicentre study of 158 cases in minor head injury. Acta Neurochir Wien. 1989:96:39-45.
- 20. Van den Brink WA, Zwienenberg M, Zandee SM, van der Meer L, Maas AI, Avezaat CJ. The prognostic importance of the volume of traumatic epidural and subdural hematomas revisited. Acta Neurochir (Wien). 1999;141:509-14.
- 21. Dubey A, Pillai SV, Kolluri SVR. Does the volume of extradural hematoma influence management strategy and outcome? Neurol India. 2004;52:443-5.

Cite this article as: Prajapati DV, Shah NJ. Outcome of traumatic Extradural Hematoma (EDH) using Glasgow Outcome Scale (GOS). Int Surg J 2018;5:3327-34.