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# Extra dural hematoma: Analysis of outcome

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**Abstract**

Outcome of patient with EDH relays on variables like GCS at first presentation, hematoma size/volume, age of patient, etc. This study was carried out to find out correlation between outcome and various factors affecting it. Aim and objectives of this study were to study outcome of patients with EDH. This study was carried out in SVP hospital, Ahmedabad including 70 patients.30 patients were operated. On admission, majority of patients had GCS of >8 on presentation. Assessment was done at time of discharge and on monthly basis. At 3rd month, 52 patients had GOS 5, 4 patient had GOS 4, 2 patients had GOS 3 and 1 patient died. Out of 52 patients having GOS 5, 12 patient had GCS 13-15 at time of admission, 40 had GCS 9-12 at time of admission. Out of 4 patients having GOS 4, 3 patient had GCS 9-12 at time of admission and 1 patient had GCS 3-8 at time of admission.2 patient having GOS 3, both had GCS 3-8 at time of admission.45 patients had EDH volume <30 ml and all patients had GOS 5. 13 patients had EDH volume ≥30 ml, among them, 7 patients had GOS 5, 4 patients had GOS 4 and 2 patient had GOS 3.Total 7 patient had died all had EDH volume ≥30 ml.GOS in EDH patient is affected by GCS and EDH volume at presentation. RTA is most common cause of EDH. Lower GCS and larger EDH volume have poor outcome.

**Keywords:** Extra Dural Hematoma, EDH, GCS, GOS, Outcome

## Introduction

Head injury has a major share in casualty with 3.4% of all presentations. Incidence of head injury is around 450 cases per 100000 population per year. Traumatic brain injury (TBI) associated with head injury having incidence of 20-40 cases per 100000 population per year. TBI is being the most common cause of death in 15-25 years and is more common in males than females. Most common cause of TBI in the UK is Road traffic accidents (RTAs) [1]. Extra dural hematoma (EDH) is presented in 2% of all head injury cases while approximately 5-15% of fatal head injury cases. EDH is one of the most serious complications of head injury, which requires immediate diagnosis and surgical evacuation. EDH is of three types acute (58%), subacute (31%) or chronic (11%). It is common in young and uncommon in extremes of ages [2].

There are 10-30% cases having incidence of delayed extradural haematoma (DEDH) following an initially negative CT scan is report. Impact of injury and/or resulting fracture line causing damage to middle meningeal vessels (more commonly seen in injury involving anterior branch) results in EDH. Other sources of EDH are injury to diploic vein or dural venous sinus. Rupture of arterial branch leads to expansion of hematoma and rapid deterioration of consciousness and bleeding from a vein resulting in development of EDH after some time. Glasgow coma scale (GSC) monitoring and neurological monitoring plays an important role in evaluation of EDH. Declining neurology and GCS are suggestive of worsening of condition [3-5].

Prompt CT scan provide accurate diagnosis of EDH after trauma. It is showing biconvex hyperdense lesion which is not crossing the suture line. Other important information like associated hematoma, edema, skull bone fracture and condition of ventricles and cisterns can be evaluated. Early craniotomy/ craniectomy and evacuation of hematoma is necessary to save the life of these patients from a potentially fatal lesion.

Early diagnosis and treatment of extradural hematoma decrease morbidity and mortality. Outcome in patient with EDH depends on GCS at time of presentation, Volume and site of hematoma, time to intervene, age of patient. There were 5 types of outcome of EDH patients measured in this study: good recovery (GOS-5), moderate disability (GOS-4), severe disability (GOS-3), vegetative state (GOS-2) and death (GOS-1). This study was carried out to find out correlation between outcome and various factors affecting them.

## Methods

This study was carried out in SVP hospital, Ahmedabad from September 2019 to September 2020. The total number of patients were 70.

- **Inclusion criteria**

Patients having Head Injury with EDH on CT Head were included.

- **Exclusion Criteria**

Patients who had history of pre-existing Neurological deficit and intracranial lesion other than EDH were excluded.

After selecting patient for study, detail neurological examination and proper history taking were done. Mode of injury, condition and GCS on presentation, pupillary reaction, neurological deficit, location and volume of EDH on CT head were noted. The EDH volume was determined by 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. GCS, fresh symptoms, pulse rate, blood pressure, neurological examination were noted in post-operative period immediately and on daily basis in patient who were operated as well as who were kept conservatively till discharge. 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 70 cases of EDH that were admitted in SVP hospital, Ahmedabad from September 2019 to September 2020. There were 60 male (85.71%) and 10 female (14.29%) patients with mean age of 38 years (range 10 years to 77 years).

**Table 1:** Age wise presentation

| Age(years) | Male | Female |
|---|---|---|
| 0-10 | 1 | 0 |
| 10-20 | 10 | 2 |
| 20-30 | 14 | 3 |
| 30-40 | 30 | 3 |
| 40-50 | 6 | 1 |
| 50-60 | 3 | 0 |
| 60-70 | 4 | 1 |
| 70-80 | 1 | 0 |

Cause of 55(78.57%) patients presenting with EDH was Road traffic accident (RTA) and it was the most common etiological factor. Out of 55, there were 4(7.27% of total trauma cases) female and 51(92.73% of total trauma cases). Cause of 8 (11.43%) patients presenting with EDH was accidental fall down, out of which 3(37.5% of total fall down cases) were female and 5(62.5% of total fall down cases) were male. Cause of remaining 7(10%) was assault, out of which 3(42.85% of total assault cases) were female and 4(57.15% of total assault cases) were male.

**Table 2:** Cause and gender wise distribution of EDH cases

| Cause | Male | Female |
|---|---|---|
| RTA | 51 | 4 |
| Fall down | 5 | 3 |
| Assault | 4 | 3 |

On admission, 12 patients (17.14%) had a GCS of 13-15, 43 patients (61.42%) had GCS of 9-12, and 15 patients (21.44%) had GCS of 3-8. Thus, majority of patients (~ 78%) had GCS of >8 on presentation.

**Table 3:** On Admission GCS wise distribution of patient.

| GCS | No. of patients |
|---|---|
| 13-15 | 12 |
| 9-12 | 43 |
| 3-8 | 15 |

Among 70 patients, 26 patients had EDH in frontal region, 18 patients had in frontoparietal region, 2 patients had in occipital region,7 patients had in parietal region, 10 patients had in parietotemporal region, 5 patients had in temporal region, 2 had front oparieto temporal region. The most common site for EDH was frontal region (37.14%) followed by front oparietal region (25.71%).

**Table 4:** Distribution of patients according to EDH location.

| Location of EDH | No. of patients |
|---|---|
| frontal region | 26 |
| frontoparietal region | 18 |
| occipital region | 2 |
| parietal region | 7 |
| parietotemporal region | 10 |
| temporal region | 5 |
| frontoparietotemporal region | 2 |

Among 70 patients, 45 patients (64.28%) had volume of EDH on CT Head <30 ml, while 25 patients (35.71%) had EDH volume ≥30 ml. 45 patients had EDH volume <30 ml and all patients had GOS 5. 13 patients had EDH volume ≥30 ml, among them, 7 patients had GOS 5, 4 patients had GOS 4 and 2 patient had GOS 3.Total 7 patient had died all had EDH volume ≥30 ml.

Surgical intervention (craniotomy/craniectomy and evacuation of hematoma) was carried out in 30 patients. The decision for operative intervention was made on the basis of the volume of EDH on CT head, presence of focal neurological signs and deterioration of neurological status. 30 patients (42.85%) were managed surgically, craniotomy/craniectomy and evacuation of extradural hematoma. 40 patients (57.15%) were managed conservatively. Four patients died immediately after diagnosis of traumatic EDH on CT Head, before doing any intervention. One patient died on 3rd post-operative day who had GCS 5/15 on admission. Mode of injury was RTA, CT head showed 50 ml EDH on Right Fronto-Parietal-Temporal region. So total 65 patients were discharged. At the time of discharge 48 patient had GOS 5, 11 patient had GOS 4, 4 patient had GOS 3 and 2 patient had GOS 2.

All discharged patients were examined after 1 month in follow up. After one month, five patients were failed to follow up, 50 patients had GOS 5, 6 patients had GOS 4, 2 patient had GOS 3 and 1patient had GOS 2 and 1 patient died.The patients who were lost to follow up had GOS of 3 and 4 at the time of discharge.

At 2nd and 3rd month, 52 patients had GOS 5, 4 patient had GOS 4, 2 patient had GOS 3 and 1 patient died.

**Table 5:** GOS at the different stages of follow-up.

| | GOS 5 | GOS 4 | GOS 3 | GOS 2 | GOS 1 |
|---|---|---|---|---|---|
| At Discharge | 48 | 11 | 4 | 2 | 0 |
| 1 month | 50 | 6 | 2 | 1 | 1 |
| 2 months | 52 | 4 | 2 | 0 | 1 |
| 3 months | 52 | 4 | 2 | 0 | 0 |

At the end of 3months of follow up, out of 58 patients 45 had EDH volume ≥30 ml and 13 patient had EDH volume < 30ml. 45 patients had EDH volume <30 ml and all patients had GOS 5. 13 patients had EDH volume ≥30 ml, among them, 7 patients had GOS 5, 4 patients had GOS 4 and 2 patient had GOS 3.Total 7 patient had died all had EDH volume ≥30 ml. Hence, 70 patients were admitted, among them four patients died during management, one patient died post operatively. Overall 65 patients were discharged. All discharged patients were examined at the time of discharge and on monthly basis till 3 months. 5 patients were failed to show up during follow up after taking discharge from hospital.

At the end of three months, 52 patients had GOS 5, 4 patient had GOS 4, and 2 patient had GOS 3 and 1 patient died. Out of 52 patients having GOS 5, 12 patient had GCS 13-15 at time of admission, 40 had GCS 9-12 at time of admission. Out of 4 patients having GOS 4, 3 patient had GCS 9-12 at time of admission and 1 patient had GCS 3-8 at time of admission.2 patient having GOS 3, both had GCS 3-8 at time of admission. Total 7 patients died had GCS 3-8 at time of admission.

**Table 6:** Relationship between GOS and GCS after 3 months.

| GCS | GOS 5 | GOS 4 | GOS 3 | GOS 2 | GOS 1 |
|---|---|---|---|---|---|
| 13-15 | 12 | 0 | 0 | 0 | 0 |
| 9-12 | 40 | 3 | 0 | 0 | 0 |
| 3-8 | 0 | 1 | 2 | 0 | 0 |

Among 30 operated patients, 12 patients had EDH located in frontal region, 11 patient had EDH located in frontoparietal region, 5 patients had EDH in temporo-parietal region and 2 patients had EDH in fronto-temporal-parietal region. Minimum EDH volume was 20 ml and maximum EDH volume was 70 ml among operated patients.

**Table 7:** EDH location in operated patient

| No. of operated patient | EDH Location |
|---|---|
| 12 | frontal region |
| 11 | frontoparietal region |
| 5 | temporo-parietal region |
| 2 | fronto-temporal-parietal region |

Middle meningeal vessels were most common source of bleeding, found during intra-operative observation. It was coagulated by using bipolar cautery. Proper hemostasis achieved with bone wax, AbGel and Surgicel. Closure done with vicryl 2-0 in subcutaneous layer and with ethilon 3-0 by continuous inter locking method on skin.

## Discussion

EDH is collection of blood between dura and skull bone. (2). Early diagnosis by CT scan and prompt treatment is only the key in the management of EDH. Most common cause of EDH is being RTA, it affects more the young adults rather than extremes of ages. In elders, periosteal layer of dura is densly adherent to skull bone, while in paediatric age plasticity of skull bone provide somewhat protection. Male are more commonly affected than female.

In present study mean age is 38 years and there were 60 male (85.71%) and 10 female (14.29%) patients. (Range 10 years to 77 years).Phoebe *et al*, mean age was 37.7 years (range 1 month to 87 years) and there were 70(79%) male and 19(21%) were female.[6] In study by Rehman *et al*, 35(92%) were male and 3(8%) were female.[7] In study by Islam *et al*, 94(93%) were male and 8 (7%) were female.[8] Hence, there is male predominance in EDH cases.

**Table 8:** Sex wise distribution comparison with other studies.

| Sex wise distribution | Present study | Phoebe *et al* [6] | Rehman *et al* [7] | Islam *et al* [8] |
|---|---|---|---|---|
| Male | 60(85.71%) | 70(79%) | 35(92%) | 94(93%) |
| Female | 10(14.29%) | 19(21%) | 3(8%) | 8 (7%) |

In this study, there were 55(78.57%) RTA cases resulting in EDH, while In Phoebe *at al*, Rehman *et al* and Islam *et al*, there were 50 (56%), 24(63%) and 66(65.3%) RTA cases resulting in EDH respectively. 8(11.43%) cases of fall down causing EDH in this study while In Phoebe at al, Rehman *et al* and Islam *et al*, there were 27(30%), 6(16%) and 66(65.3%) fall down cases resulting in EDH respectively. In this study 7(10%) assault cases resulting in EDH while In Phoebe *et al*, Rehman *et al* and Islam *et al*, there were 10(11%), 8(21%) and 24(23.3%) assault cases resulting in EDH respectively. Here, RTA is being most common cause resulting in EDH while assault being least common mode of trauma. The incidence of assaults was relatively less common in this study as compared with other studies, Rehman *et al* **(**21%), Islam *et al* (20%). Percentage of fall down is almost double in Phoebe *et al* in comparison to other studies.

**Table 9:** Cause wise comparison with other studies.

| Mode of injury | Present study | Phoebe *et al* | Rehman *et al* | Islam *et al* |
|---|---|---|---|---|
| RTA | 55(78.57%) | 50 (56%) | 24 (63%) | 66 (65.3%) |
| Fall down | 8 (11.43%) | 27 (30%) | 6 (16%) | 12 (11.3%) |
| Assault | 7(10%) | 10 (11%) | 8 (21%) | 24 (23.3%) |

Location of EDH can be decided by CT scan, by comparing various studies, we can see that EDH involving multiple region is most common in this study and study by Phoebe *et al*. Temporal EDH is most common location in study by Rehman *et al*. Frontal EDH is being most common in study by Islam *et al* and in present study in view of isolated region involvement. Location of extradural hematoma is important for both patient and the surgeon and deciding prognosis and neurological presentation of patient. Its location is more common in the distribution of middle meningeal artery and its branches. Occipital EDH is being lass common in every study.

**Table 10:** EDH location comparison with other studies.

| EDH location | Present study | Phoebe *et al* | Rehman *et al* | Islam *et al* |
|---|---|---|---|---|
| Frontal | 26(37.14%) | 15 (16.9%) | 7 (18%) | 22 (21.6%) |
| Temporal | 5(7.14%) | 24 (27%) | 12 (33%) | 42 (41.2%) |
| Parietal | 7(10%) | 12 (13.5%) | 10 (26%) | 18 (17.6%) |
| Occipital | 2(2.8%) | 5 (5.6%) | 2 (5%) | 4 (3.9%) |
| Multiple | 30(42.85%) | 34 (38.2%) | 7 (18%) | 16 (15.7%) |

On comparing outcome in patients having GCS 13-15, in present study 12(17.14%) patients had Good outcome scale (GOS), (GOS 5), in Phoebe *et al* and Rehman *et al*, 53(58.9%) and 14(36.8%) patients had Good outcome (GOS 5) respectively. Though only 12 patient had GCS 13-15, but there 100% good outcome in all of them, which is suggestive of that initial higher GCS is associated with good outcome, which can be seen in other studies too.

In this study 43 patients having GCS 9-12, 40(57.14%) patients had Good outcome (GOS 5), in Phoebe *et al* and Rehman *et al*, 6(6.7%) and 12(31.6%) patients had Good outcome (GOS 5) respectively. Present study has maximum patients fall down in GCS 9-12 category in which >90% has good outcome. In Phoebe *et al* >80% patients with 9-12 GCS has good outcome, while in Islam *et al* >60% patients with 9-12 GCS has good outcome.

In this study 10 Patients having GCS 3-8, from which 7(70%) patients have been expired which suggestive of poor outcome (GOS 1), in Phoebe *et al* and Rehman *et al*, 8(44%) and 1(11.11%) patients had poor outcome (GOS 1) respectively. This study has worst outcome in patient with GCS 3-8 which is contradictory to other studies in which <50% has worst outcome.

**Table 11:** GCS-GOS relationship in different studies.

| GCS | GOS | Present study (n=70) | Phoebe *et al* (n = 89) | Rehman *et al* (n = 38) |
|---|---|---|---|---|
| 13-15 | 5 | 12(17.14%) | 53(58.9%) | 14(36.8%) |
| | 4 | 0 | 6(6.7%) | 1(2.6%) |
| | 3 | 0 | 1(1.1%) | 0 |
| | 2 | 0 | 1(1.1%) | 0 |
| | 1 | 0 | 1(1.1%) | 0 |
| 9-12 | 5 | 40(57.14%) | 6(6.7%) | 12(31.6%) |
| | 4 | 3(4.23%) | 1(1.1%) | 2(5.3%) |
| | 3 | 0 | 2(2.2%) | 0 |
| | 2 | 0 | 0 | 0 |
| | 1 | 0 | 0 | 0 |
| 3-8 | 5 | 0 | 7(7.8%) | 2(5.3%) |
| | 4 | 1(1.42%) | 0 | 2(5.3%) |
| | 3 | 2(2.85%) | 3(3.3%) | 3(7.9%) |
| | 2 | 0 | 0 | 1(2.6%) |
| | 1 | 7(10%) | 8(9.0%) | 1(2.6%) |

In this study, 45 patients had EDH volume <30 ml and all patients had GOS 5, while study by rehman *et al* and dixit *et al* has 4 and 69 patient with EDH volume <30ml respectively, out of which 3(75%) and 69(100%) has GOS 5. Hence, we can say that patient with <30ml EDH volume has good outcome which is similar in provided studies. In this study, 13 patients had EDH volume ≥30 ml, among them, 7 patients had GOS 5, 4 patients had GOS 4 and 2 patient had GOS 3.Total 7 patient had died all had EDH volume ≥30 ml. In study by rehman *et al* 25(73.3%) patients with EDH volume ≥30 ml had GOS 5, which is highest in provided studies. There is 14(70%) patients with EDH volume ≥30 ml had GOS 5 in study by dixit *et al*. which are better in comparison with 7(34%) patients with EDH volume ≥30 ml had GOS 5 in present study. Present study has highest 7(34%) patients with EDH volume ≥30 ml had GOS 1 in comparison to other studies which has similar outcome as in study by Rivas *et al*[10] which has unfavourable outcome in patients with hematoma volume of more than 50 ml. Similar outcome is also noted in other studies like lobato *et al*[11], Lee *et al*[12] and Servadi *et al*[13].

**Table 12:** EDH volume and outcome comparison

| EDH volume | GOS | Present study (n=70) | Rehman *et al* (n=38) | Dixit *et al*[9] (n=89) |
|---|---|---|---|---|
| <30 ml | 5 | 45(64.28%) | 3(7.8%) | 69(77.6%) |
| | 4 | 0 | 0 | 0 |
| | 3 | 0 | 1(2.6%) | 0 |
| | 2 | 0 | 0 | 0 |
| | 1 | 0 | 0 | 0 |
| ≥30 ml | 5 | 7(10%) | 25(65.7%) | 14(15.7%) |
| | 4 | 4(5.71% | 5(13.1%) | 1(1.1%) |
| | 3 | 2(2.85%) | 2(5.3%) | 0 |
| | 2 | 0 | 1(2.6%) | 0 |
| | 1 | 7(10%) | 1(2.6%) | 5(5.6%) |

In this study, survival from traumatic extradural hematoma was 90% (63/70). Our mortality is 7 (10%) seems similar to Phoebe *et al* (10%), lower when compared to mortality rate of another study by Islam *et al* (15.7%). Lowest mortality is noted in study by Rehman *et al* which is only 2(5.3%) patients.

**Table 13:** Survival and mortality rate comparison

| Outcome | Present study (n=70) | Phoebe *et al* (n = 89) | Rehman *et al* (n = 38) | Islam *et al* (n = 102) |
|---|---|---|---|---|
| Survival | 63(90%) | 80 (90%) | 36 (94.7%) | 86 (84.7%) |
| Mortality | 7(10%) | 9 (10%) | 2 (5.3%) | 16 (15.7%) |

## Conclusion

RTA is being most common cause resulting in EDH with predilection for young men. Safety precaution while driving like use of helmets and seatbelts can effectively cause decrease in incidence of EDH. Higher values of GCS at the time of presentation is associated with good outcome. Volume of EDH also plays important role as patients with EDH volume more than 30ml have poor outcome in comparison to patients with EDH volume less than 30ml. Volume of EDH increase with time due to ongoing bleeding from injured vessel, hence early intervention has favourable outcome. As patients with EDH has around 80-90% survival rate, it can be increased by early and timely intervention.

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