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Surgical Outcome between Early and Delayed Surgery of Extradural Haematoma (EDH) in Closed Head Injury

Md. Abdus Salam[1], Md. Mahfuzur Rahman[2], Kalim Uddin[3], Md. Rafiqul Islam[4], Md. Ashraful Hoque[5], Abu Nayeem[6], Amir Mohammad Khan[7], Sudipto Kumar Mukharjee[8], Sk Sader Hossain[9]

[1]Associate Professor, Department of Neurotrauma, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [2]Assistant Professor, Department of Neurotrauma, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [3]Registrar, Department of Neurotrauma, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [4]Assistant Professor, Department of Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [5]Assistant Professor, Department of Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [6]Associate Professor, Department of Neurology, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [7]Assistant Professor, Department of Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [8]Assistant Professor, Department of Paediatric Neurosurgery, National institute of Neurosciences & Hospital, Dhaka, Bangladesh; [9]Professor & Head, Department of Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh

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Abstract

Background: Surgical management of Extradural Haematoma (EDH) in Closed Head Injury is an essential issue. **Objective:** The purpose of the present study was to compare the surgical outcome between early and delayed surgery of extradural haematoma (EDH) in closed head injury. **Methodology:** This comparative cross-sectional study was carried out from January 2010 to June 2011 for a period of one year and six months in the Department of Neurosurgery, Dhaka medical College Hospital, Dhaka, Bangladesh. All patients presented with traumatic head injury having extradural haematoma in any age with both sexes who were underwent surgical management were selected as study population. The patients were categorized into groups designated as group A or early surgery group where operation was done within 24 hours of head injury and group B or delayed surgery group where operation was done after 24 hours to 3 days of head injury. Inclusion of patients in group B was not intentional but due to delayed referral from primary and secondary hospitals of different parts of the country. Glasgow coma scale (GCS) was used for initial assessment and Glasgow outcome scale (GOS) was applied to assess outcome in terms of neurological recovery in all patients. General and neurological examinations and findings were recorded. Surgical outcome was noted and recorded in the data collection sheet. **Result:** Eighty (80) patients of traumatic head injury with EDH operation (EDH operated within 24 hours and after 24 hours of head injury) were enrolled in this study. Mean (±SD) age of the patients of group A and group B was 32.66±16.65 and 33.23±13.38 respectively. In this study the patient's age ranged from 3 years to 64 years. In group A, 6 patients were admitted with GCS (14-15) and 01 patient in group B. With GCS (9~13), 19 patients in group A and 22 patients in group B. With GCS (3-8), 15 patients were admitted in group A and 17 patients in group B. Out of all patients' good recovery occurred in 80.0% in group A and 45.0% in group B. Moderate disability and severe disability in both group A and group B was 12.5% vs 30% and 7.5% vs 12.5% respectively. Furthermore 5.0% persistent vegetative state and 7.5% death occurred only among the patients of group B ($p<0.05$). Out of all patients good recovery occurred in 82.6% in group A and 54.0% in group B. Moderate disability and severe disability in both group A and group B was 10.0% vs 27.5% and 7.5% vs 13.51% respectively. 5.41% persistent vegetative state occurred only in patients of group B ($p<0.05$). **Conclusion:** In conclusion morbidity and mortality rate can be reduced in patients with EDH by early surgical intervention in better GCS score. *[Journal of National Institute of Neurosciences Bangladesh, 2019;5(1):24-28]*

Keywords: Surgical Outcome; Early and Delayed Surgery; Extradural Haematoma; EDH; Closed Head Injury

Correspondence: Dr. Md. Abdus Salam, Associate Professor, Department of Neurotrauma, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; Email: drsalamnins@gmail.com; Cell no.: +8801714073094

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Introduction

Extradural haematoma (EDH) usually forms within an hour from the time of injury[1]. There is lot of controversy in management and its outcome of patient with EDH though surgery is the treatment of choice for extradural haematoma and in some cases of small EDH, non-surgical treatment can be attempted[2]. Patients with Glasgow Coma Scale (GCS) 14 to 15, haematoma smaller than 01 cm and with no midline shift demonstrated by CT scan can be treated by conservative management with excellent outcome[3]. Craniotomy is usually done after localizing the position of haematoma by CT-scan[2]. During surgery it is important to detect and control the bleeding point perfectly, including bleeding from the surface of the dura mater. However spontaneous arrest of the bleeding may have already occurred in many cases at the time of operation[4].

Outcome of cranio-cerebral injury depends on severity of primary injury, intracranial pathologies like haematoma and type of injuries[5]. Mortality and morbidity from head injuries are also results from secondary brain damage from failure of adequate cerebral perfusion, failure of cerebral oxygenation and raise in intracranial pressure (ICP) due to mass lesions and cerebral edema leading to fall in cerebral perfusion pressure and herniation of brain is a major factor in poor outcome[6]. Almost all patients dying from severe head injury have patho-morphological evidence of cerebral ischemia, impairment of cerebral auto regulation with areas of hyper and hypo perfusion. Hyper perfusion of damaged brain may increases cerebral edema which increases ICP[7].

In Bangladesh, excellent outcome in extradural haematoma at international level is difficult to achieve because health infrastructure is not at its best. Neurosurgical services are not available in all district hospitals even not in all medical college hospitals. Modern diagnostic tools like CT and MRI are not available at periphery. Neurosurgeons are not in enough numbers. So diagnosis becomes late. Usually patients from interior area of the country first touches the Upazilla health complex then is referred to district hospitals or to regional medical college hospitals then neurosurgical centre. By this time patients level of consciousness gradually deteriorates with the development of secondary brain damage. Patient with EDH reaches the neurosurgical centre when they are already in coma causing poor outcome although surgically managed. The management during the first hour following trauma is considered as golden hour, which will largely determine the degree of morbidity and the ultimate result. The present study was undertaken to compare the surgical outcome between early and delayed surgery of extradural haematoma (EDH) in closed head injury.

Methodology

This study was designed as comparative cross-sectional study. This study was carried out from January 2010 to June 2011 for a period of one year and six months. This study was carried out in the Department of Neurosurgery, Dhaka medical College Hospital, Dhaka, Bangladesh. All patients presented with traumatic head injury having extradural haematoma in any age with both sexes who were underwent surgical management were selected as study population. The patients were categorized into groups designated as group A or early surgery group where operation was done within 24 hours of head injury and group B or delayed surgery group where operation was done after 24 hours to 3 days of head injury. Inclusion of patients in group B was not intentional but due to delayed referral from primary and secondary hospitals of different parts of the country. Patients with traumatic extradural haematoma who were diagnosed clinically by classical presentation of EDH and radiologically by non-contrast CT scan of brain and were underwent surgical management were included in this study. In all cases traumatic extradural haematoma were supratentorial. Patients presented with non-traumatic extradural haematoma, patients not willing to participate in the study, patients with bilateral extradural haematoma, posterior fossa extradural haematoma, patients on anticoagulant therapy and extradural haematoma as a post-surgical complication were excluded from this study. At admission, a detailed history of the illness was taken from the patients/patient's attendants by face-to-face interview with the help of a pre-formed questionnaire. Questionnaire was prepared with key variables like age, sex, occupation of the patient, date of admission, date of occurrence, clinical findings (conscious level just after injury, at the time of presentation and after surgery), associated injuries, investigations, surgical management, time interval between occurrence and surgery, surgical outcome of patient's and follow-up. Glasgow coma scale (GCS) was used for initial assessment and Glasgow outcome scale (GOS) was applied to assess outcome in terms of neurological recovery in all patients. The questionnaire was tilled up on admission prior to giving management, at discharge and after one-month follow-up during visit. General and neurological examinations and findings were recorded. Surgical outcome was noted and

recorded in the data collection sheet. All the data were checked and edited after collection. Then the data were entered into computer and statistical analysis of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-13) (SPSS Inc, Chicago, IL, USA). The categorical variables were expressed in percentage and were tested for significance by chi-square test. The continuous variables were expressed in term of mean and standard deviation. Statistical significance was set at $p<0.05$. Prior to the commencement of this study, the ethical committee of Dhaka Medical College, Dhaka, approved the thesis protocol.

Results

Eighty (80) patients of traumatic head injury with EDH operation (EDH operated within 24 hours and after 24 hours of head injury) were enrolled in this study.

Table 1: Age distribution of the study population (n=80)

Age Group	Study Group	
	Group A	Group B
≤10 Years	05 (12.5)	02(5.0)
11 to 20 Years	09(22.5)	11(27.5)
21 to 30 Years	10(25.0)	09(22.5)
31 to 40 Years	09(22.5)	11(27.5)
41 to 50 Years	04(10.0)	03(7.5)
>50 Years	03175)	04(10.0)
Total	40(100)	40(100)
Mean (±SD)	32.66±16.65	33.23±13.38

Group A=EDH operated within 24 hrs of head injury; Group B=EDH operated after 24 hrs of head injury, Figures within parenthesis indicated percent.

Out of all patients of group A maximum 25.0% patients belonged to (21 to 30) years age range followed by 22.5% within (11-20) years and (31-40) years age group, 10.0% within (41 to 50) and 7.5% within above 50 years age group. Within all patients of group-B maximum 27.5% within (11 to 20) years and (31 to 40) years age group, 22.5% within (21 to 30) years age group, 10.0% within >50 years age group, 7.5% within (41 to 50) years age group and 5.0% within up to 10 years age group. Mean (±SD) age of the patients of group A and group B was 32.66±16.65 and 33.23±13.38 respectively. In this study the patient's age ranged from 3 years to 64 years (Table 1).

In group A, 6 patients were admitted with GCS (14-15) and 01 patient in group B. With GCS (9-13), 19 patients in group A and 22 patients in group B. With GCS (3-8), 15 patients were admitted in group A and 17 patients in group B. After surgery on discharge there was improved number of patients of 22 from 06 at GCS (14-15) in group A and 19 patients from 01 patient in group B. 03 patients died in group B on discharge of GCS (3-8) (Table 2).

Table 2: Distribution of GCS on admission and discharge.

Variables	GCS Group	Group A	Group B
Admission GCS	14 to 15	6	1
	9 to 13	19	22
	3 to 8	15	17
Total		**40**	**40**
Discharge GCS	14 to 15	22	19
	9 to 13	12	8
	3 to 8	6	10
Total		**40**	**37**

Table 3: Distribution of Glasgow outcome scale by group (At Discharge)

Glasgow Outcome Scale	Study Group		P value
	Group A	Group B	
5-(Good recovery)	32(80.0%)	18(45.0%)	
4-(Moderate disability)	5(12.5%)	12(30.0%)	0.01
3-(Severe disability)	3(7.5%)	5(l2.5%)	
2-(Persistent vegetative state)	0(0.0%)	2(5.0%)	
l-(Death)	0(0.0%)	3(7.5%)	
Total	**40(100.0%)**	**40(100.0%)**	

Chi square test was done to measure the level of significance; Group A=EDH operated within 24 hrs of head injury; Group B=EDH operated alter 24 hrs of head injury

The surgical outcome of the patients of both groups during discharge was recorded. Out of all patients' good recovery occurred in 80.0% in group A and 45.0% in group B. Moderate disability and severe disability in both group A and group B was 12.5% vs 30% and 7.5% vs 12.5% respectively. Furthermore 5.0% persistent vegetative state and 7.5% death occurred only among the patients of group B. Statistical significant difference was observed between groups in term of Glasgow outcome scale ($p<0.05$) (Table 3).

The surgical outcome of the patients of both groups after one month was recorded. Out of all patients good recovery occurred in 82.6% in group A and 54.0% in group B. Moderate disability and severe disability in both group A and group B was 10.0% vs 27.5% and 7.5% vs 13.51% respectively. 5.41% persistent vegetative state occurred only in patients of group B. Statistical significant difference was observed between groups in term of Glasgow outcome scale ($p<0.05$) (Table 4).

Table 4: Distribution of Glasgow outcome scale by group (After one month)

Glasgow Outcome Scale	Study Group		Total
	Group A	Group B	
5-(Good recovery)	33(82.5%)	12(55.0%)	
4-(Moderate disability)	5(10.0%)	12(27.5%)	
3-(Severe disability)	3(7.5%)	5(13.5%)	0.01
2-(Persistent vegetative state)	0(0.0%)	2(5.0%)	
l-(Death)	0(0.0%)	3(07.5%)	
Total	**40(100.0%)**	**40(100.0%)**	

Chi square test was done to measure the level of significance; Group-A (EDH operated within 24 hrs of head injury); Group-B (EDI-1 operated after 24 hrs of head injury); 3 patients died from group-B within the end of first week

Discussion

EDH constitutes a major source of preventable mortality and occurs in 1.0 to 2.0% of hospital admitted cases of acute head injury[7]. State of consciousness just before surgery largely influences the prognosis of EDH and also depends on the extensiveness of secondary brain damage and the presence of other intracranial pathologies; however, other main reasons of mortality are due to late surgical intervention and incorrect assessment of the patients[8].

It has been pointed out that in the outcome of surgical management of EDH patients who are alert or have slightly altered consciousness at the time of operation should have virtually no mortality while those who are unconscious with brain stem signs will have a mortality of over 50.0%[9]. Greenberg[8] observed in patients with extradural haematoma (EDH), optimal diagnosis and treatment within few hours result in 54.0% mortality. The aim of head injury management is to minimize damage arising from secondary brain injury caused by haematoma, brain swelling, brain shift, ischemia, hypoxia.

A total of eighty (80) patients of traumatic head injury, 40 with extradural haematoma operated within 24 hrs of head injury and 40 with extradural haematoma operated alter 24 hrs to 3 days ol` head injury were enrolled in this study. In study the patient's age ranged from 3 years to 64 years irrespective to sex. ln group A, maximum 25.0% patients belonged to 21 to 30 years age range followed by 22.5% within (11 to 20) years and (31 to 40) years and in group B, maximum 27.5% belonged to (11 to 20) years and (31 to 40) years followed by 22.5% within (21 to 30) years. In Khaled et al[4] series patients' age ranged from 2.5 years to 83 years. Highest numbers of patients were in the third decade (29%) followed by second decade (27.55%). Only 4.92% were above the age of 50 years.

In this study in group A, 6 patients were admitted with GCS (14 to 15) and 01 patient in group B. With GCS (9 to 13), 19 patients in group A and 22 patients in group B. With GCS (3 to 8), 15 patients were admitted in group A and 17 patients in group B. After surgery on discharge there was improved number of patients of 22 from 06 at GCS (14 to 15) in group A and 19 patients from 01 patient in group B. 03 patients died in group B on discharge of GCS (3-8). It has been reported that the principal factor regulating outcome alter evacuation of an intracranial haematoma is the patients level of consciousness before operation[10]. Comatose patients undergoing surgical evacuation of extradural haematoma had a mortality rate 5 to 10 times higher than that of non-comatose patients[11].

In this study in group A, out of all patients with favorable outcome 22.5% had GCS (3-8), 42.5% had GCS (9-13) and 15.0% had GCS (14-15) and in patients with unfavorable outcome 15.0% had GCS (3-8) and 05.0% had GCS (9-13). In group B, out of all patients with favorable outcome 12.5% had GCS (3-8), 0% had GCS (9~l3) and 2.5% had (l4~l5) GCS and in patients with unfavorable outcome 30.0% had GCS within 3 to 8 and 10.0% had GCS (9~13). In both the groups who's GCS was (3-8) had undergone worst outcome. Several authors found that GCS before surgery is the most important predictor of outcome in patient with extradural haematoma (EDH) undergoing surgery[9-11].

In this study surgical outcome of patients of both groups were evaluated during discharge and after one month. At discharge, out of all patients in group A. 80.0% had good recovery, 12.5% had moderate disability, 7.5% had severe disability. No death occurred in group A. In group B, 45.0% had good recovery, 30.0% had moderate disability and 12.5% had severe disability. 05.0% has persistent vegetative state and 07.5% died from group-B, all had GCS 3-8 and all mortality was at discharge. After one 1nonth, out of all patients' good recovery occurred 82.5% in group A and 54.0% in group B, 10.0% moderate disability in group A and 27.3% in group B and severe disability in both group A and group B was 07.5% and 13.5% respectively. 5.4% persistent vegetative state occurred only in patients of group B. Statistical significant difference was observed between groups in term of Glasgow outcome Scale (GOS). Patients with lower GCS score at presentation had higher incidence of an intra-parenchymal damage with EDH[12]. It has

been identified that associated secondary brain injury is an important predictor of unfavorable outcome even after surgery of EDH and this had been confirmed by several others[7,10]. Other important predictors of unfavorable outcome are pupillary abnormalities and raised ICP[7]. The highest mortality (74.0%) was found in patients of EDH with subdural haemorrhage and a GCS between 3 and 5[13]. Patient with an EDH and a GCS of 3 to 5 had a mortality of 36% and patients with an EDH and a GCS of 6 to 8 had a mortality of only 9%[6]. The incidence of secondary damage in cases with EDH significantly increased the mortality rate from 7.0% to 19.0%[13]. In this series unfavorable outcome was observed in patient with low admission GCS and extradural haematoma patients operated alter 24 hours of head injury.

In statistical analysis of the factors affecting the outcome of EDH who were treated surgically found strong correlation between the result and preoperative GCS[14]. Almost all authors strongly advocate early diagnosis and quick evacuation of EDH at a stage in which the patients remains conscious for better outcome. Mortality and morbidity after head injury and EDH is not only due to the primary insult itself but also due to secondary brain damage[15]. It has been accepted that a portion of neurons are irreversibly damaged at initial impact and neuronal damage continues until brain resuscitation is initiated[10]. Indeed traumatized brain is metabolically deranged and particularly vulnerable to hypoxia and hypotension.

By preventing delay in admission, investigation and necessary treatment the mortality of EDH could be reduced to 5% only[9]. It has been pointed out that associated brain injury, volume and density of the clot, degree of brain shift and obliteration of the basal cisterns are significantly correlated with functional outcome of EDH treated surgically[13]. The most significant factors associated with unfavorable outcome were higher age, lower GCS, delayed operation and higher extradural hematoma volume.

There are some limitation of this study. Due to poverty, ignorance and lack of awareness of the patients' follow-up was really difficult. When patient improved, they were not interested for follow-up. There was absence of long-term follow up. This was a single centered study, multi-centre scenario not reflected here. There was limited ICU facilities which made surgical management especially of comatose patients very difficult.

Conclusion

In conclusion morbidity and mortality rate can be reduced in patients with EDH by early surgical intervention in better GCS score. Delay in management of EDH patients with poor level of consciousness has adverse effect on mortality and morbidity.

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