A RETROSPECTIVE STUDY OF SEVERE HEAD INJURIES IN A GENERAL SURGICAL UNIT

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SYNOPSIS

194 patients with severe head injuries including 156 treated operatively and 38 who died without surgery were studied over a three-year period of 1972 to 1974.

The indications for operation and the type of lesions in relation to the clinical manifestations, morbidity and mortality were analysed.

Possible ways of improving the results are discussed.

INTRODUCTION

Accident is the fourth commonest cause of death in Singapore. 70% of the accident victims have severe head injuries. The mortality and morbidity rates from severe head injuries are high. This study is carried out to determine how the results of management can be improved.

Our departmental policy in the management of severe head injuries has been:

(1) to observe the patient if the conscious level is improving and he has no localising sign;
(2) to operate if the conscious level deteriorates, or if there are localising signs and the patient is not fully conscious, or if there is a compound depressed fracture;
(3) to investigate with echoencephalogram and carotid angiogram if patients' conscious level is not improving or if there are localising signs in the fully conscious patients.

Over a three-year period (1972-1974), a total of 194 patients were available for study. 156 patients were operated on and 38 patients had no operations.

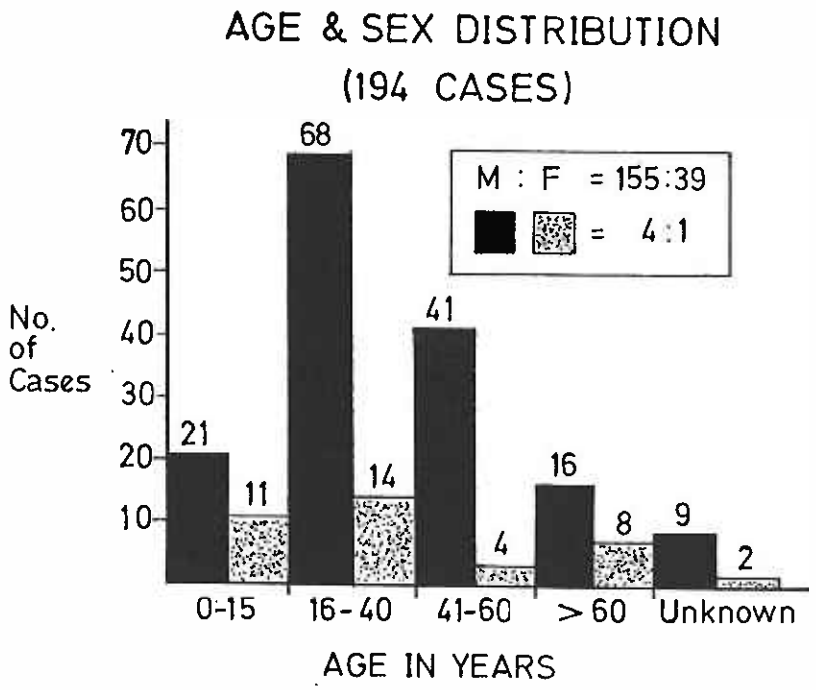


Fig. 1. Age and sex distribution of 194 cases of severe head injuries.

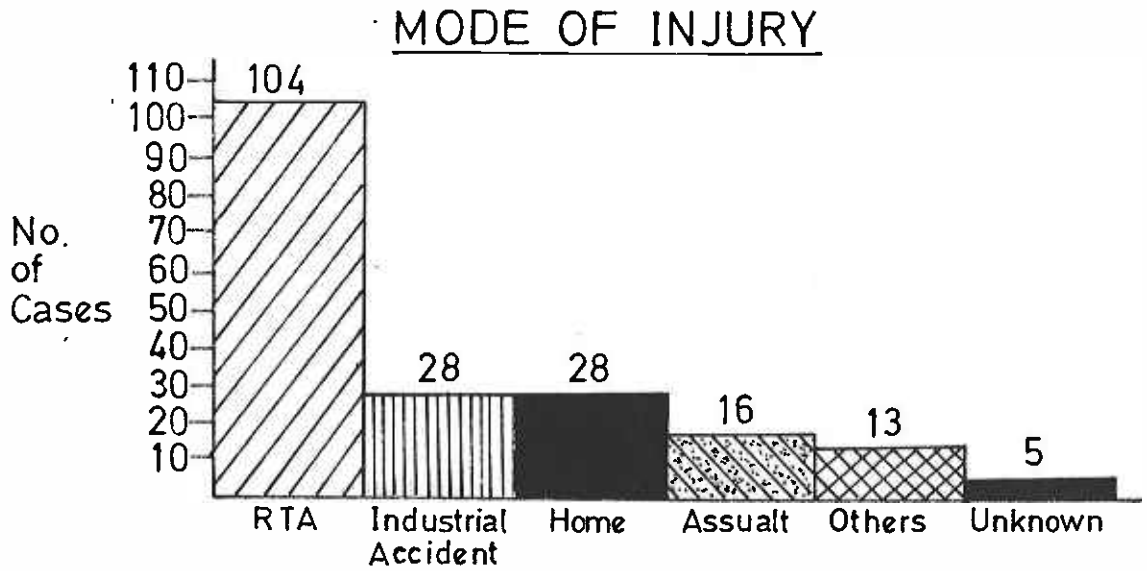


Fig. 2. Figure showing the mode of injury in 194 cases of severe head injuries.

AGE AND SEX (Figure 1)

42% of the patients were in the age group of 16 to 40 years, people in the prime of their lives and economically productive. Male to female ratio was 4 to 1.

MODE OF INJURY (Figure 2)

54% of the patients were victims of road traffic accidents. The majority of them being pedestrians. With the introduction of compulsory wearing of crash helmet for motor cyclist, the incidence of severe head injuries among them had decreased. A fair number of patients sustained their injuries from fall while trying to get on or off a moving bus.

Industrial and home accidents each accounted for 14% of the cases. While over the years, head injuries from road traffic accidents tended to decline, those due to industrial and home accidents had not been so. The authority should now put more emphasis on industrial safety and prevention of accidents at home.

TABLE I

THOSE OPERATED ON TYPES OF INJURY	NO. OF CASES	ALIVE	DEAD	MORTALITY RATE
Extradural Haematoma	28(18%)	19	9	32%
Acute Subdural Haematoma	72(48%)	16	58	78%
Chronic Subdural Haematoma	3(2%)	3	0	0%
Intra Cerebral Haematoma	19(12%)		19	100%
Cerebral Oedema	18(12%)	9	9	50%
Compound Depressed Fracture	14(8%)	14	0	0%
TOTAL	156(100%)	61	95	61%

TABLE II: Patients who died without operations; Types of injuries; Corelation with Time of Death

Time in hours / Types	6 <	6-12	< 12-24	> 24	TOTAL
Extradural	0	2	0	1	3
Subdural	2	4	0	2	8
Intracerebral	1	0	0	1	2
Cerebral Laceration	21	2	1	1	25
TOTAL	24	8	1	5	38

LESION (Table I)

The commonest type of lesion in patients operated on was the acute subdural haematoma. There was 74 cases. There were 28 patients with extradural haematoma, 3 with chronic subdural haematoma, 19 with intracerebral haematoma, 18 with cerebral cedema and 14 with compound depressed fractures.

In the 38 patients who died without operation, the commonest lesion was cerebral laceration/contusion with no associated intracranial haematoma. 21 of the 25 patients with this lesion died within 6 hours after admission (Table II).

EXTRADURAL HAEMATOMA

There were 31 patients with extradural haematoma. The commonest indication for operation was deterioration of conscious level. (Table III) 13 cases had unequal pupils, while 3 had other localising signs. Echoencephalogram and angiogram helped in the decision to operate in 3 and 5 cases respectively. Skull fracture was seen in 14 out of 21 X-rayed.

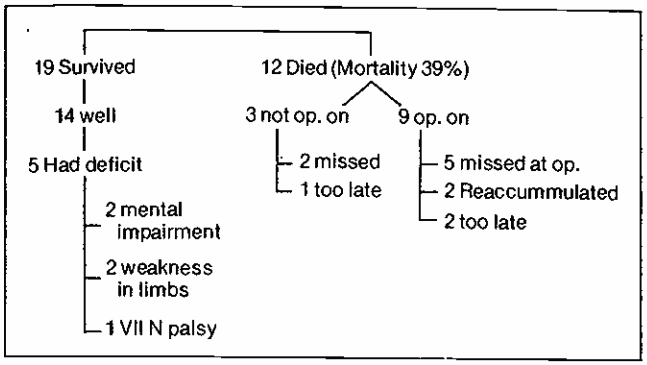
TABLE III: Extradural Haematoma (31 cases)

Indications For Operation	
Consciousness	18
Unequal Pupils	13
Other Localising Signs	3
Angiogram	5
Echogram	3
Fracture Skull	14/21

RESULTS (Table IV)

Of the 28 cases operated on, 19 survived. Of these, 14 had complete recovery, while 5 had some neurological deficit — 2 had slight mental impair-

TABLE IV: Extradural Haematoma (31 cases)



ment, 2 had residual weakness of the limbs, and 1 had seventh nerve palsy with slurred speech.

12 patients died a mortality of 39%. 9 were operated on. Of these, the extradural haematoma in 5 patients was missed at operation. 2 patients had reaccumulation and 2 had cardiac arrest before operation. Of the 3 not operated on, one came in already with coning. The remaining two were admitted with drowsiness and no pupillary or other localising signs. They developed cardiac arrest suddenly, one 10 hours and the other 36 hours after admission, without warning of neurological deterioration.

Of the 5 cases whose extradural haematomas were missed at operation, the haematomas were either in the frontal or occipital regions, and the usual finding at operation was that of gross cerebral cedema. 36% of the extradural haematomas in this series were so located (Table V), if only bi-temporoparietal areas were explored, they would be missed. Apart from the dilated pupil, local injury on the scalp indicated the site of haematoma quite accurately. Of the 14 cases with scalp injuries, 12 had haematomas underlying the scalp lesion. (Table VI) Thus in 3 of the cases which were missed at operation, 2 had lacerations and bruishing over the forehead with underlying frontal haematoma, and one had laceration over the occipital region with an underlying occipital haematoma.

TABLE V: Site of Extradural Haematoma

Temporo-Patietal	18	64%
Frontal	6	36%
Occipital	4	
Not Documented	3	
Total	31	

TABLE VI: Site of Extradural Haematoma; Corelation with dilated pupils and local injury

13 Dilated Pupils:	Same Side	12
	Opposite Side	1
14 Local Injury:	Same Site	12
	Opposite Site	2

SUBDURAL HAEMATOMA (Table VII)

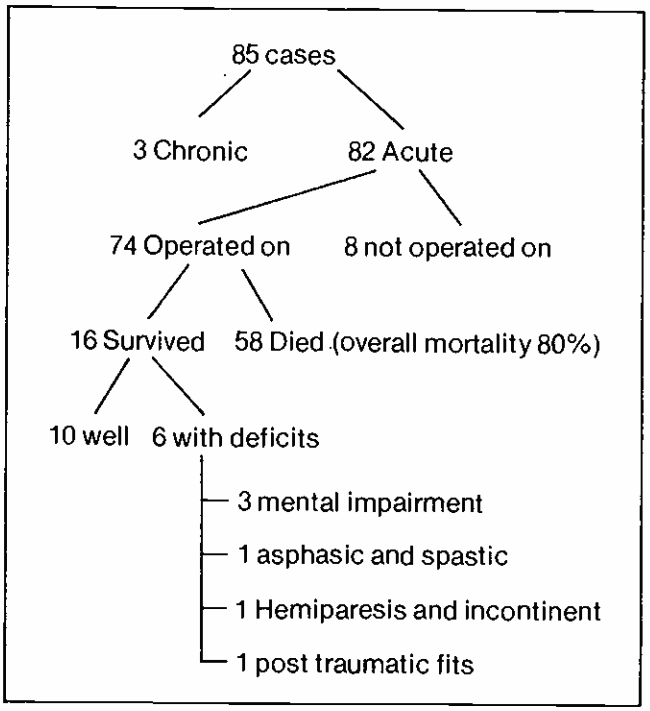
There were 85 patients with subdural haematomas. Of these, 3 were chronic and 82 acute.

CHRONIC SUBDURAL HAEMATOMA

All 3 patients with chronic subdural haematomas developed symptoms 14 days or more after a minor injury. Two recovered fully after operation. One had minimal spasticity in the limbs after two years. All three patients were over 41 years of age.

The low incidence of chronic subdural haematoma in this series is probably due to the fact that most of these cases were admitted incorrectly to the medical wards, and when on investigations, were found to have chronic subdural haematoma, they were referred to the Neurosurgical department rather than the General Surgical Department for further management.

TABLE VII: Subdural Haematoma



ACUTE SUBDURAL HAEMATOMA

Out of the 82 cases of acute subdural haematoma, 74 were operated on, of whom 58 died. 8 were not operated on and were diagnosed at autopsy. The overall mortality was 80%.

Of the 74 operated on, 16 survived, 10 were well and 6 had neurological deficits — 3 with mental impairment, 1 was aphasic and spactic, 1 had hemiparesis and incontinence and 1 had post traumatic fits.

The majority of patients were admitted in a comatose state, and the mortality and morbidity rates increased with the degree of unconciousness at the time of admission. Thus the mortality was 50% if the patient was conscious, and 95% if he was in deep coma initally. (Table VIII)

The commonest indication for operation was unequal pupil, and the dilated pupil usually indicated the side of the haematoma (Table IX) However, 47% of the patients had bilateral lesions. Thus it is imperative that the contralateral side of the head should always be explored even though a sizeable subdural haematoma has been found on one side.

Of the 66 patients who died, 42 had complete post mortem records for study (Table X). Of these, 23 (55%)had associated cerebral contusion or laceration; 8 (19%) had petechial haemorrhage in the pons, and 17 (40%) had evidence of coning. Of these 17 cases with coning, 11 were associated with either cerebral laceration or haemorrhage in the pons, and only 6 (14%) had no such association, 5 (12%) had no associated gross brain injury or herniation.

In 9 patients, the acute subdural haematomas were missed at operation. In addition, 7 operative cases had evidence of a reaccumulation, 5 at autopsy and 2 at re-exploration — all 7 died.

74% of our patients with acute subdural haematoma had associated gross brain injuries. The mortality was expectedly high. Nevertheless, our results can be improved if the incidence of the operative and nonoperative misses is reduced, and reaccumulation is detected early and treated.

INTRACEREBRAL HAEMATOMA (Table XI)

There were 21 patients with intracerebral haematoma and there were no survivals. 14 cases were associated with acute subdural haematomas, two with extradural and three with both. Only two cases had no other associated intra-cranial lesions and both were diagnosed as "cerebral oedema" at operation. As one would imagine not all of them were admitted in a deep comatose state. At the time of admission, two were conscious, and ten were drowsy. If

TABLE VIII: Subdural haematoma; State of Conscious Level at Admission; Corelation with Mortality & Morbidity

Result / Conscious Level	Alive		Dead		Total
	Well	Deficit	Number	Mortality Rate	
Conscious	2	1	3	50%	6
Coma I - II	6	1	20	74%	27
Coma III	2	3	24	82%	29
Coma IV	0	1	19	95%	20
TOTAL	10	6	66	80%	82

TABLE IX: Acute Subdural Haematoma

Indications for Operation	
Consciousness	29
Unequal pupils	47
Other localising signs	12
Angiogram	8
Echogram	7
Skull Fracture	16/29 X-rayed

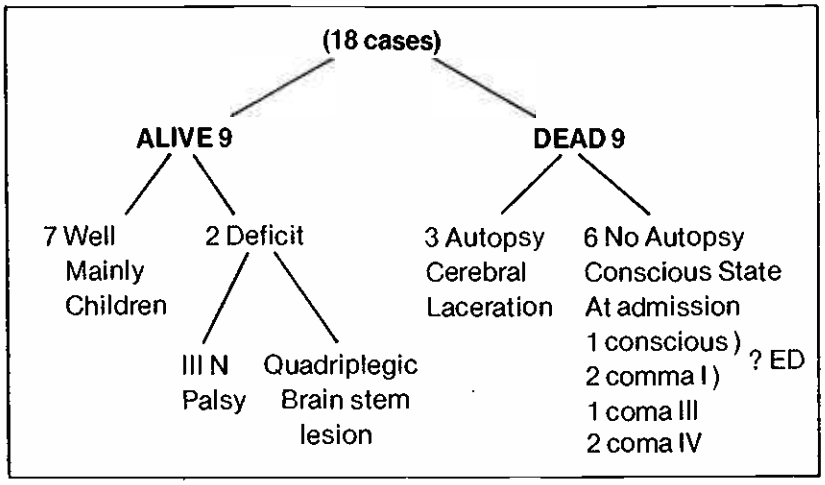
TABLE X: Postmortem Findings in Acute Subdural Haematoma (42 cases)

Cerebral Contusion/Laceration	23 (55%)
Haemorrhages in Pons	8 (19%)
Evidence of Herniation	17 (40%)
Herniation Alone	6 (14%)
No Gross Brain Injury or Herniation	5 (12%)

TABLE XI: Intracerebral Haematoma

21 Cases	No survival
Associated Injury	
Subdural Haematoma	14
Extradural Haematoma	2
Subdural and Extradural	3
Not associated	2
Conscious State At Admission	
Conscious	2
Coma I - II	10
Coma III	7
Coma IV	2

TABLE XII: "CEREBRAL OEDEMA"



these cases were diagnosed preoperatively, and treated in a neurosurgical unit with better expertise and facilities, some of them could have been salvaged.

"CEREBRAL OEDEMA" (Table XII)

There were 18 cases (12%) operated on and no significant collection of intracranial haematoma was found, but all showed varying degrees of cerebral oedema.

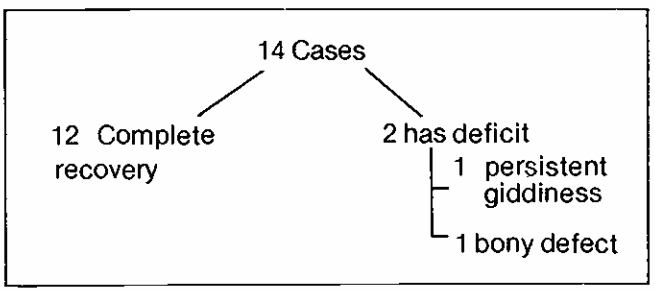
Out of these, 9 cases survived, 7 had complete recovery. It is interesting to note that out of these 7, 5 were children under 12 years of age.

Of the 9 who died, 3 had cerebral lacerations and contusions confirmed at postmortem. 6 had no postmortem reports available for study. It is possible that in some of those who were conscious or drowsy at the time of admission with only cerebral oedema found at subsequent operation an intracranial haematoma could well have been missed.

COMPOUND DEPRESSED FRACTURE (Table XIII)

There were 14 cases of compound depressed fractures of the skull, and all recovered with few complications. 12 had complete recovery, 1 complained of persistent giddiness and 1 had a significant bony defect requiring cranioplasty. None had wound infection or osteomyelitis in this series.

TABLE XIII: Compound Depressed Fracture



CONCLUSIONS

In conclusion, several facts became apparent in our study, our results could be improved with some modifications to our management policy.

Firstly, most of the patients with severe, non-salvageable brain injuries admitted in deep coma usually died within 6 hours. Those with potentially treatable intracranial haematomas who were observed initially because of light coma and lack of localising signs often did not show much change or die within 6 hours. Beyond that period, they could deteriorate rapidly and catch us with insufficiant time to carry out operative treatment. A point can be made for early investigations by the end of 6 hours of observation if there is status quo.

Secondly, in cases of suspected intra-cranial haematoma, if patient conscious level is not deteriorating rapidly, a carotid angiogram would help the surgeon to locate the exact site of the haematoma, thus reducing the mortality from the patients who had their lesions missed at craniotomy. However, it must be emphasied, for those patients who are deteriorating rapidly, especially if a pupil is dilated, no time should be wasted in organising for a carotid angiogram to be done. Such patients could develop coning and irrepairable brain damage within a short time and urgent craniotomy is required.

Thirdly, when operation has been decided on, attention should be paid to the site of external local injury as indicating a possible underlying extradural haematoma. If the patient has clinical features of an intracranial haematoma, particularly if he is con-

scious or only drowsy on admission, a diagnosis of cerebral oedema should not be easily accepted at operation and further exploration should be carried out. All such negative explorations should have carotid angiogram done soon after operation. In some cases, intracerebral haematoma may be found, and patients should then be referred to the neurosurgeons. With their expertise, a few patients may still be saved.

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REFERENCES

1. Harris P: Current concepts in the management of brain truma. J.R. Coll. Surg. Edin. 15: 268-82, 1970.
2. Maloney, A.F.J. and Whatmore W.J.: Clinical and pathological observations in fatal head injuries Brit. J. Surg. 56:23-31, 1969.
3. McKissock W. et al: Extradural haematoma, observations in 125 cases. Lancet, Z: 167-172, 1960.
4. McKissock, W., et al: Subdural haematoma, a review of 389 cases. Lancet: 1365-1369, 1960.
5. Overguard J., et al: Prognosis after head injury based on early clinical examination. Lancet 2: 631-5, 1973.
6. Sevitt S: Fatal Road accidents: Brit. J. Surg. 55: 481, 1968.