ORIGINAL ARTICLE

Contusion Index: Its Importance in Management of Traumatic Brain Contusions

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ABSTRACT

Objective: To describe the changes of Glasgow Outcome Scale (GOS) and Glasgow Coma Scale (GCS) after surgical and / or conservative management of patients with contusions based on Contusion Index (C. I.).

Study Design: Descriptive Study

Setting: Department of Neurosurgery, Dow University of Health Sciences/ Civil Hospital, Karachi.

Duration of Study: Two years and five months between August 2006 and January 2009.

Subjects and Methods: 50 patients of ages between 6 to 75 years, including both sexes were evaluated on the basis of contusion index as determined by computerized tomographic scan (C.T. Scan) findings and their Glasgow outcome scores were established.

Results: Patients with contusion index 0 – 3 should be conservatively managed. Patients with contusion index 6 should be given the benefit of some sort of surgical procedure first, which showed best results with surgical management and poor results with conservative management. Patients with contusion index 9, no matter what, always show a poor outcome.

Conclusion: We recommend that a future study should be done to arrive at a decision regarding conservative versus surgical management of patients with cerebral contusions based on Contusion Index which will help us avoid unnecessary surgeries and vice versa.

Key words: Contusion Index, Glasgow outcome score, Intracerebral Contusions.

INTRODUCTION

Head trauma constitutes one of the most important causes of morbidity and mortality in the modern world.[1] Traumatic cerebral contusions, by definition, must primarily involve the superficial grey matter of the brain,[2-5] or they are defined as bruises of brain parenchyma where the subpial membrane remains intact. If it distorts the subpial membrane then it is termed as a laceration. The underlying white matter is usually spared unless the contusion is extremely large.

Because grey matter is much more vascular than white matter, contusions are more likely to be hemorrhagic [6]. The hemorrhagic foci may vary in size from small petechiae scattered throughout the larger non-hemorrhagic zone of injury to multiple large confluent regions of hemorrhage occupying an entire lobe. Contusions tend to be multiple and bilateral. Contusions most commonly involve the temporal and frontal lobes [2, 7, 8]. Temporal lobe lesions mostly occur just above the petrous bone or posterior to the greater sphenoid wing. Frontal lobe lesions tend to lie just above the cribriform plate, planum sphenoidale and lesser sphenoidal wing. The parietal and occipital lobes are implicated much less frequently. Angular acceleration forces are important in the development of contusions. They cause differential movement of the brain within the skull and results in

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sliding of the cortical surface along the inner table. [9-11] Cortical contusions are less frequent in infants and young children because of the smooth inner surface of the skull.

PATIENTS AND METHODS

50 patients of all ages and both sexes, having intracerebral contusions with the time duration of less than 24 hours from time of injury were included in this study after taking informed consent. It was carried out in the Department of Neurosurgery, Dow University of Health Sciences, and Civil Hospital Karachi over a period of two years and five months (between August, 2006 and January, 2009).

Exclusion criteria were intracerebral contusions in patients with poly trauma, patients with systemic illness, patients with other significant brain injuries like extradural hematomas, subdural hematomas, severe diffuse injury, intraventricular haemorrhage [5-8] etc. apart from the contusions, time of duration i.e. > 24 hours from time of injury, patients with surgical complications [5-6]

All the 50 patients included were assessed carefully by proper history taking,[4] examinations, CT scan findings and follow up. CT scan findings were used to determine the Glasgow Coma Scale (GCS), Glasgow Outcome Scale (GOS) and Contusion Index (Table-1) and all were divided into three groups on the basis of Contusion Index. Group-1: Contusion Index 0 – 3, Group-2: Contusion Index 4 – 6, Group-3: Contusion Index 8 – 9. Sampling technique was non-probability convenience and the study design was descriptive.

1. (Contusion Index 0 – 3) – Conservative management.
2. (Contusion Index 4 – 6) – Conservative / Surgical management.
3. (Contusion Index 8 – 9) – Conservative / Surgical management (provided the Glasgow Coma Scale was >7)

TABLE-1: MEASUREMENT OF CONTUSION INDEX:

Grade	Depth of contusion	Extent of contusion
0	Absent	Absent
1	Does not extend to the full thickness of contex	Localized
2	Affects the full thickness of contex	Moderately Extensive
3	Extend into the white matter	Extensive

NOTE

The contusion index for any anatomical locator selected is derived from depth x extent; it can range from 0 x 0 = 0 (contusion absent) to 3 x 3 = 9 (deep and extensive contusion).

i.e. Depth x Extent = Contusion
0 x 0 = 0 [contusion absent / no contusion]
3 x 3 = 9 [deep & extensive contusion]

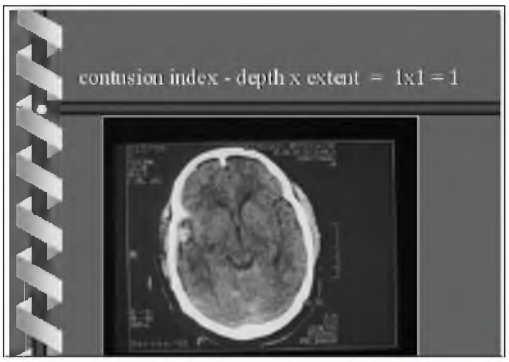
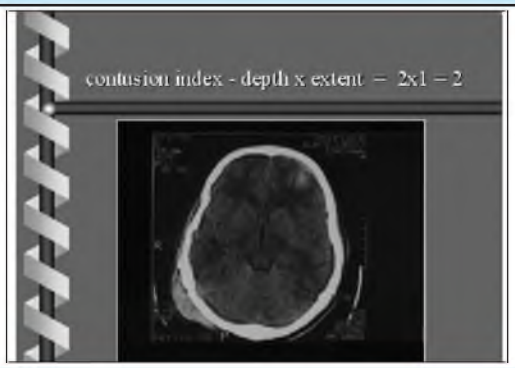


Figure – 1 :



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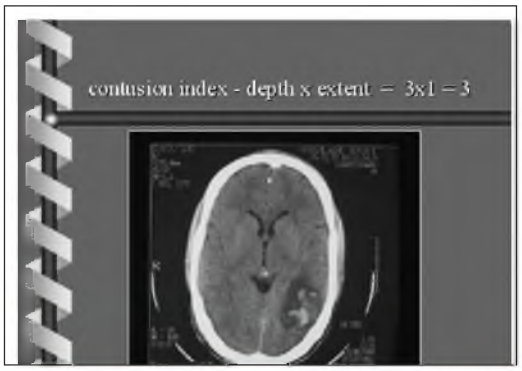

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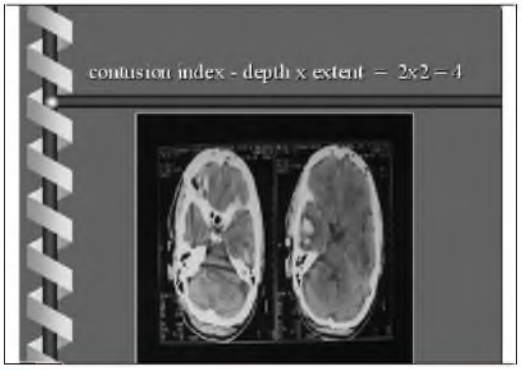

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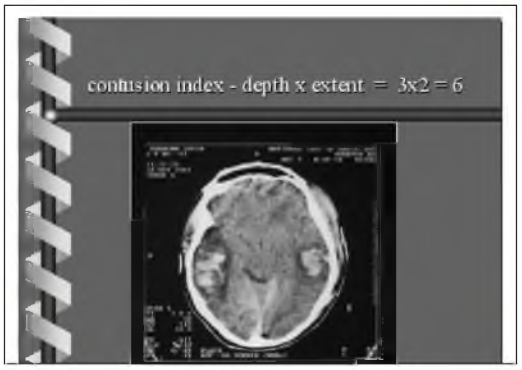

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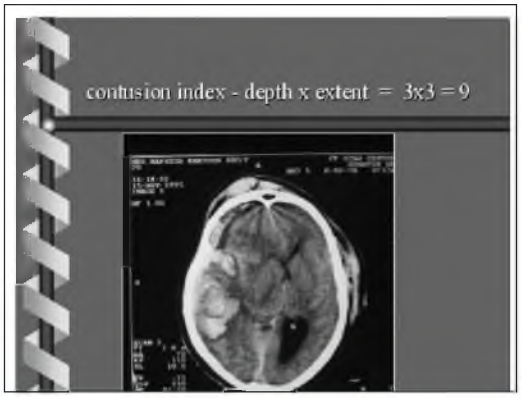

Figure – 6 :

RESULTS

50 patients of ages 6 to 75 years including both sexes were evaluated on the basis of contusion index as determined by the CT scan findings.

Group-1 (Contusion Index 0-3):

16 out of 50 patients belonged to Group-1. This group was therefore conservatively managed. Of these 16 patients, 2 had a contusion index of 1, 9 had a contusion index of 2 and 5 had a contusion index of 3.

15 patients out of these 16 turned out to have a Glasgow Outcome Score (GOS) of 5 (93.23%) and only 1 patient had a GOS of 3 (6.78%). This was the patient whose presenting Glasgow Coma Scale (GCS) was 5 / 15. He was aphasic and had right sided hemiparesis.

Group-2 (Contusion Index 4-6):

30 out of these 50 patients belonged to Group-2. Of these 30 patients, 14 had an index of 4 and 16 had an index of 6. This group was therefore subdivided into two groups on the basis of contusion index; i.e.**Group-2a** including the 14 patients with contusion index 4 and **Group-2b** including the 16 patients with contusion index 6 and then both the groups were individually analyzed. It was found that in **Group-2a,** of 14 patients with Contusion index 4, 10 patients had a Glasgow Outcome Score of 5. Out of these 10 patients, 8 were conservatively managed and 2 were surgically managed but 1 patient out of the 2 had undergone wound debridement only and the contusion was not touched.

Group 2a [Contusion Index 4]:

1 patient out of these 14 patients with contusion index 4 had a Glasgow Outcome Score of 4 and he had received conservative management [10] only.

1 patient had a Glasgow Outcome Score of 3 and he also received conservative management [10] only. The presenting Glasgow Coma Scale of this patient was 8 / 15 which contributed to the low Glasgow Outcome

Score. 2 out of these 14 patients expired (Glasgow Outcome Score 1). Both died of intractable seizures [11]. 1 of these had undergone surgery because on the 5th day of conservative management the contusion had expanded to an index of 6 but immediately after surgery he developed intractable seizures and died. Another patient died on the first day of admission due to seizures.

Group-2b [Contusion Index 6]:

4 patients out of these 16 patients with contusion index 6 had a Glasgow Outcome Score of 5. Out of these 4 patients, 3 were managed surgically at the outset preoperative ,Glasgow Coma Scales being 14 / 15, 8 / 15 and 7 / 15 respectively, and 1 patient was managed conservatively (Glasgow Coma Score being 15 / 15).

4 out of these 16 patients had a Glasgow Outcome Score of 4 and out of these 4 patients, 2 were managed conservatively at the outset and 2 were managed surgically, Glasgow Coma Scales being 9 / 15 and 10 / 15 respectively. Of 2 that were conservatively managed (Glasgow Coma Scale being 15 / 15 and 11 / 15), the one with the lower Glasgow Coma Scale had to be surgically dealt with because on the 3rd day contusion expanded.

8 out of these 16 patients expired with Glasgow Outcome Score 1.

On careful analysis of these 8 patients it was noted that 5 out of these 8 were conservatively managed at the outset. Glasgow Coma Scales of these being 5 / 15, 9 / 15, 7 / 15, 11 / 15, 10 / 15 respectively and 3 out of these 8 were managed surgically at the outset. Glasgow Coma Scales of these being 5 / 15, 9 / 15 and 10 / 15. Of the 5 that were conservatively managed 2 underwent surgery later after 24 hours as their initial Glasgow Coma Scale was 9 / 15 and 7 / 15 and the contusions had expanded to an index of 9 but despite this they could not be saved. In 1 out of these 5 patients who had a Glasgow Coma Scale of 10 / 15, surgery was required but because of the severe coagulopathy that had developed after admission, the contusion expanded to an index of 9 and he expired. Of the 3 that were surgically managed, 1 had a poor Glasgow Coma Scale on admission of 5 / 15 which had contributed to this poor outcome. 1 had expired due to seizures although his admission Glasgow Coma Scale was 9 / 15. In one case expiry was not related to surgery because patient had improved to a Glasgow Outcome Score of 3 but because of poor nutritional status and metabolic conditions she died 10 days after surgery. Her presenting Glasgow Coma Scale was 9 / 15.

So evaluating and summarizing the second group of 30 patients (Contusion Index 4-6) it was found that:

1. 14 patients out of a total of 30 patients in this second group had an ultimate Glasgow Outcome Score of 5 = 46.66% with 10 out of 14 from Contusion Index 4 group = 71.44% and 4 out of 14 from Contusion Index 6 group = 28.5%. This means that the patients with Contusion Index 4 had a better outcome compared to the patients with Contusion Index 6 which was only 28.57%.

2. 5 patients out of 30 had a Glasgow Outcome Score of 4 = 16.66% out of which 1 was from Contusion Index 4 group = 20% and 4 were from Contusion Index 6 group = 80%.

3. Only 1 out of these 30 patients had a Glasgow Outcome Score of 3 and was from Contusion Index 4 group 33.33%.

4. 10 out of these 30 patients i.e. 33.33% expired (Glasgow Outcome Score 1). Out of these 10, 2 were from Contusion Index 4 group = 20% and 8 were from Contusion Index 6 group = 80%. So the major mortality was from the group with contusion index 6 i.e. 80% of the 33.33% with Glasgow Outcome Score 1.

5. It is however also worth noting that of the 16 patients with contusion index 6 there were 8 patients =50% that were surgically managed and 8 patients = 50% that were conservatively managed at the outset. It was found that 4 patients = 50% out of the 8 conservatively managed patients ultimately required surgery but by then their neurological status had further deteriorated and only 1 survived with Glasgow Outcome Score 4. So of the 8 conservatively managed only 3 had a good outcome 37.5% and 5 expired (Glasgow Outcome Score 1) that is 62.5%.

6. Of the 8 surgically managed, 5 had a good outcome at the

outset. This means that those patients with Contusion Index 6 should be managed surgically from the beginning because they show better results with surgery rather than with conservative management.

Group-3 (Contusion Index 8 – 9)

Only 4 out of 50 patients belonged to Group-3. Of these 4 patients, 2 were managed conservatively; Glasgow Coma Scale being 9 / 15, 9 / 15 respectively and 2 were managed surgically at the outset, Glasgow Coma Scale being 7 / 15 and 10 / 15 respectively. Of the two conservatively managed 1 had to undergo surgery on the second day because of further deterioration in the neurological status. It was however noticed that no matter how this group was managed (conservatively or surgically) there was 100% mortality. These contusion index 9 patients have a poor outcome no matter how they are managed.

DISCUSSION

In this study of 50 patients it was found that the patients belonging to the Group-1 (Contusion Index 0 – 3), conservative management was good enough. It was also noticed that the presenting Glasgow Coma Scale of majority was above 10 / 15 and the only one patient whose presenting Glasgow Coma Scale was very low (5 / 15) was the one with Glasgow Outcome Score of 3 with residual deficits. So 100% patients in this group survived on conservative management out of which 93.23% showed Glasgow Outcome Score of 5 and 6.78% (1 patient only) showed Glasgow Outcome Score of 3. This means that patients belonging to this group should be given a chance of conservative management only when the size of contusion is small and the chances of expansion of contusion is very low. Only in 1 out of these 16 of patients the contusion expanded to an index of 4 i.e. 6.78% and that too on conservative management showed Glasgow Outcome Score of 5.

Since there are no studies available both locally as well as internationally, therefore no references can be cited showing comparison of our results with any previous studies [12]. This is a pilot study and we can only say what the results showed in terms of percentages of Glasgow Outcome Scores in the three groups. Much larger studies are therefore necessary taking into account the different aspects of our study before a definitive management protocol can be laid down on the basis of Contusion Index.

Group-2 of our study included the 30 patients with Contusion Index 4 – 6. It was noticed that the best Glasgow outcome score of 5 was in 46.66% only and that 71.44% of this was occupied by patients from contusion index 4 and only 28.57% were from contusion index 6 groups.

5 out of these 14 patients were managed surgically out of which 3 were from Contusion Index 6 group, and 2 were from Contusion Index 4 group but 1 out of these 2 patients had undergone surgery for depressed fracture and wound debridement but the contusion itself was not touched.

This means that the major part of good outcome in this group was seen in patients with Contusion Index 4. The majority of these i.e. 8 / 10 were conservatively managed. In 2 out of these 8 patients contusion had expanded to an index of 6 but since the overall condition was stable, the patients showed improvement on conservative management only.

Although in patients with Contusion Index 6, only 1 did well and that too was on surgical rather than conservative management.

Again, in this second group of 30 patients with Contusion Index 4 – 6, 5 patients i.e. 16.66% had a Glasgow Outcome Score of 4. This time 80% of this score was occupied by Contusion Index 4 group. It was again noticed that patients with Contusion Index 6 did best on surgical management rather than conservative because 4 out of 5 of these 30 patients had belonged to this group and 2 out of these 4 were conservatively managed at the onset and 2 surgically. In the cases that were conservatively managed, 1 had to be surgically dealt with after 3 days, because the

contusion expanded to an index of 9 and patient's Glasgow Coma Scale had dropped from 11 / 15 to 9 / 15.

So the above results again favor the initial surgical management in patients with Contusion Index 6. Again this is all an observation from our study and since this is a descriptive study and we do not have any previous studies relating contusion index to Glasgow outcome score on the basis of surgical versus conservative management, we cannot compare our results with any other studies. In this second group, only 1 patient had a Glasgow Outcome Score of 3 and he belonged from the contusion index 4 and was conservatively managed. This constituted 3.33% of the 30 patients in this group.

There was 33.33% mortality (10 out of 30) in this group and the major bulk of deaths, i.e. 80% was in patients with Contusion Index 6 whereas only 20% was in patients with Contusion Index 4. Careful analysis again revealed that the high mortality in Contusion Index 6 patients was because 5 out of 8 patients were initially managed conservatively and despite the fact that out of these, 5 patients were offered surgeries, later they did not survive. This again favors an initial surgical rather than a conservative approach in patients with Contusion Index 6.

The cause of mortality in the 2 patients with Contusion Index 4 was mainly intractable surgeries. 1 of these patients had presented with Glasgow Coma Scale of 6 / 15 and had died within 24 hours of admission probably because of intractable seizures and not the index of contusion. The other patient although had a Glasgow Coma Scale of 13 / 15 the contusion expanded on 5th day to an index of 6. He was operated but post-operatively developed intractable seizures and died.

Group-3 (Contusion Index 8 – 9) had only 4 patients. 2 of which were conservatively managed and 2 were surgically managed. Out of the 2, 1 was given the benefit of surgery after 2 days because of deterioration in Glasgow Coma Scale to 7 / 15 but he also showed poor results. Despite initial Glasgow Coma Scales of 7 / 15, 10 / 15, all died. So there was 100% mortality in this group whether surgically or conservatively managed.

CONCLUSION

In our conclusion we can say that patients with contusion index 0 – 3 should be conservatively managed. Patients with contusion index 4 should be monitored carefully and may do well with conservative management only, but however, occasionally surgery may be required. Patients with contusion index 6 should be given the benefit of some sort of surgical procedure first, because this was the group in our study, which showed best results with surgical management and poor results with conservative management. Patients with contusion index 9, no matter what, always showed a poor outcome [13]. In our study there was 100% mortality in this group. Our study design was descriptive and since no such work has been done in the past to determine any relationship between contusion index and Glasgow outcome scores on the basis of conservative or surgical management we cannot give a definitive management protocol. We have simply stated what our results revealed. This study has, in no doubt, provided a framework for further studies in this context and is also free for criticism on how it could have been improved. The main purpose for any future study for patients with contusions based on Contusion Index.

This is very important because this will help the on call neurosurgeon to arrive at a decision regarding conservative versus surgical management of patients with cerebral contusions based on Contusion Index and will also help to avoid unnecessary surgeries or vice versa.

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