

Intracranial Pressure Monitoring, Experience in Jordan University Hospital

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Abstract

Objective: This retrospective study was done to evaluate the Intracranial Pressure (ICP) monitoring and its effect on the outcome of multi-trauma patients, including severe head injury, in Jordan University Hospital, as many studies were published with controversies.

Methods: A total of 67 patients were included in the study, and in 42 patients ICP monitoring was used.

Results: It was found that the mortality rate increases with the higher readings in the ICP, reaching up to 100% in patients with an ICP of 60mmHg and above. Although the mortality rate was less in the ICP monitored patients (35.7%), compared to the Non- ICP monitored patients (52%).

Conclusion: The final outcome of severely head injured patients is not truly known especially in multi-trauma patients.

Keywords: Intracranial Pressure Monitoring, Outcome, Severe Head Injury.

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Introduction

After Lundberg¹ introduced direct and continuous Intracranial Pressure (ICP) monitoring into modern neurosurgery, monitoring and targeted management of the ICP has become a routine procedure in the management of severely head-injured patient.

Many reports of the indications of ICP monitoring after trauma, various methods and therapeutic consequences has been published with controversies.^{2,3}

This study was done to evaluate our modest experience using ICP monitoring in closed severe

head injury patients and its effect on the outcome in a university hospital.

Patients and Methods

In this retrospective study, 67 patients with closed severe head injury, Glasgow Coma Scale (GCS) score of eight and below, who were admitted to Jordan University hospital during an eight year period (1997-2004) were analyzed to evaluate the ICP monitoring and its effect on the outcome. The two patients who suffered high-velocity missile injuries to the brain and other three patients who died within the first 24 hours were excluded.

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ICP was monitored in 42 patients (62.7%), using the Camino device. 34 times using a subarachnoid bolt, 5 times using an intraventricular catheter and in 3 times we used the subdural space to place the device. All patients who underwent ICP monitoring were multi-trauma patients except for 3 patients with isolated head injury.

Mean duration of ICP measurement was 4.7 days (range, 1-12 days).

In 25 patients with closed severe head injury, ICP monitoring was not used (37.3%).

All patients were immediately intubated and ventilated and CT brain was done as soon as they were hemo-dynamically stable.

Treatment of increased ICP (≥ 20 mmHg) consisted of head elevation (30 degrees), controlled ventilation, arterial Pco₂ of 25-30mmHg with adequate sedation, ventricular drainage if possible, and mannitol as needed. Neither barbiturate coma nor dexamethasone was used as a standard therapy. All surgical extradural and subdural hematomas were immediately evacuated; this occurred in 16 out of 67 patients (23.6%), and in 6 patients (8.9%) lobectomies was performed for contusions and mass effect.

Results

42 patients (62.7%) with closed severe head injury were monitored for their ICP, there were 29 (66.6%) males and 14 females (33.4%), the mean age was 22.8 years (range 0 .5-87 years). Pedestrians (64.3%) were the most common victims involved in closed head injury. Most of the cases (92.9%) were multi-trauma patients except for three patients (7.1%) with isolated head injury. All patients had an abnormal computerized scans of the brain, having extradural, subdural hematomas, intracerebral contusions and/or brain edema.

ICP readings at insertion were categorized as per table (1); the most common reading was from 20 to 40 mmHg in 35% of cases, with a mortality

rate of 46.6%, reaching 100% for patients with ICP ≥ 60 mmHg.

Table (1): Intracranial pressure reading and mortality at insertion.

ICP (mmHg)	Number of patients (%)	Mortality (%)
<12	13(30)	1(7)
12-<20	10(23)	4(40)
20-<40	15(35)	7(46.6)
40-<60	3(7)	2(67)
≥ 60	1(4.6)	1(100)

The 42 patients (62.7%) with ICP monitoring were divided according to Glasgow Coma Scale score (GCS) into two groups, table (2), 16 patients (40%) in the first group with GCS ≤ 5 had a mortality rate of 50%, and 26 patients (60%) in the second group with a GCS of 6 to 8 had a mortality rate of 23, 8%.The overall mortality in ICP monitored patients was 35.7%.

Table (2): 42 patients with ICP monitor.

Glasgow Coma Scale	Number of patients (%)	Mortality (%)
3-5	16 (40)	5 (50)
6-8	26 (60)	7 (23.8)

Glasgow outcome scale for the rest of the ICP monitored patients was as follows: 23.8% for each of the good recovery and the moderate disabled patients, and 11.9% for the severe disabled patients and 4.8% for the vegetative state patients.

In the 25 patients (37.3%) with no ICP monitoring, there were 22 males (88.8%) and 3 females (11.2%), the mean age was 25.4 years (range 1.5-78 year). Seven patients (28%) had isolated head injury and 72% were multi-trauma patients. CT scan of the brain was abnormal in all patients, extradural or subdural hematomas, intracerebral contusions and/or brain edema.

As per table (3), out of 25 patients with no ICP monitor, 17 patients (68%) presented with a GCS ≤ 5 had a mortality rate of 58.8%, and 8 patients (25.2%) with a GCS of 6 to 8 had a mortality rate of 37.5%. The overall mortality in patients without ICP monitoring was 52%.

Glasgow outcome scale for the Non-ICP monitored patients showed 12% good recovery, 16% for both moderate and severe disabled patients and 4% for the one vegetative state patient.

Table (3): 25 patients without ICP.

<i>Glasgow Coma Scale</i>	<i>Number of patients (%)</i>	<i>Mortality (%)</i>
3-5	17 (68)	10 (58.8)
6-8	8 (32)	3 (37.5)

Discussion

The entry criteria of our series of 67 severely closed head-injured patients was a Glasgow Coma Scale score of eight or less for at least 24 hours. Patients who died within the first 24 hours were not included in the study as well as the two patients with gun shot wounds. This series is not too large, but similar to some published series.⁴⁻⁶ Reasons not to monitor ICP in severely head injured patients were most often related to the discretionary judgment of the attending neurosurgeon, and sometimes to the non-availability of the device.

The use of ICP monitoring in severely head injured patients remains controversial because no randomized controlled trials have been conducted. Several authors argued in favor of ICP targeted therapies for traumatic brain injury by comparing mortality rates of 28-36% observed since the introduction of routine ICP monitoring,⁷ and a 50% mortality rate observed by Jenett et al.⁸ This was also observed in our modest series that the mortality rate was 35.7% in patients with ICP monitor and 52% in patients with no ICP monitor. The mortality rate varies between the two groups of the ICP and Non-ICP patients, as the relation of the mortality to the severity of the head injury ranges from 50% to 58.8% in the ICP and Non-ICP patients, respectively in the very severe head injury (GCS ≤5), and ranges from 23.8% to 37.5% in the ICP and Non-ICP patients, respectively in severe head injury (GCS 6-8).

Indications for ICP monitoring were published as Guidelines,⁹ it includes that ICP monitoring is appropriate in patients with severe head injury with an abnormal admission brain CT scan that reveals hematomas, contusions, edema, or compressed basal cisterns. If the CT scan is normal, ICP monitoring is appropriate if two or more of the following features are noted at admission: age over 40 years, unilateral or bilateral motor posturing, and systolic blood pressure < 90 mm Hg. In our study, the CT scans of the brain were abnormal for all patients, so as per guidelines, all patients needed an ICP monitoring, but this was performed in 62.7% of all patients, this figure is comparable with other studies in which the rate for ICP insertion was 63%, as in the Traumatic Coma Bank study.¹⁰

We could observe that the mortality rate increase with the higher reading in ICP, reaching up to 100% in patients with an ICP of more than 60mmHg. Taking into consideration that most of the patients in our study were multi-trauma patients, 92.7% in the ICP group and 72% in the Non-ICP group, those systemic injuries, by its secondary insult to the brain like hypoxia and/or ischemia, may affect adversely the outcome.¹¹ This may be true because we observed that 40% of patients with an ICP of 12-20 mmHg at insertion died and 7% of patients with an ICP < 12 mmHg at insertion also died.

More recently, outcomes were compared between individuals who did or did not receive an ICP monitor,¹² the effect varied from improved to worsened outcome. Although the mortality rate was less in the ICP monitored patients (35.7%) compared to the Non- ICP monitored patients (52%), it would be difficult to conclude any definitive conclusion because of the relative small number of patients.

Gelpke et al.¹³ found higher survival rates in centers with a more conservative management regimen compared with more aggressive ones. Patel et al.¹⁴ found an improved functional status, but not a reduced mortality rate in which the ICP/cerebral perfusion pressure protocol was used. The functional status in our study, despite its modest group of patients, was similar for both

the vegetative state and severe disability, but a relatively increase in the incidence of moderate disability and good recovery in the ICP monitored patients versus the Non-ICP monitored patients.

Conclusion

Intracranial pressure monitoring is indicated in patients with severe closed head injury, it may be a prognostic factor but the final outcome is not truly known especially in multi-trauma patients with its secondary effect on the brain.

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قياس ضغط الدماغ الداخلي في مستشفى الجامعة الأردنية

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الملخص

الهدف: تقييم استخدام جهاز قياس ضغط الدماغ الداخلي لحالات الإصابات المتعددة بالجسم ومدى الاستفادة منه في حالات إصابة الرأس الشديدة في مستشفى الجامعة الأردنية، حيث يوجد عدة دراسات منشورة متباينة النتائج.

الوسائل: قمنا بمراجعة ملفات المرضى الذين لديهم إصابات متعددة بالجسم مع إصابة شديدة بالدماغ (معدل جلاسكو 8 أو أقل) خلال الفترة من عام 1997 ولغاية عام 2004. (عدد المرضى الإجمالي 67 مريضاً). تم استخدام جهاز قياس الضغط الداخلي للدماغ في 42 مريضاً ولم يستخدم في 25 مريضاً.

النتائج: تبين لنا حدوث نسبة مطردة للوفيات للمرضى الذين لديهم قياس ضغط دماغ داخلي عال حيث وصلت النسبة إلى 100 % في حالات كان قياس ضغط الدماغ الداخلي 60 ملم زئبق أو أعلى. وأن نسبة الوفيات كانت أعلى في المرضى الذين لم يتم قياس الضغط الداخلي للدماغ، حيث وصلت نسبة الوفيات 52 % مقارنة ب 35 % للذين تم قياس ضغط الدماغ الداخلي لهم.

الخلاصة: تبين الدراسة أن استخدام جهاز قياس ضغط الدماغ الداخلي يساعد في العلاج ومؤشر على النتائج النهائية للمرضى، مع وجود عوامل أخرى تؤثر في محصلة العلاج للمرضى ذوي الإصابات المتعددة.

الكلمات الدالة: قياس ضغط الدماغ الداخلي، النتائج، إصابات الدماغ الشديدة.