Laporan Kasus

ICP MONITOR PLACEMENT STEPWISE EARLY DECOMPRESSIVE CRANIECTOMY FOR THE MANAGEMENT OF SEVERE TBI PATIENTS: A CASE REPORT

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Abstract

Introduction. *Increased intracranial pressure (ICP) is a secondary event that mostly occurs following traumatic brain injury (TBI) and it correlates with poor outcome of the patients. Several studies have suggested that early decompressive craniectomy (DC; within 48 hours after injury) is recommended for severe TBI patients requiring removal of intracranial hemorrhage and early DC was able to reduce the complications of TBI caused by increased ICP. However, even early DC has been performed, increased ICP may still progress due to massive brain edema.* ***Methods****. We herein report a case report of patient admitted with severe TBI and intracranial hemorrhage. The patients were underwent DC and ICP monitor placement after the removal of the intracranial hemorrhage. During postoperative observation in ICU, the CSF of the patients was gradually drained if the ICP was over 15mmHg.* ***Results****. The ICP right after performed early DC was 30 cmH_2O (22 mmHg). One day after surgery, the hemodynamic of the patient was stable and the GCS was 2X5 with the ICP of the patient was about 18 cmH_2O. On day 2-5, patient was hemodynamically stable with improved GCS (3X5) and decreased of ICP (around 13-15 cmH_2O). On day 6, the ICP monitor was removed and the patient discharged on day 19 after fully recovered.* ***Conclusion****. The placement of ICP monitor and the application of gradual release of CSF after DC might be helpful to reduce increased ICP in severe TBI patients, and thus reducing the morbidity and mortality.*

*Keywords****:*** *Traumatic brain injury, intracranial pressure monitor, decompressive craniectomy*

Abstrak

Pendahuluan. Peningkatan tekanan intrakranial (ICP) merupakan kejadian sekunder yang sering terjadi setelah cedera otak traumatis (TBI) dan berkorelasi dengan hasil yang buruk pada pasien. Beberapa penelitian menunjukkan bahwa kraniektomi dekompresif awal (DC) (dalam 48 jam setelah cedera) direkomendasikan untuk pasien dengan TBI berat yang membutuhkan evakuasi perdarahan intrakranial dan DC awal mampu mengurangi komplikasi TBI yang disebabkan oleh peningkatan TIK. Namun, meskipun DC awal telah dilakukan, peningkatan TIK masih dapat berlangsung karena terjadi edema otak yang masif. **Metode.** Sebuah kasus pasien yang dirawat dengan TBI berat dan perdarahan intrakranial. Pasien kemudian menjalani DC dan pemasangan ICP monitor setelah evakuasi perdarahan intrakranial. Selama observasi pasca operasi di ICU, cairan serebrospinal (CSF) pasien secara bertahap akan dikeluarkan jika ICP lebih dari 15mmHg. **Hasil**. ICP sesaat setelah dilakukan DC awal yaitu 30cm H20 (22 mmHg). Hari pertama setelah operasi, hemodinamik pasien stabil dan GCS 2X5 dengan ICP pasien sekitar 18 cmH2O. Pada hari ke 2-5, pasien hemodinamik stabil dengan GCS membaik (3X5) dengan penurunan ICP (sekitar 13-15 cmH2O). Pada hari ke-6, ICP monitor dilepaskan dan pasien dipulangkan pada hari ke 19 setelah pulih sepenuhnya. **Kesimpulan**. Penempatan ICP monitor dan aplikasi pelepasan CSF secara bertahap setelah DC mungkin membantu mengurangi peningkatan ICP pada pasien dengan TBI berat, dan dengan demikian mengurangi morbiditas dan mortalitas.

Kata kunci: Cedera otak traumatik, monitor tekanan intrakranial, kraniektomi dekompresi

Introduction

Traumatic brain injury (TBI) is a well-recognized as the leading cause of death of the traumatic injury patients. In the United States, from no less than 2.5 million TBI-related patients, the mortality is accounted for more than 55.000 cases per year.[1] Beside intracranial hemorrhages, elevated intracranial pressure (ICP) is mostly attributed due to brain edema formation and thus resulting unfavorable outcomes among TBI patients. [2,3] Therefore, one of the main focus of the medical therapies for TBI patients is to treat increased ICP due to brain edema formation so that cerebral perfusion and oxygenation can be maintained.[4] If medical treatments have failed in lowering ICP, decompressive craniectomy (DC) is an option to treat increased ICP following TBI. Further, recent studies recommended that DC should be performed within 48 hours after trauma to significantly improve neurological functions and mortality outcomes. [2,5-7]

A guideline based on evidences has been proposed for managing severe TBI patients. In the guideline, ICP monitoring for severe TBI patients is recommended so that clinicians can give therapies based on the information from ICP monitors in treating increased ICP[8]. In a retrospective study, 1.874 patients (out of 10.628) who have ICP monitors had lower odds of mortality especially in patients under 65[9]. Another retrospective study also showed that the mortality in severe TBI patients was increased in patients that were treated without ICP monitors.[10]

In some severe TBI case, increased ICP may still progress due to massive brain edema even after early DC. If uncontrollable ICP happens, early DC will not significantly improve the outcomes. Therefore, it is questionable whether ICP monitor placement stepwise early DC have favorable outcomes in severe TBI patients after the removal of the intracranial lesions. If the ICP remains uncontrollable even after early DC and medical therapies, gradual release of cerebrospinal fluid (CSF) might be helpful to reduce the increased ICP.

Case Presentation

A 31 years old male patient was involved in a motor vehicle accident 30 hours before admission. Previously, he was brought for treatment in a local hospital right after the accident. He was then referred to our hospital for further treatment. The patient had history of decreased consciousness since the accident, vomited 3 times, bloody otorrhea of the left ear, and no seizure. Upon arrival at our hospital the GCS score was 8 with unequal pupil diameter, decreased light reflex of the left eye and right parieto-occipital cephalohematoma. The latest head CT scan, 15 hours after accident, showed multiple contusions at left-right frontal region and enlargement of intracerebral hemorrhage (ICH) at left frontal region with volume around $\pm$ 25 cc compared to previous head CT Scan 4 hours after accident ($\pm$ 7,5cc), and thus causing midline shift > 0,5 cm to the contralateral side (fig.1and 2).

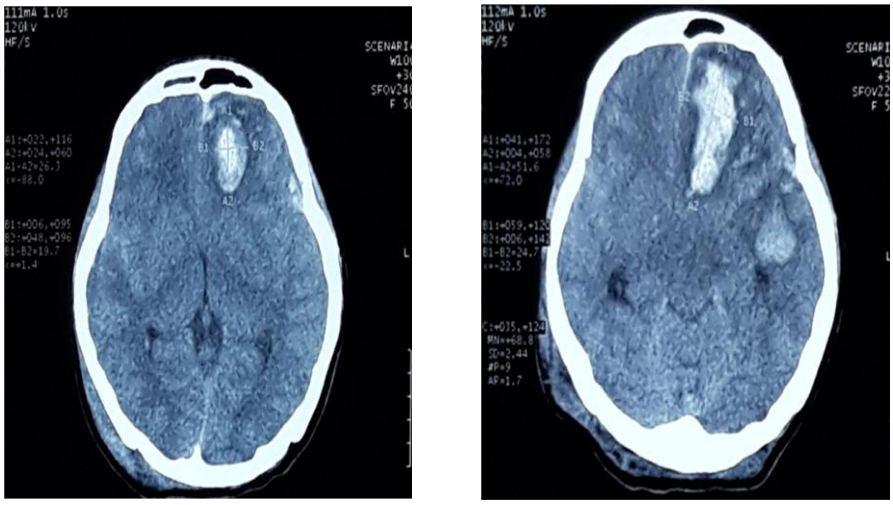

Figure 1. an axial pre-operative CT scan show multiple contusions at left-right frontal region and enlargement of intracerebral hemorrhage (ICH) at left frontal region, causing midline shift > 0,5 cm to the contralateral side)
Source: Database Neurosurgery Department, Dr. Soetomo General Hospital

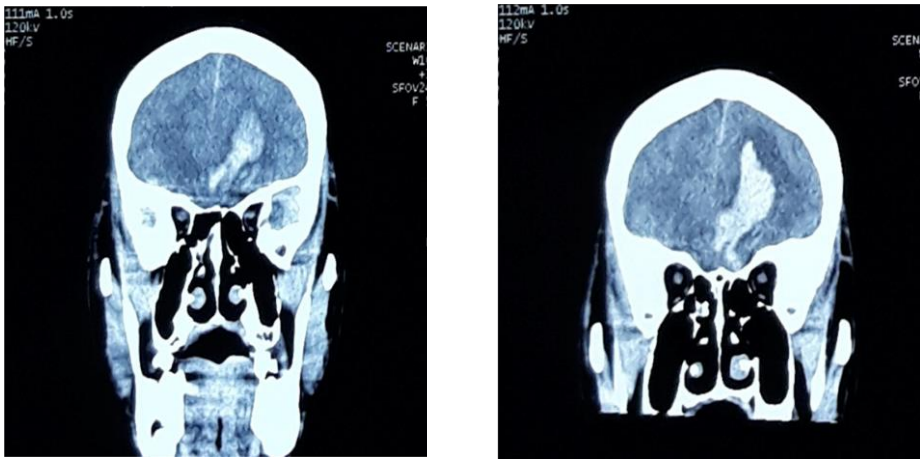

Figure 2. A coronal pre-operative CT scan show multiple contusions at left-right frontal region and enlargement of intracerebral hemorrhage (ICH) at left frontal region.
Source: Database Neurosurgery Department, Dr. Soetomo General Hospital

The patient underwent right-sided DC to evacuate the ICH followed by ICP monitor placement at right Kocher's point. Initial pressure post early decompression showed a value of 30 cmH_2O (22 mmHg) (Fig.3&4). A tracheostomy procedure was then performed to secure the airway and prevent sputum retention in the post-surgical care.

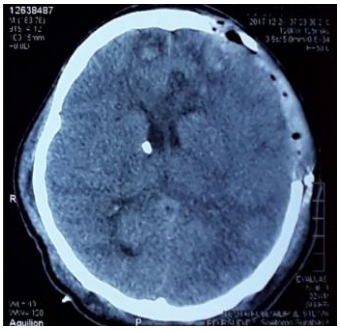

Figure 3

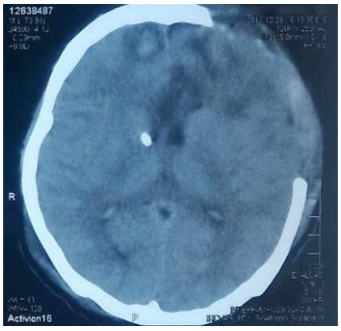

Figure 4

Figure 3. 2 days post-operative axial CT scan showed condition after DC, note that the ICH had been removed and ICP monitor had placed. Figure 4. 6 days post-operative CT scan, notice the ICP monitor still exist and brain became swollen)
Source: Database Neurosurgery Department, Dr. Soetomo General Hospital

Following surgery, the patient was treated and intensively observed in the intensive care unit (ICU). The ICP was monitored periodically and the CSF was drained if the ICP above 15 cmH_2O (11 mmHg), with a maximum 100cc in a day. One day after surgery, the hemodynamic of the patient was stable and the GCS was 2X5 with the ICP of the patient was about 18 cmH_2O (100cc of CSF drained). On day 2, the GCS was improved to 3X5 with the ICP of 15 cmH_2O (100cc of CSF drained). Until day 5 post surgery, patient was hemodynamically stable with GCS 3X5 and ICP around 13 – 15 cmH_2O (less than 100cc of CSF drained per day). The ICP monitor was then removed on day 6 after surgery and the patient was transferred from ICU to our high care unit (HCU). During treatment in HCU, the patient was also treated by pulmonologist due to pneumonia complications. The patient was discharged from hospital on day 19 after fully recovered with GCS 4X6 and pneumonia treatment was finished.

Discussion

The high number of mortality and morbidity in TBI is often attributed to the increased ICP as a result of brain edema[11,12]. Therefore, managing brain edema in order to prevent increased ICP is one of the focuses of medical management in TBI. However, progressive brain edema refractory to medical management is likely occurred in severe TBI, thus resulting high mortality rate[13] (close to 100%; Miller, 1977). In managing refractory intracranial hypertension DC is considered as a

salvage procedure and has been widely used in severe TBI. Recently, many studies showed that early DC, within 48 hours of injury, in severe TBI improves the outcome and reduces mortality rate. In a study conducted by Grindlinger et al[3] ICP post early DC was significantly decreased, thus resulting in good outcome and decreased mortality rate.[3]

In our case we performed early decompressive craniectomy due to enlargement of intracerebral haemorrhage at left frontal region, previous head CT 4 hours after accident showed (+¬ 7,5cc) while 15 hours after accident showed + 25 cc of hematoma, thus causing > 0,5 cm midline shift. After DC was performed, the patient GCS was 2X5, and improved to 3x5 at Day 2, corresponds as Kim said that DC performed within 48 hours after trauma, significantly improve neurological functions and mortality outcomes[5]. Not only DC was performed, ICP monitor was also placed and drained the CSF if the ICP above 15 cmH2O (11 mmHg), this aimed to treat increased ICP so that cerebral perfusion and oxygenation can be maintained, as recommended by brain trauma foundation in the management of severe TBI[8]. Alali also support this guidelines in his retrospective study which showed that mortality in severe TBI patients was lower in group of patients treated with ICP monitor[9].

Until 5th day after surgery, the patient's haemodynamic and neurological functions was stable, which is showed a favorable outcome as Grindlinger stated in his study[3]. However this case found that the ICP of our severe TBI patient was remain high (±30cm H_2O) even after DC procedure. Although the day after surgery showed a prominent decreased of ICP, it could be seen that early DC might not enough to control refractory increased ICP

Conclusions

The placement of ICP monitor and the application of gradual release of CSF after DC might be helpful to reduce the increased ICP of severe TBI patients, and thus reducing the morbidity and mortality. However, in this case report showed that that early DC might not enough to control refractory increased ICP.

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