Surgical Treatment of Supra- and Infratentorial Epidural Hematoma

Supra- ve İnfratentorial Epidural Hematomun Cerrahi Tedavisi

Wang XIAOYU, Li GUOPING
Sichuan University, Department of Neurosurgery, Chengdu, China

Corresponding Author: Li GUOPING / E-mail: yuxixi1052006@126.com

ABSTRACT

Supra- and infratentorial acute epidural hematoma (SIEDH) is a common type of posterior fossa epidural hematoma (PFEDH), representing 11–64% of all PFEDHs (1, 3-6, 10-12, 14, 17). Although SIEDH is associated with typical characteristics, it might be difficult to diagnose when presenting as infratentorial acute epidural hematoma, which is clinically silent and has nonspecific symptoms. However, this type of hematoma can often be rapidly deteriorating, causing a sharp rise in intracranial pressure that leads to a life-threatening foramen magnum herniation. Early diagnosis and management of SIEDH are imperative (7-9). Traditional surgical management has always required relatively large craniotomies, larger than the hematoma itself, to expose its edge, and then tack up the dura matter. It usually opens the window and emphasizes retention of the bone bridge outside the transverse sinus. This method can effectively eliminate the hematoma, but it is associated with larger postoperative wound, longer operation time, larger skull defect, and more complications. Hence, exploration into a better surgical method is direly needed.

KEYWORDS: Acute epidural haematoma, Cranietomy, Posterior fossa, Cleaning hematoma

ÖZ

Supra- ve infratentorial akut epidural hematom (SIEDH) sık görülen bir posterior fossa epidural hematomu (PFEDH), tipidir ve tüm PEEDS'lerin % 11–64'ünü temsil eder. SIEDH'nin tipik özellikleri olma da klinik olarak sessiz olan ve belirtileri nonspesifik olan bir infratentorialal akut epidural hematom olarak ortaya çıktığında tani konması zor olabilir. Ancak bu tür hematom hızlı kötüyeye gidebilir ve yaşamı tehdit edici foramen magna herniasyonuna yol açacak şekilde intrakraniyal basınçta ani bir yükselme neden olabilir. SIEDH için erken tanı ve tedavi şarttır. Geleneksel cerrahi tedavi hematomun kenarını göstermek ve sonra dura materi kapatmak için hematomun kendisinden daha büyük nispeten büyük granülotomiler gerektirmiştir. Sıklıkla transvers sinus dışındaki kemik köprünün retnansiyonunu vurgular ve pencereyi açar. Bu yöntemin hematomu etkisi çekilde ortadan kaldırılabilir ama daha büyük bir postoperatif yara, daha uzun ameliyat süresi, daha büyük kafatası defeksi ve daha fazla komplikasyona iliskildir. Bu nedenle, daha iyi bir cerrahi yöntemin bulunması kesin olarak gerekli olur.

ANAHTAR SÖZÜKLER: Akut epidural hematom, Kraniyektomi, Posterior fossa, Hematom temizleme

INTRODUCTION

Supra- and infratentorial acute epidural hematoma (SIEDH) is a common type of posterior fossa epidural hematoma (PFEDH), representing 11–64% of all PFEDHs (1, 3-6, 10-12, 14, 17). Although SIEDH is associated with typical characteristics, it might be difficult to diagnose when presenting as infratentorial acute epidural hematoma, which is clinically silent and has nonspecific symptoms (2). However, this type of hematoma can often be rapidly deteriorating, causing a sharp rise in intracranial pressure that leads to a life-threatening foramen magnum herniation. Early diagnosis and management of SIEDH are imperative (7-9). Traditional surgical management has always required relatively large craniotomies, larger than the hematoma itself, to expose its edge, and then tack up the dura matter (15-16). It usually opens the window and emphasizes retention of the bone bridge outside the transverse sinus. This method can effectively eliminate the hematoma, but it is associated with larger postoperative wound, longer operation time, larger skull defect, and more complications. Hence, exploration into a better surgical method is direly needed.

In this article, we adopted the supratentorial approach in 25 patients with SIEDH, who were diagnosed and treated at the Department of Neurosurgery, West China Hospital, Sichuan University, Sichuan, China, between January 2006 and August 2009. We conducted a retrospective study of patient records to evaluate the technical aspects of the supratentorial approach with respect to the surgical indications, treatment effects, limitations, and complications. This evaluation suggests that the supratentorial approach provides good results in patients with SIEDH. It is the first report to describe the supratentorial approach for the management of SIEDH.

MATERIAL and METHODS

Patient Population

25 patients with SIEDH were evaluated and surgically treated at the Department of Neurosurgery, West China Hospital,
The scalp was sutured (Figure 1A-F). by this method. Finally, an epidural catheter drainage tube tack-up stitches. Most of hematomas were passively removed with a gelfoam was applied and the dura was secured with hemorrhage was observed, a bipolar was used to stop the first, preventing dissection of the hematoma by force. Then In sinus region, the hematoma was cleaned near the bone and the dura was slinged, except toward the transverse sinus. were explored. The supratentorial hematoma was cleaned a rongeur was used to open the bone to avoid sinus injury. 2 burr holes were drilled on both sides of midline and then hematoma was thick. But when the hematomas were thin, high-speed craniotome was used without sinus injury if the bone flap was then removed and parts of hematoma were explored. The supratentorial hematoma was cleaned and the dura was slinged, except toward the transverse sinus. In sinus region, the hematoma was cleaned near the bone first, preventing dissection of the hematoma by force. Then the infratentorial hematoma was cleaned. If a meningeal hemorrhage was observed, a bipolar was used to stop the hemorrhage. If sinus bleeding was encountered, compression with a gelfoam was applied and the dura was secured with tack-up stitches. Most of hematomas were passively removed by this method. Finally, an epidural catheter drainage tube with a silicone vacuum was insered, the bone was reset, and the scalp was sutured (Figure 1A-F).

**Evaluation**

From a total number of 54 patients with PFEDH, 25 patients were diagnosed with SIEDH by CT (46.3% of PFEDH cases). The clinical course of traumatic PFEDH was classified as acute, subacute, and chronic, with the onset of symptoms within the first 24 hours of trauma, until the 7th day post-trauma, and thereafter, respectively (3). Surgical indications, determined by CT findings, are: 1) obliteration of the perimesencephalic cisterns (particularly the quadrigeminal cistern); 2) compression and/ or displacement of the fourth ventricle, and the presence of hydrocephaalus; 3) extension of the hematoma to the supratentorial region, with marked compression to the brain.

**Technique**

25 patients were intubated under general anesthesia during surgery. The patients were in a lateral or prone position, with the head secured in a Mayfield head holder. Anatomic landmarks (e.g., midline, the transverse sinus) were marked with a skin marker. According to the size and location of supratentorial hematoma, the site of the craniotomy was marked on the skin. For 23 patients with unilateral hematoma, which did not extend to the midline, a unilateral occipital skin flap was incised. For 2 patients with bilateral hematoma, which extended to the midline, the skin flap crossed the midline depending on the location of hematoma. The incised skin flap was turned toward the neck. Four burr holes in the four corners of bone flap were drilled with a high-speed bone drill. The bone flap was cut off by using a high-speed craniotome. For bone flaps that crossed the midline, a high-speed craniotome was used without sinus injury if the hematoma was thick. But when the hematomas were thin, 2 burr holes were drilled on both sides of midline and then a rongeur was used to open the bone to avoid sinus injury. The bone flap was then removed and parts of hematoma were explored. The supratentorial hematoma was cleaned and the dura was slinged, except toward the transverse sinus. In sinus region, the hematoma was cleaned near the bone first, preventing dissection of the hematoma by force. Then the infratentorial hematoma was cleaned. If a meningeal hemorrhage was observed, a bipolar was used to stop the hemorrhage. If sinus bleeding was encountered, compression with a gelfoam was applied and the dura was secured with tack-up stitches. Most of hematomas were passively removed by this method. Finally, an epidural catheter drainage tube with a silicone vacuum was insered, the bone was reset, and the scalp was sutured (Figure 1A-F).

**RESULTS**

**Clinical Presentation**

The time interval from injury to diagnosis ranged from 2 to 24 hours; 22 of the patients were diagnosed within 24 hours (acute SIEDH) and 3 within 7 days (subacute SIEDH). No patients diagnosed beyond 7 days were encountered (chronic cases). Acute cases were of all ages, with a peak incidence in those aged 16–20 years.

The most important complications were occipital swelling (25 patients), headache (24 patients), and vomiting (12 patients). The symptoms and signs of the patients are summarized in Table I. Admission GCS score was 3–8 points in 2 patients, 9–12 points in 4 patients, and 13–15 points and 19 patients. Papilledema was observed in 8 patients.

**Radiological Findings**

23 patients had unilateral SIEDH, of which 10 were on the left and 13 on the right. In 2 patients, the hematoma was bilateral. 21 patients had fracture of the occipital bone as revealed by CT bone window level films. 18 patients had fourth ventricle compression and 3 patients had hydrocephaalus. The first examination revealed a hematoma in 23 patients and a late fat hematoma in 2 patients. Tada epidural hematoma volume was 10–25 mL (mean, 17 mL).

**Associated Lesions**

We observed an acute temporoparietal epidural hematoma in 2 patients, a frontal hemorrhagic contusion in 3 patients, a pneumocephalus in 4 patients, and basal skull fractures with cerebrospinal (CSF) fistula in 2 patients (Table II).

**Surgical Management**

A total of 25 patients with SIEDH were surgically treated by the supratentorial approach. Intraoperative linear fracture of the occipital region was observed in 21 patients, and bleeding from the transverse sinus was observed in 3 patients. The fracture line at the plate barrier with bleeding was observed in 18 patients, meningeal blood vessel bleeding in 4 patients, and no active bleeding point in 25 patients (Table III). Blood loss during the operation ranged from 30–60 mL, with mean blood loss of 40 mL. Operation time ranged from 45–120 min (mean, 55 min). Hematoma was not visible on CT scan on the day after the first surgical operation, with no further intracranial bleeding (Figure 2). GCS score revealed that 23 patients recovered well; 2 patients who had GCS score of 3–8 on admission were moderately disabled following discharge from hospital.

**DISCUSSION**

SIEDH is a common type of posterior fossa epidural hematoma (PFEDH), representing 11–64% of all PFEDHs (1, 3-6, 10-12, 14, 17). In our series, 25 patients were diagnosed with SIEDH, accounting for 46.3% of the total of 54 patients with PFEDH. The entity was a lesion of younger-aged patients, mainly in those aged 16–20 years, with mean age of 17 years. This
Figure 1: Photographs of the operative procedure. A) Planned skin incision with a skin marker of the midline and transverse sinus. B) Incised skin flap was turned toward the neck, making a burr hole in bone flap. C) Exposure of the hematoma and slinging of the dura. D) Supratentorial hematoma was cleaned. E) Infratentorial hematoma was cleaned. F) An epidural catheter drainage tube with a silicone vacuum was inserted and the dura was slinged.

Table I: Signs and Symptoms

<table>
<thead>
<tr>
<th>Signs and symptoms</th>
<th>No. of signs</th>
<th>Percentage of signs(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occipital swelling</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Headache</td>
<td>22</td>
<td>88</td>
</tr>
<tr>
<td>Vomiting</td>
<td>16</td>
<td>64</td>
</tr>
<tr>
<td>Cerebellar signs and symptoms</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Pyramidal signs</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Loss of consciousness</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Anisocoria</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Otorrhagia</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>Occipital fracture</td>
<td>23</td>
<td>92</td>
</tr>
</tbody>
</table>

Table II: Associated Lesions

<table>
<thead>
<tr>
<th>Associated lessons</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporoparietal epidural hematomas</td>
<td>2</td>
</tr>
<tr>
<td>Frontal hemorrhagic contusion</td>
<td>3</td>
</tr>
<tr>
<td>Pneumocephalus</td>
<td>2</td>
</tr>
<tr>
<td>Basal skull fractures with</td>
<td>4</td>
</tr>
<tr>
<td>Cerebrospinal (csf) fistula</td>
<td></td>
</tr>
</tbody>
</table>

Table III: Bleeding Point

<table>
<thead>
<tr>
<th>Bleeding from</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse sinus</td>
<td>3</td>
</tr>
<tr>
<td>The fracture line at the plate barrier</td>
<td>18</td>
</tr>
<tr>
<td>Meningeal blood vessels bleeding</td>
<td>4</td>
</tr>
</tbody>
</table>
is confirmed, surgery should be performed as soon as possible to eliminate the hematoma and lift the compression to the transverse sinus.

Traditional surgical management of SIEDH has always required relatively large craniotomies, sometimes even larger than the hematoma itself, to expose its edges and the bleeding. So it is always necessary to combine suboccipital craniectomy with the supratentorial approach to achieve complete hematoma evacuation. However, this leads to bigger postoperative wound and requires dissection of the muscle of cervico-occipital region, causing more blood loss and longer operation time (almost 2–3 hours longer) as well as more financial costs. In hospitals where there is no a high-speed bone drill and craniotome, suboccipital craniectomy is hard to perform and always leads to bone defects. Bone defects not only lead to cosmetic problems, but also functional deficits. An occipital bone defect may require another surgery of cranioplasty. This type of bone defect may cause psychological problems, particularly in children, affecting cognitive development. Thus, bone flap replacement is consistent with anatomical concerns as well as neurological recovery. The packing around the transverse sinus may compress the sinus and obstruct the blood flow. The bone defect after traditional suboccipital craniectomy may result in complications of subcutaneous hydrops and CSF leakage, which may lead to postoperative

Figure 2: Right supra- and infratentorial acute epidural hematoma was not visible on CT scan on the day after the first surgical operation, with no further intracranial bleeding.
wound infection and intracranial infection. Another operation might be needed to solve those problems, extending the hospitalization stay of the patients and increasing the financial burden on the health system. Therefore, traditional suboccipital craniectomy should be reduced to a minimum in the management of patients with SIEDH.

As there are no major meningeal arteries and main branch vessels in the posterior fossa, no sinus tearing is encountered with the supratentorial approach, facilitating hemostasis. Also, detachment of the transverse sinus and dura, caused by hematoma, can lead to formation of a compartment with bone, which allows for the removal of the infratentorial part. We can thus use the supratentorial approach to remove all parts of SIEDH throughout that compartment.

Dissection of the hematoma by force is intraoperatively contraindicated in the sinus region. If bleeding is encountered, the recommendation is to compress it with gelfoam and secure it with tack-up stitches. From our experience, suction can be used to suck out the residual hematoma as long as one is close to the edge of the hematoma.

The improved method has following advantages: bone resetting meets the requirements of anatomy and prevents skull defects, which are caused by the conventional methods; complete removal of the hematoma, effectively lifting transverse sinus compression and avoiding excessive suspension of the transverse sinus that causes venous reflux disorder; the surgery is minimally invasive, preventing large bone defects, and reducing operation time and cost of surgery.

In the present series, there were no cases of arterial bleeding. All patients underwent surgery with the supratentorial approach and had complete hematoma evacuation. Control CT scans 12 and 24 hours postsurgery revealed no further bleeding or residual hematomas. Our study indicates that the supratentorial approach is as effective as suboccipital craniectomy for the management of SIEDH, and it is not associated with large bone defects and large postoperative wounds.

**CONCLUSION**

Our study demonstrates that the supratentorial approach to craniectomy can effectively eliminate SIEDH. It not only leads to satisfactory hematoma evacuation, but is also a minimally invasive surgery, avoiding large bone defects and complex bone fixes, and reducing the operation time and cost of surgery.

**REFERENCES**