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Methods of intra-operative treatment of cranioplasty in patients with abnormal bone window flap pressure after decompressive craniectomy

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ABSTRACT

Objective: This study was performed to investigate the method of cranioplasty in patients with abnormal bone window pressure after decompressive craniectomy.
Methods: We performed a retrospective analysis for 25 cases after decompressive craniectomy in patients with abnormal flap pressure of clinical data.
Results: Flap pressure increased in 15 cases, including 6 cases of hydrocephalus, 5 cases of contralateral subdural effusion, 2 cases of subdural effusion bone window, 2 cases of bone window cystic encephalomalacia communicating with the ventricle; Flap pressure decreased in 10 cases, including 6 cases of hydrocephalus after ventriculoperitoneal shunt, and 4 cases of low intracranial pressure. ALL of patients were treated by appropriate measures to make the operation smoothly.
Conclusion: Our data suggest that after analysis of the factors for abnormal bone window flap pressure by decompressive craniectomy and symptomatic treatment, the difficulty of operation and operative complications can be reduced.

1. Introduction

Cranioplasty after decompressive craniectomy is a common operation of neurosurgery; according to the traditional view, cranioplasty should be conducted in after 3–6 months of craniocerebral operation; some surgeons claim super early operation so as to promote the recovery of patients' clinical symptoms. However, for some patients, too high or too low skull bone window flap pressure caused by intracranial other complication symptoms brings cranioplasty certain difficulties and the forced cranioplasty tends to cause some serious complications and influence the prognosis of patients. In the paper, a total of 89 patients with cranioplasty treated in the hospital from January 2006 to December 2013 were are summarized, including 25 ones with abnormal bone window flap pressure; through the analysis of the preoperative and intraoperative abnormal factors, the related processing is carried out; satisfactory results have been achieved and are reported as follows.

2. Patients and methods

2.1. General information

The group includes 17 cases of male and 8 cases of female, aged from 19 to 74, an average age of 43.5; 11 cases of craniocerebral trauma, 8 cases of incarceration of aneurysm, 5 cases of hypertensive cerebral hemorrhage, 1 case of arteriovenous fistula; all of their first operation is implemented in the hospital; all skull deficiency of the patients is one side of the frontal temporal bone flap; the relaxation suture is conducted on their cerebral dura mater by adopting the artificial meninx produced by Beijing Tianyifu Medical Treatment Equipment Co., Ltd., The major clinical manifestations are the disturbance of consciousness, speech dysfunction, epilepsy, dizziness, headache, dystonia, slow response, and gatism. The time span from the first operation to the cranioplasty is 4 ~ 16 months, with an average of 7 months.

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2.2. Skull CT examination findings

15 cases have higher bone window pressure, including 6 cases of hydrocephalus complication, 5 cases of contralateral subdural effusion complication, 2 cases of bone window subdural effusion complication and 2 cases of bone window cystic encephalomalacia communicating with the ventricle. 10 cases have lower bone window pressure, including 6 cases with hydrocephalus ventricle peritoneal shunt operation and 4 cases of lower cranial pressure.

2.3. Preoperative preparation and operation methods

For skull titanium meshes material, the digital titanium meshes of Medtronic is used; 640 row CT skull three-dimensional reconstructions is used for preoperative data acquisition. All patients are divided into the group of pressure increase and the group of pressure decrease.

2.4. Treatment for patients of increased bone window flap pressure

4 patients with hydrocephalus have ventriculoperitoneal shunt one month earlier than cranioplasty; 2 cases have ventriculoperitoneal shunt during the operation and then have cranioplasty after the intracranial pressure drops (Fig. 1a). In the operations, Medtronic programmable valve (Strata II) is placed in the contralateral ventricle with skull defects; pressure adjustment is decided according to the decrease degree of bone window flap pressure; valve pressure is adjusted after the cranioplasty according to the actual circumstance of patients (Fig. 1b). 3 cases of contralateral subdural effusion have cranioplasty after the contralateral bone window pressure decreases by draining cerebrospinal fluid with 2 cm YL-1 puncture needle (Beijing Wanfute, Co., Ltd., Beijing, China) under the local anesthesia one day earlier than the operation (Fig. 1c). For 2 cases of patients with subdural effusion in bone window, fine needle puncture is conducted on the liquid lumen during the operation; the skull titanium mesh is placed after pressure falls (Fig. 1d). For 2 cases of bone window cystic encephalomalacia communicating with the ventricle, the continued lumbosacral cerebrospinal fluid drainage is used to release cerebrospinal fluid and reduce intracranial pressure; while bone window was further expanded by using abrasive drilling for incarcerated brain tissue. Cranioplasty was preceded when the intracranial pressure decreases to the satisfactory level (Fig. 1e).

2.5. Treatment for patients of decreased bone window flap pressure

6 cases of patients have lower bone window flap pressure because the too low hydrocephalus shunt valve pressure causes excessive diversion; they have cranioplasty after the bone window flap pressure increases to the satisfactory level by increasing shunt valve pressure before the operation (Fig. 2). For 4 cases of patients with too low intracranial pressure, before operation we tell them to lie on the bone window side to increase intracranial pressure; in the procedure, the flap is expanded behind the original operation incision 4 ~ 5 cm; the scalp is separated; skull titanium mesh is placed into after fully releasing subcutaneous bonnet aponeurosis. For the group, because of long-term low flap pressure, they have local skin atrophy, and temporal muscle atrophy; in the process of separation, temporalis and scalp are overturned at the same time so as to reduce the risk of bleeding and postoperative local ischemic necrosis of the skin.

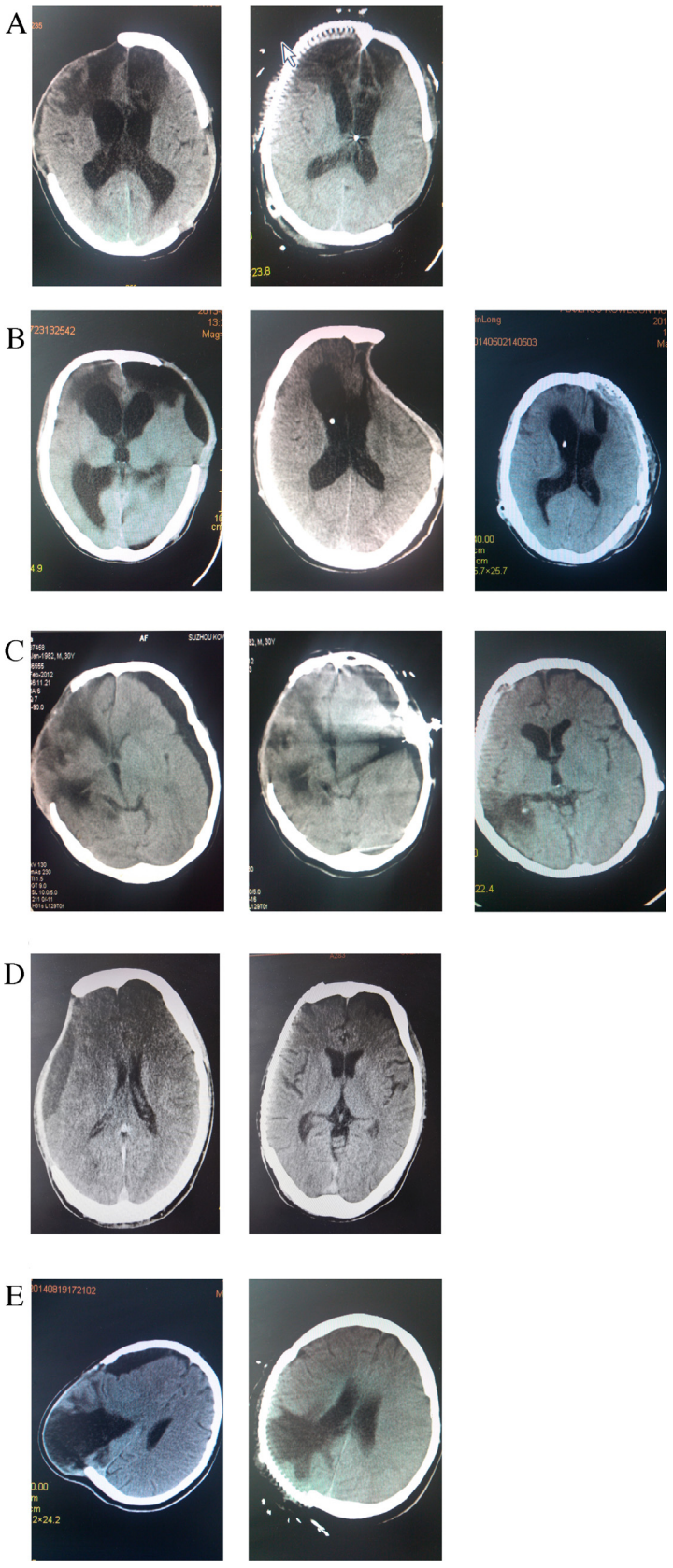

Fig. 1. Methods of cranioplasty on pressure increased patients. (a) cases have cranioplasty after the intracranial pressure drops by ventriculoperitoneal shunt. (b) cases have cranioplasty after the intracranial pressure drops by adjusting Medtronic programmable valve. (c) cases of contralateral subdural effusion is conducted draining cerebrospinal fluid with 2 cm YL-1 puncture needle, and then have cranioplasty. (d) cases of patients with subdural effusion is conducted puncture, and the skull titanium mesh is placed after pressure falls. (e) cases of bone window cystic encephalomalacia communicating with the ventricle is conducted lumbosacral cerebrospinal fluid drainage to reduce intracranial pressure, and then have cranioplasty.