

OUTCOME FOLLOWING DECOMPRESSIVE CRANIECTOMY FOR ACUTE INTRAOPERATIVE BRAIN SWELLING ASSOCIATED WITH BLUNT HEAD TRAUMA

J. Paul Elliott, MD, Peter D. LeRoux, MD,
Matthew A. Howard, MD, M. Sean Grady, MD,
David W. Newell, MD, and H. Richard Winn, MD, FACS

ACUTE INTRAOPERATIVE brain swelling (AIBS) during craniotomy for the treatment of the sequelae of blunt head trauma is most likely a manifestation of impaired cerebral autoregulation and is thought to herald a poor outcome. When mannitol and hyperventilation fail to control AIBS after removal of subdural hematoma, we augment the dura and do not replace the bone flap. Previous studies have reported this technique for the treatment of acute traumatic subdural hematoma with mixed results.¹⁻³ In this study we retrospectively reviewed patients treated with decompressive craniectomy for medically refractory AIBS following blunt head trauma. Clinical and radiographic parameters associated with neurologic outcome are identified.

MATERIALS AND METHODS

Medical records and radiographic studies were reviewed for 53 consecutive patients undergoing decompressive craniectomy for AIBS following blunt head trauma from 1986 to 1990. Prehospital management included intubation and hyperventilation in 83% of patients. Prior to head computerized tomography (CT), all patients were mechanically hyperventilated, administered 100% oxygen, and given a bolus of 1 g/kg of mannitol if hemodynamically stable. A large frontotemporoparietal bone flap allowed for removal of subdural hematoma and contused brain. If AIBS was medically refractory ($\text{PaCO}_2 = 25$ mm Hg, 2 g/kg of mannitol), the dura was augmented and bone flap was not replaced. Postoperatively, intracranial pressure was monitored in a neurosurgical intensive care unit and treated when >20 mm Hg. Routine postoperative CT scans were performed. All CT scans were evaluated for maximal subdural hematoma thickness, midline shift, and presence of associated pathology. Subdural hematoma volume was calculated using computer-assisted morphometric analysis (Bioquant). Outcome was assessed using the Glasgow Outcome Scale (GOS) at 6 months and 12 months postoperatively. Patients graded as neurologically intact or moderately disabled were considered a favorable outcome; those severely disabled, vegetative, or dead were considered a

From the Department of Neurological Surgery, University of Washington, Seattle.

poor outcome. Statistical analysis was performed using the Fischer exact test.

RESULTS

Forty-seven (89%) patients were male; 6 (11%) were female. Mean age was 31 ± 15 (mean \pm SEM) years. Mean GCS (Glasgow Coma Scale) at the scene of injury was 5 ± 2 and on admission was $4T \pm 2T$. Mean PaO_2 was 306 torr (range 42–551 torr). Mean subdural hematoma volume was 37 mL (range 4–160 mL).

Seventeen (32%) patients had a favorable outcome. Thirty-six (68%) patients had a poor outcome, with an overall 58% mortality rate. Postoperative peak intracranial pressure (ICP) was <25 mm Hg in 45 (85%) cases.

Factors associated with favorable outcome included age <45 years ($P = 0.04$), GCS ≥ 5 at the scene of injury ($P < 0.03$), admission $\text{PaO}_2 \geq 100$ mm Hg ($P = 0.04$), postoperative peak ICP <25 mm Hg ($P = 0.04$), and subdural blood volume ≤ 38 mL on admission head CT scan ($P = 0.05$). Brain stem or cerebral low density on admission CT was associated with a poor outcome ($P = 0.04$). Sex, mechanism of injury, time to surgery, side of subdural hematoma, and maximum thickness of subdural hematoma, or degree of midline shift on preoperative head CT scan did not appear to affect outcome.

DISCUSSION

ICP control is important to outcome following acute subdural hematoma (ASDH).⁴ In this series, decompressive craniectomy effectively controls ICP following AIBS. Patients who develop AIBS may represent a more severely injured subpopulation who benefit from decompressive craniectomy. Less likely, AIBS may reflect a transient dysfunction of cerebral autoregulation, which has little consequence on postoperative ICP, with outcome in this series predominantly dependent on other factors. A 32% favorable outcome and 58% mortality rate compares well with a recent series of ASDH.⁴ Only 10% of the patients continue to need chronic nursing care, obviating the fear that decompressive craniectomy might decrease mortality rates at the expense of increasing numbers of severely disabled patients. From this preliminary study, it appears that decompressive craniectomy following AIBS will most likely benefit the younger, nonhypoxic patient, who demonstrates flexion or better on examination, and lacks low density on admission head CT scan. Further prospective randomized study is indicated.

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