Suboccipital Decompressive Craniectomy For cerebellar infarction Case Series

Retrospective Studies

2020

In a retrospective, single-center study, from Göttingen of 34 consecutive patients necrosectomy appears to be a suitable alternative to Suboccipital Decompressive Craniectomy for cerebellar infarction, achieving comparable mortality and functional outcomes. Further trials are necessary to evaluate which surgical technique is more beneficial in the setting of cerebellar infarction [1].

2019

From October 2006 to June 2017, a total of 14 consecutive patients (12 men, 2 women; mean±SD age 65±12 years, range 42-84 years) were admitted to the Kajikawa Hospital, and underwent DSC at the time of admission or during their hospitalization. Inclusion criteria were (1) a level of consciousness below Glasgow Coma Scale (GCS) 13, and/or (2) brainstem compression and/or obstructive hydrocephalus caused by brain edema due to cerebellar infarction. Ventricular drainage was performed simultaneously or later, according to the surgeon's decision.

At the 90-day point, 12 of the 14 patients (85.7%) had survived, 10 (71.4%) of whom were independent (modified Rankin scale ≤2). Four (28.6%) were either completely dependent or dead. Comparisons between good and poor prognoses showed that the factors affecting the prognosis were lesions other than the cerebellar infarction (p<0.01) and/or obstructive hydrocephalus (p<0.05).

Early suboccipital Decompressive Craniectomy should be considered for cerebellar infarction treatment in patients with GCS 13 or worse. A poor prognosis is inevitable in patients whose infarction is combined with other locations than the cerebellum but in those who already have obstructive hydrocephalus at the time of surgery [2].

2018

All patients treated with SDC due to space-occupying cerebellar infarction between January 2009 and October 2015 in Rigshospitalet Copenhagen were included in the study. Data was retrospectively collected from patient records, CT/MRI scans and surgical protocols. Long-term functional outcome was determined by the modified Rankin Scale (mRS) and mRS ≥ 4 was defined as unfavorable outcome.

Twenty-two patients (16 male, 6 female) were included in the study. The median age was 53 years. Nine patients were treated with external ventricular drainage as an initial treatment attempt prior to suboccipital decompressive craniectomy. Median time from symptom onset (stroke ictus) to initiation of the suboccipital decompressive craniectomy was 48 h (IQR 28-99 hours) and median GCS before SDC was 8 (IQR 5-10). At follow-up, median mRS was 3 (IQR 2-6). Outcome was favorable (mRS 0-3) in

12 patients and unfavorable in 10 (3 with major disability, 7 dead). Brainstem infarction and bilateral cerebellar infarction were associated with unfavorable outcome.

In this small study, functional long-term outcome in patients with space-occupying cerebellar infarction treated by suboccipital decompressive craniectomy was acceptable and comparable to previously published results (favorable outcome in 54% of patients). Brainstem infarction and bilateral cerebellar infarction were associated with unfavorable outcome [3].

2013

Mostofi retrospectively analyzed the clinical features, and imaging studies of 53 patients with MICI who had been treated by surgery or conservative treatment between January 2000 and December 2008 at the Department of Neurosurgery of the general hospital of Fort de France in Martinique. A total of 25 patients underwent surgery and 28 were treated medically.

The results show significantly better outcomes in the operated patients compared with the patients treated medically; Operated comatose patients demonstrated significant improvement in their Glasgow coma score (GCS) score with only two deaths. Whereas, nonoperated comatose patients lost points in their GCS with four deaths.

The results of the study suggest that surgery may be an effective procedure and quite helpful for MICI in the majority of cases [4].

2011

Ten patients with expansive bilateral cerebellar infarction and decreased level of consciousness were operated on with suboccipital craniectomy in Uppsala University Hospital, removal of the infarcted tissue, and placement of external ventricular drainage. The long-term outcome was assessed using the modified Rankin scale (mRS).

The mean Glasgow coma scale (GCS) score before surgery was 8.9 ± 3.3 and improved to 12.6 ± 3.6 at discharge. At the long-term follow-up (median 57.6 months), six patients had a favorable outcome (mRS 1.3 ± 0.8). Four patients, all with an associated brain stem infarct, had a poor outcome.

In the absence of brainstem infarction, surgical treatment resulted in a favorable clinical outcome and should be considered a treatment option for patients with expansive bilateral cerebellar infarction [5].

2009

A total of 57 patients from the University of Munich, were identified. All of them were treated by bilateral SDC. External ventricular drainage was inserted in 82%, necrotic tissue was evacuated in 56% of patients. There were no fatal procedural complications. Five patients were lost for follow-up. In the remaining 52 patients, the mean follow-up interval was 4.7 years (1 to 11 years). Within the first 6 months after surgery 16 of 57 patients (28%) had died. At follow-up, 21 of 52 patients (40%) had died and 4 patients (8%) lived with major disability (mRS 4 or 5). Twenty-one patients (40%) lived functionally independent (mRS 0 to 2). The presence of additional brainstem infarction was associated with poor outcome (mRS > or =4; hazard ratio: 9.1; P=0.001). Quality of life in survivors was

moderately lower than in healthy controls.

SDC is a safe procedure in patients with malignant cerebellar infarction. Infarct- but not procedure-related early mortality is substantial. Long-term outcome in survivors is acceptable, particularly in the absence of brainstem infarction [6].

In a retrospective single-center study, 56 consecutive patients with acute space-occupying cerebellar infarction treated surgically between 1996 and 2005 in Heidelberg were included. Baseline data included clinical findings, Glasgow Coma Scale on admission and before surgery, NIHSS on admission, mass effects on neuroimaging, and surgical treatment strategies. Modified Rankin Scale, NIHSS, and Scale for the Assessment and Rating of Ataxia were used to assess outcome.

39.3% of patients had died, 51.8% had a mRS < or =3, 35.7% had a mRS < or =2, 28.6% had a mRS < or =1. There were no significant differences in survival between treatment groups. In multivariate analysis age and mRS score at discharge were the most evident independent predictors for the outcome.

So far this is the largest study on long-term outcomes after space-occupying cerebellar infarction. The value of different treatment strategies and prognostic factors for patient selection remains unclear and should be evaluated in larger prospective case series or registries. To investigate the issue of preventive SDC randomized trials are needed [7].

2007

A total of 25 patients with severe cerebellar infarction from the Department of Neurosurgery at Hyogo Cancer Center, Akashi, Japan were subdivided into two groups to compare the outcome of the group (group A) with EVD with that of the group (group B) with decompressive surgery as the first surgery. There was no statistically significant difference in age between group A with 71 +/- 6 years and group B with 61 +/- 15 years. The preoperative status as Glasgow Coma Scale (GCS) score 6 in all the patients in group A. It was GCS score of 4 in one patient, GCS score of 6 in 9 patients, GCS score of 7 in 8 patients, and GCS score 9 in two patients in group B. The preoperative neurologic background was almost the same for both groups. In group A, one patient had a good recovery. However, 3 patients became severely disabled and one patient died. In group B, 10 patients had a good recovery and 6 patients became moderately disabled, although two patients were disabled and two patients died. The outcome was good in one patient of group A and in 16 patients of group B, although it was poor in 4 patients each in both groups. Patients in group B had a significantly better prognosis than those in group A. No clear evidence of surgical indications for EVD or suboccipital decompression from neurologic signs or symptoms and from neuroimaging has been reported. The results seem to suggest that preemptive suboccipital decompression with or without resection of necrosis is warranted in patients with severe cerebellar infarction [8]

2006

A report from Hospital São Joaquim, Real e Benemérita Associação Portuguesa de Beneficência, São Paulo, Brazil. presents the treatment of 151 patients with cerebellar infarction, 98 men (65%) and 53 women (35%), mean age 62.4 years old. Occlusive hydrocephalus was diagnosed in 7.9% of the patients associated with an extensive cerebellar infarction and in all 11 surgical patients (7.2%). Four

patients underwent external ventricular drainage with 3 deaths (75%) and 7 underwent a decompressive suboccipital craniectomy with 2 deaths (28.5%). The mortality of the clinical group was 15 patients (10.7%). Vertigo, vomiting, Romberg sign, and dysmetria were the signs and symptoms of cerebellar involvement that were most frequently observed. cerebellar infarction from an embolism after cardiovascular surgery occurred in 57 patients (37.7%). cerebellar infarction, as an isolated fact, occurred in 59 patients (39%) and cerebellar plus infarction in other regions occurred in 92 patients (61%). Magnetic resonance image was the best diagnostic form for cerebellar lesions, however, computerized tomography could show cerebellar infarction in 68 patients (78%) [9].

2003

A total of 44 patients (24 male and 20 female patients; average age, 56 yr) from Department of Neurological Sciences, Neurosurgery, University of Rome "La Sapienza," Rome, Italy were treated for cerebellar infarctions in the past 8 years. Twenty-five patients received conservative treatment; two patients who were deeply comatose received no treatment. The remaining 17 patients underwent emergency surgery. Of those 17 patients, 8 underwent external ventricular drainage alone, 5 underwent external ventricular drainage as the first treatment plus secondary suboccipital craniectomy, and 4 underwent suboccipital craniectomy, with the removal of necrotic tissue, as the first treatment.

Of the 25 conservatively treated patients, 20 experienced good outcomes, 4 experienced moderate outcomes, and 1 died as a result of pulmonary embolism. Of the 17 surgically treated patients, 10 experienced good functional recoveries (7 treated with external ventricular drainage only and 3 treated with drainage followed by suboccipital craniectomy) and 3 survived with mild neurological deficits (one patient underwent ventriculostomy, one suboccipital craniectomy plus external ventricular drainage, and one suboccipital craniectomy only). The overall mortality rate was 13.6% (6 of 44 patients).

For patients with worsening levels of consciousness and radiologically evident ventricular enlargement, they recommend external ventricular drainage. They reserve surgical resection of necrotic tissue for patients whose clinical status worsens despite ventriculostomy, those for whom worsening is accompanied by signs of brainstem compression, and those with tight posterior fossa [10].

1999

In a retrospective study 100 consecutive patients from Universitätskliniken für Neurochirurgie, Austria with cerebellar apoplexy were evaluated with regard to presenting symptoms, diagnostic and therapeutic strategies according to changes in the clinical condition of the patients. The results of decompressive suboccipital craniectomy in patients with a cerebellar infarction are also evaluated in this retrospective study as the valency from use the Glasgow-Coma-Score as a prognostic factor and monitoring instrument in patients with a cerebellar stroke. Different therapeutic modalities were critically analyzed. Outcome was significantly influenced by age ($p = 0.003$), localization and size of the lesion ($p = 0.004$), a space-occupying character on computed tomography ($p < 0.001$), the progressive appearance of brainstem dysfunction, and reduction of the level of consciousness as measured with the Glasgow Coma Scale ($p < 0.001$). They were able to show that the GCS is a valid instrument for the evaluation of the clinical course of patients with cerebellar stroke since a statistically significant relationship exists between the GCS prior to surgical intervention and outcome. In the patient with a GCS <, 12 a reduction of mortality by 15% was obtained by surgical intervention,

and the outcome as measured by the GOS was significantly improved [11]

1995

10 patients with progressive neurological deterioration due to massive cerebellar infarctions from Department of Neurosurgery, Kohnan Hospital Sendai. Computerized tomography scans confirmed obstructive hydrocephalus and brainstem compression. All 10 patients (seven men, three women; mean age, 59 years) were treated by external ventricular drainage and decompressive suboccipital craniectomy. After discharge from the hospital, they were followed up (23-101 months) and their functional independence was evaluated by the Barthel Index. The condition of three patients with brainstem infarction had deteriorated despite decompressive surgery. Two of these died during the acute stage and one because severely disabled. The remaining seven patients showed neurological improvement during the postoperative period. Four patients with preoperative Japan Coma Scale of 100 returned to their previous jobs within the follow-up period and three patients with preoperative Japan Coma Scale of 200 required some assistance in daily activities. It is suggested that decompressive surgery may be beneficial for massive cerebellar infarction. The postoperative prognosis depends mainly on the presence or absence of coexisting brainstem infarction. It is possible that, without brainstem infarction, patients who remained in a "dependent" state may have recovered better if they had been operated on earlier [12].

1994

Of 52 patients with space-occupying cerebellar infarction defined by computed tomographic criteria were reevaluated with regard to clinical course, etiology, therapeutic management, mortality, and functional outcome.

In most cases clinical deterioration started on the third day after stroke, and a comatose state was reached within 24 hours. Sixteen patients were treated medically, and 30 by suboccipital craniectomy (22 plus ventriculostomy, 12 plus tonsillectomy). Ten patients primarily had ventriculostomy, which in 4 patients was supplemented by craniotomy because of continuing deterioration. Twenty-nine patients made a good recovery, 15 remained disabled, and 8 died. Even comatose patients had a 38% chance of a good recovery with decompressive surgery. Age older than 60 years (P = .0043) and probably initial brain stem signs (P = .0816) and a late clinical stage (P = .0893) were linked with a fatal or disabling outcome.

Decompressive surgery should be the treatment of choice for massive cerebellar infarction causing progressive brain stem signs or impairment of consciousness [13].

1992

11 patients (seven men, four women; mean age, 54 years) were treated in Kaohsiung Medical University Chung-Ho Memorial Hospital with suboccipital craniectomy for decompression and temporary ventriculostomy for cerebrospinal fluid pressure monitoring and drainage.

Seven patients demonstrated neurological improvement on the first postoperative day. Two patients returned to their previous jobs 3 months after surgery. The Barthel Index indicated that six individuals were functioning with minimal assistance within a follow-up period of 16-60 months. The remaining

three were functionally dependent. No mortality was noted in this series.

These results suggest that decompressive suboccipital craniectomy may be an effective, life-saving procedure for malignant cerebellar edema after a large infarction [14].

1990

During the past 9 years and 2 months we have encountered 33 cases with cerebellar infarction. These patients were classified into 3 types according to their clinical course. Type 1 (18 cases); The course was benign, and symptoms and signs improved without surgical treatment. Type 2 (11 cases); The course was progressive with deterioration of consciousness between 24-72 hours after the onset. Type 3 (4 cases); The course was rapid resulting in lapse into coma within a few hours. Also, its prognosis was fatal due to coexisting brain-stem infarction regardless of any treatment. Surgical intervention was required for Type 2 in which the lesion included the region of the vermis or occupied more than one-third of the cerebellar hemisphere, and had subsequently compressed the brain-stem and caused obstructive hydrocephalus. In 9 cases out of Type 2, ventricular drainage alone was performed and prompt improvement of consciousness level was detected except in one case. We consider that ventricular drainage is not so invasive a method, and it is beneficial. However, in 2 cases of Type 1 and 4 cases of Type 2, hemorrhagic infarction occurred. Thus, one should be aware of the possibility of hemorrhagic infarction, even though it may be asymptomatic infarction. If prompt improvement of consciousness is not detected after ventricular drainage, suboccipital craniectomy should be recommended [15].

1986

A report summarizes the outcome of 56 patients with cerebellar lesions of vascular origin, 40 patients with cerebellar infarction, and 16 with spontaneous cerebellar haemorrhage. All patients had computerized tomography: occlusive hydrocephalus was diagnosed in 75% of patients with cerebellar haemorrhage and in 23% with cerebellar infarction. Nine out of 10 patients survived after early surgical evacuation of the haematoma and 4 of them recovered completely. Two patients underwent only external ventricular drainage (EVD), one died after 2 days, and the other recovered with a moderate deficit. Three of 4 medically treated patients died within one week; all had developed occlusive hydrocephalus. The fourth medically treated patient recovered completely; consciousness had never deteriorated nor had occlusive hydrocephalus developed. Among 40 patients with cerebellar infarction, 13 developed progressive deterioration of consciousness; 7 of them underwent decompressive craniectomy of the posterior fossa and survived. One patient had only external ventricular drainage and died. Four out of the 5 medically treated patients died during the acute phase. From these observations and several reports in the literature, it is concluded that both cerebellar haemorrhage and infarction should be operated on as soon as progressive deterioration of consciousness develops. This occurs more frequently in patients with cerebellar haemorrhage than with cerebellar infarction. Individual decision-making in each case necessitates intensive neurosurgical observation [16].

1979

cerebellar infarction has been inadequately recognized by clinicians. A review of 75 cases showed

that in 55 of them the infarct acted as an expanding mass lesion and compressed the brain stem. Once this occurred, the mortality without operation was very high. With surgical treatment, the mortality was reduced considerably. The computerized tomographic scan is the diagnostic test of choice [17)

Propensity score matching

2016

Between March 2007 and September 2015, 28 patients underwent preventive Suboccipital Decompressive Craniectomy. Kim et al. from Korea performed propensity score matching to establish a proper control group among 721 patients with cerebellar infarction during the same period. Group A (n=28) consists of those who underwent preventive SDC, and group B (n=56) consists of those who did not undergo preventive SDC. They analyzed and compared clinical outcomes between groups.

Clinical outcomes were better in group A than in group B at discharge (P=0.048) and 12-month follow-up (P=0.030). Group B had more deaths within 12 months than group A (log-rank, P<0.05). Logistic regression analysis showed that preventive SDC (odds ratio, 4.815; P=0.009) and the absence of brain stem infarction (odds ratio, 2.862; P=0.033) were independently associated with favorable outcomes (modified Rankin Scale score of 0-2) at 12-month follow-up.

Favorable clinical outcomes including overall survival can be expected after preventive Suboccipital Decompressive Craniectomy in patients with a volume ratio between 0.25 and 0.33 and the absence of brainstem infarction. Among these patients, preventive Suboccipital Decompressive Craniectomy might be better than the best medical treatment alone [18).

Prospective Studies

Large multicenter RCTs are lacking for this situation probably due to the well-known devastating effects of brainstem compression and hydrocephalus

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The clinical course and neuroradiological features of 84 patients (aged 22-78, mean 58.5 years) with massive cerebellar infarction confirmed by computed tomography were prospectively observed for 21 days after admission and at 3-month follow-up using a standardized protocol. Data were gathered from 1992 to 1996 in 17 centers. The patients were assigned to three treatment groups depending on the decision of the primary caretaker: 34 underwent craniotomy and evacuation, 14 received ventriculostomy, and 36 were treated medically. Treatment groups differed regarding the level of consciousness, signs of mass effect in computed tomography, and signs of brainstem involvement. The overall risk for poor outcome depended on the level of consciousness after clinical deterioration (odds ratio = 2.8). Subgroup analysis of awake/drowsy or somnolent/stupor patients revealed no relationship to treatment. The vascular territory involved did not affect the outcome. Surgical treatment for massive cerebellar infarctions was not found to be superior to medical treatment in awake/drowsy or somnolent/stupor patients. Half of all patients deteriorating to coma treated with ventricular drainage or decompressive craniectomy had a meaningful recovery. Jauss et al. were unable to compare surgical versus medical therapy in this subgroup due to the lack of a control

group. This study supports the notion that the level of consciousness is the most powerful predictor of outcome, superior to any other clinical sign and treatment assignment. Deterioration of consciousness typically occurred between days 2 and 4, with a maximum on day 3 [19].

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