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CLINICAL ARTICLE

Surgical treatment of patients with unilateral cerebellar infarcts: clinical outcome and prognostic factors

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Abstract

Background There are limited data on the long-term outcome and on factors influencing the prognosis in patients with cerebellar infarcts treated with surgical decompression.

Methods Thirty-two patients (age 64.3±9.9 years) with expansive unilateral cerebellar infarcts were retrospectively evaluated. All patients were treated with ventriculostomy, suboccipital decompressive craniectomy and removal of the necrotic tissue. The Glasgow Coma Scale (GCS) and the Reaction Level Scale (RLS) scores evaluated the level of consciousness during hospitalization, while the modified Rankin Scale (mRS) was used for the 6-month and long-term outcome. Predicting factors were analyzed using a univariate logistic regression model.

Results The median time from ictus to surgery was 48.4 h (range 8–120 h). Before surgery, the median GCS score was 9 (3–13). At discharge, the GCS score improved to 13.6 (7–15) ($p<0.05$ compared to preoperative scores). At the long-term follow-up (median 67.5 months), ten patients were dead, and 77% of survivors had a good outcome (mRS score of ≤2). The number of days on a ventilator and the GCS score prior to surgery and at discharge were strong predictors of clinical outcome ($p<0.05$), although one third of patients with a GCS≤ 8 at the time of surgery had a good long-term outcome. In patients ≥70 years old, 50% had a good long-term outcome, and advanced age was not associated with a bad result ($p>0.05$).

Conclusions Our results imply that surgical evacuation of significant cerebellar infarctions may be considered also in patients with advanced age and/or a decreased level of consciousness.

Keywords Cerebellar infarct · External ventricular drainage · Surgical decompression · Modified Rankin Scale · Outcome · Age

Introduction

Cerebellar infarcts may rapidly swell, compress posterior fossa structures and lead to a life-threatening condition [11, 12, 25]. Clinical deterioration can occur within hours or days from ictus, and is usually the result of brain stem compression from post-infarct edema and/or the development of hydrocephalus [10, 12, 16]. If left untreated, patients may deteriorate and die, or develop irreversible neurological deficits [10, 11].

After the initial reports in 1956 describing successful treatment using surgical decompression [7, 22], there have been several publications suggesting that surgery for space-occupying cerebellar infarctions can be life-saving, and thus, this treatment option is considered routine management in many neurosurgical centers [1, 4, 12, 14, 20, 23, 25]. Nevertheless, the optimal surgical technique has long been debated. External surgical decompression (with or without removal of the infarcted tissue, i.e., internal decompression) of the posterior fossa, either alone or with placement of an external ventricular drainage (EVD),

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is a common treatment option. Additionally, the sole use of an endoscopic third ventriculostomy or an EVD alone has also been described [2–4, 8, 14, 15, 20, 25, 27, 37].

Limited data exist on the timing of surgery and the long-term outcome among surgically treated patients [4, 12, 14, 15, 20, 24]. Finally, factors related to the clinical outcome have not been thoroughly investigated [14, 15, 24]. In this report, we surgically treated 32 patients with unilateral cerebellar infarction that developed into a space-occupying lesion causing a decreased level of consciousness. All patients were operated on with EVD, suboccipital craniectomy and removal of the necrotic (infarcted) tissue.

Materials and methods

Patients and setting

From June 1999 to October 2008, all patients (n=32) with radiological signs of acute unilateral cerebellar infarctions who were treated surgically with EVD, suboccipital craniectomy and removal of the necrotic tissue at the Department of Neurosurgery, Uppsala University Hospital, Uppsala, Sweden, were included in this survey study. We excluded 51 conservatively treated patients, 6 patients that received only external ventricular drainage and 10 patients with bilateral cerebellar infarcts [31]. Patients with confirmed basilar artery thrombosis or bilateral cerebellar infarcts were not included in the analysis. The patients' records were reviewed retrospectively. The Glasgow Coma Scale (GCS) score was used for the evaluation of the level of consciousness at onset, repeatedly during the course of the disease and at discharge from our unit [30]. The study was approved by the Regional Research Ethical Review Board of Uppsala University.

Radiological evaluation

Head computed tomography (CT) scan was always performed for the initial diagnosis and assessment of the infarction. The CTscan was always repeated on the first postoperative day and later in the course of the disease for clinical decision making. In selected cases, magnetic resonance imaging (MRI), magnetic resonance angiography (MRA) and/or digital subtraction angiography (DSA) were also performed to diagnose or exclude vascular pathology, brain stem infarct or tumor.

The occluded artery was identified according to the protocol previously published by Tatu et al. [29]. The CT score ranged from 0 to 9 and was calculated based on the criteria proposed by Jauss et al. This score contains three graded items: the degree of compression of the 4th ventricle (0–3) and the quadrigeminal cistern (0–3), as well the dilatation of the inferior horn of the lateral ventricle (0–3), where "0" refers to normal status [14]. Tight posterior fossa was defined directly as effacement of the posterior fossa basal cisterns and compression of the 4th ventricle, and indirectly as enlargement of the 3rd and lateral ventricles as previously suggested [33]. The degree of 4th ventricle compression was defined as grade I in patients with minimal or no compression, grade II in patients with moderate compression and grade III in patients with severe compression [18].

Treatment protocol

Reduced levels of consciousness (GCS score≤13) on clinical evaluation together with signs of marked compression of the 4th ventricle, upward cerebellar herniation and/or obliteration of the posterior fossa cisterns were absolute indications for surgical treatment. However, in some patients the decision to proceed to surgery was individualized specifically when there was an acute neurologic deterioration. Patients deeply comatose (GCS: 3–4) immediately following ictus and/or verified brain stem infarct were not considered candidates for surgical treatment. Depending on the progress of their clinical and radiological status, patients were operated on either early (≤24 h) or late (>24 h) in the course of the disease (*vide infra*).

Surgical and neurointensive care management

At surgery, insertion of an EVD was the initial step. The EVD was always inserted into the right frontal horn to allow for cerebrospinal fluid (CSF) diversion during surgery and postoperatively when needed, and for measuring intracranial pressure (ICP). The patient was then turned to prone position with the head flexed and fixed in a three-point holder. Following a midline occipitocervical incision, a bilateral suboccipital craniectomy was performed from the external occipital protuberance to the foramen magnum, and the posterior arch of the C1 vertebra was also removed to provide additional decompression in circa 40% of patients. A wide Y-shaped opening of the dura mater and resection of the necrotic tissue followed. After meticulous hemostasis, the dura was closed either directly, or using a dural graft or a gelatin sponge to bridge the defect. Biological glue (Tisseel Duo Quick, Baxter Medical AB, Kista, Sweden) was applied regardless of the method of dural closure. Finally, the wound was closed with interrupted sutures in multiple layers (Table 4).

The patients were treated in our Neurocritical Care Unit (NCC) using an ICP- and cerebral perfusion pressure (CPP)-guided protocol [6]. This protocol included slight hyperventilation/normoventilation, head elevation (30°) and careful volume expansion to obtain normovolemia. A combination of intermittent intravenous morphine (1–3 mg

Morfin Meda®, Meda, Sollentuna, Sweden) and continuous intravenous propofol infusion (1–4 mg/kg; Propofol-®Lipuro, B. Braun Melsungen AG, Melsungen, Germany) was used for analgesia and sedation. All patients received intraarterial blood pressure monitoring. Arterial blood gases and blood glucose levels were also monitored. The treatment goals included an ICP of ≤20 mmHg and a CPP of ≥60 mmHg. Cerebrospinal fluid (CSF) drainage, typically against a pressure of 15–20 mmHg, was applied postoperatively when required. Before drainage, a CT scan was always done to rule out a postoperative hematoma or remaining mass effect by the infarct [6].

Outcome measures

The current outcome at time of follow-up (median 67.5 months, range 14–113 months) was assessed as well as the estimated outcome at 6 months. The GCS and the RLS scores were used to estimate the neurological and functional status at discharge, whereas the modified Rankin Scale (mRS) was used for the 6-month and long-term analysis of outcome [5, 35]. A standardized questionnaire was sent to the patients for assessment of clinical outcome according to mRS [35]. The mRS estimation was strengthened through additional contact and structured personal interviews via phone calls. In the questionnaire and/or phone interview, patients were asked to estimate their clinical status at 6 months post-surgery compared with their current status. For patients dead at long-term follow-up, the time and cause of death were retrieved from the Swedish Death Register. Additionally, hospital records were retrieved and analyzed to enable an estimation of the 6-month clinical outcome according to the mRS in addition to establishing the disease-specific mortality.

Statistical analysis

All nominal data were presented as the medians and the 75th percentile, and all parametric data were presented as the mean ± standard deviation (SD). Categorical variables were compared using chi-square statistics. Non-parametric data were analyzed using Kruskal-Wallis analysis of variance (ANOVA), which was followed by a Mann-Whitney U-test for pair-wise comparisons if significant. Student's t-test was used to compare normally distributed data. Predictive factors influencing 6-month and long-term outcomes were evaluated with univariate regression analysis using a dichotomized outcome (favorable; mRS≤2; poor; mRS≥3) as dependent variables [34]. Multivariate regression analysis was not performed because of the small number of included patients. Data were analyzed using the Statistica® software, version 9 (StatSoft, Tulsa, OK). A p-value of <0.05 was considered statistically significant.

Results

Baseline characteristics

Thirty-two patients (24 male, 8 female) were included (Table 1). The mean age was 64.3±9.9 years (range 44–79 years; 43.8% of patients ≥70 years old). At least one predisposing factor was recognized in 25 patients (78.1%), with arterial hyper-

Table 1 Demographics and clinical features of patients operated for unilateral cerebellar infarct

Patient characteristic	No.	%
Number of patients	32	
Age (mean, years)	64.3±9.9	
Gender		
Male	24	75
Female	8	25
Etiology		
Medium or large vessel disease	17	53.1
Arterial emboli (suspected)	6	18.8
Vertebral artery thrombosis	2	6.3
Vertebral artery dissection	2	6.3
Undetermined	8	25
Predisposing factors		
Arterial hypertension	15	46.9
Atrial fibrillation	6	18.8
Diabetes mellitus	6	18.8
Coronary disease	5	15.6
Rheumatic disease	2	6.3
Coagulopathy	2	6.3
Other associated conditions	5	15.6
None	7	21.9
Symptom		
Dizziness	23	71.9
Vertigo	22	68.8
Headache	12	37.5
Vomiting	12	37.5
Nausea	7	21.9
Agitation	4	12.5
Sign		
Limb paresis	13	40.6
Nystagmus	9	28.1
Dysarthria	7	21.9
Altered consciousness	6	18.8
Gait disturbances	6	18.8
Ataxia	5	15.6
Gaze palsy	5	15.6
Dysdiadochokinesia	2	6.3
Dysphagia	2	6.3
Double vision	2	6.3

tension being the most frequent (15 patients, 46.9%; Table 1). In 25%, the mechanism of infarct formation was unknown. Dizziness and vertigo were the most common presenting symptoms, which were seen in 71.9% and 68.8% of patients, respectively. At the time of surgery, the median GCS score was 9 (3–13) (Table 2), and 15 patients (47%) were comatose (GCS≤8).

Neuroradiology

When all preoperative CT scans were evaluated, the posterior inferior cerebellar artery (PICA) was recognized as the only occluded artery causing the infarct in 24 cases (75%). The mean CT score before surgery was 5.6±1.2. Preoperative hydrocephalus was present in 29 out of 32 patients (90.6%). Most patients (68.8%) demonstrated a Grade II compression of the 4th ventricle. Other co-existing brain pathology such as lacunar or hemorrhagic infarcts in the cerebral hemispheres was identified in eight patients (25%; Table 3).

Treatment

The median time between ictus and surgery was 48.4 h (range 8–120). Nine patients (28.1%) were operated on in the acute phase (≤24 h from ictus). The EVD was used for CSF drainage in eight patients (25%). All patients needed neurocritical care and had a median ventilator time of 3.3 days (range 1 to 10). Of these patients, 14 remained on the ventilator for ≥3 days (Table 4).

Clinical outcome

The median length of stay in the unit was 9 days (range 3–25) with no postoperative deaths during this period. At discharge, the median GCS score improved from 9 (3–13) preoperatively to 13.6 (7–15) ($p<0.05$). The clinical status was favorable (GCS score ≥14) in 23 patients (71.9 %), moderate (GCS score 9–13) in 7 (21.9%) and poor in 2 patients (6.3%; GCS score 3–8).

Table 2 Level of consciousness (median) at onset and before surgery

At onset	Value
GCS (median)	12.2 (7–15)
12–15 (n)	23/32
7–11 (n)	9/32
Before surgery	
GCS (median)	9 (3–13)
9–13 (n)	17/32
3–8 (n)	15/32

GCS Glasgow Coma Scale score

Table 3 Radiological findings

Variable	Value	%
Side		
Right	16	50
Left	16	50
Responsible vessel		
PICA	24	75
AICA	0	0
SCA	0	0
PICA + SCA	6	18.8
PICA + AICA	1	3.1
PICA + AICA + SCA	1	3.1
4th ventricle compression		
Grade I	5	15.6
Grade II	22	68.8
Grade III	5	15.6
CT score (mean)	5.6±1.2	
MRI, MRA	7	21.9
DSA	4	12.5
Hydrocephalus	29	90.6
Tight posterior fossa	27	84.4
Associated brain pathology*	8	25

PICA posterior inferior cerebellar artery; *AICA* anterior inferior cerebellar artery; *SCA* superior cerebellar artery; *CT* computed tomography; *MRA* magnetic resonance angiography; *MRI* magnetic resonance imaging; *DSA* digital subtraction angiography; *infarcts or hemorrhages in other brain locations

At 6 months post-surgery, 28 patients (87.5%) were alive, and 19 patients (59.3%) had a good outcome (mRS≤2). Eight patients (57.1%) ≥70 years old had a good outcome at 6 months with a median mRS of 1.6 (0–3) (Table 4).

The median long-term follow-up period was 67.5 months (range 14–113 months). At this time post-surgery, ten patients were dead, with the disease-specific mortality being 50%. Of the patients dead at follow-up, the mean survival time was 38.8 months (range 7 days to 107 months) (Fig. 1), and 50% died more than 2 years after the ictus.

Of the 22 (68.8%) patients alive at the time of follow-up, 17 patients (77.2% of survivors) had a favorable outcome (mRS≤2), and 5 (22.7%) had a poor outcome (mRS 3–5; Table 4, Fig. 1). Five of the 15 patients who were comatose (GCS≤8) prior to surgery and 7 (50%) out of the 14 patients ≥70 years old at the time for surgery had a good long-term outcome (Table 5).

Factors associated with poor outcome

Low pre-surgical GCS, low GCS score at discharge and a high number of days on the ventilator were significantly associated with a poor 6-month outcome ($p<0.05$). Poor

Table 4 Surgical and clinical considerations, short- and long-term outcome according to GCS, RLS and modified Rankin score

Variable	No.	%
Length of stay [median (days) and range]	9.3 (3–25)	
Time of surgery from ictus [median (hours) and range]	48.4 (8–120)	
Acute surgery (≤24 h from ictus)	9	28.1
Delayed surgery (>24 h from ictus)	23	71.9
Reoperation*	6	18.8
EVD (median) (days)	4.2 (2–9)	
Removal of atlas arch	12	37.6
Mechanical ventilation	28	87.6
Days of mechanical ventilation [median (n=29)]	3.3 (1–10)	
Complications		
Pneumonia	5	15.6
Meningitis	3	9.3
Cardiac arrhythmia	1	3.1
Acute renal failure	1	3.1
Myocardial infarction	1	3.1
Outcome at discharge		
GCS score (median)	13.6 (7–15)	
Death	0	0
Outcome at 6 months		
Survivors	28	87.5
mRS (overall, median)	2.5 (0–6)	
Good (mRS: 0–2)	19	59.3
Poor (mRS: 3–5)	9	28.1
Death (mRS: 6)	4	12.5
mRS (median, survivors)	2 (0–4)	
mRS (median, ≥70 years)	2.6 (0–6)	
mRS (median, survivors, ≥70 years)	1.6 (0–3)	
Long-term follow-up and outcome		
Period (months)	67.5 (14–113)	
Survivors	22	68.8
mRS (overall, median)	3.1 (0–6)	
Good (mRS: 0–2)	17	53.1
Poor (mRS: 3–5)	5	15.6
Death (mRS: 6)	10	31.3
mRS (median, survivors)	1.8 (0–4)	
mRS (median, ≥70 years)	3.3 (0–6)	
mRS (median, survivors, ≥70 years)	1.3 (0–3)	

*Replacement of external ventricular drainage (n=3), re-evacuation of infarcted tissue (n=2), removal of postoperative cerebellar hematoma (n=1); *EVD* external ventricular drainage; *GCS* Glasgow Coma Scale score; *mRS* modified Rankin Score

long-term outcome was associated with a low GCS scores prior to surgery and at discharge, and with the number of days on ventilator ($p<0.05$). Age was not an independent prognostic factor for either the 6-month or long-term outcome ($p>0.05$).

Discussion

The present report describes the characteristics and the results of a uniform surgical treatment in 32 patients with unilateral cerebellar infarcts operated on in the early phase following the onset of the infarct. All patients were operated with posterior fossa decompression, removal of the necrotic cerebellar tissue and ventriculostomy. The number of significant complications from the treatment was low. Most patients had a favorable clinical result at discharge, at 6 months post-surgery and at long-term follow-up. The days on mechanical ventilation and the level of consciousness prior to surgery and at discharge were identified as the most important factors associated with a bad clinical outcome. Neither the time of surgery nor patients' age was significantly associated with outcome.

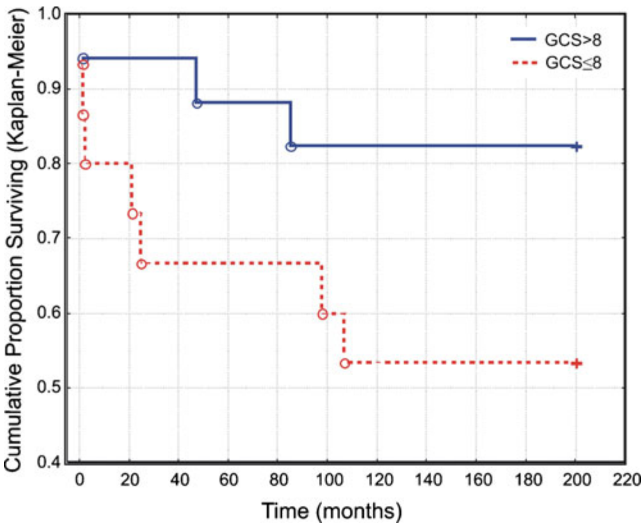

Fig. 1 Kaplan-Meier plot showing the clearly higher mortality in patients unconscious [Glasgow Coma Scale (GCS) score≤8] compared to conscious patients at the time of surgery

In cases of clinically significant and space-occupying posterior fossa infarction, surgery is the treatment of choice [9, 11, 12, 15, 17]. The initial nihilistic approach to surgical treatment has been overcome since patients with deteriorating neurological status or even in comatose state can improve remarkably after decompressive surgery with or without the use of external ventricular drainage [4, 12, 14, 20]. In the present series, timing for surgery (≤24 or >24 h from ictus) did not influence outcome, an observation consistent with previous studies [15, 24]. In our series, 8/9 patients that were operated on for acute neuroworsening over 5 days from ictus had a good outcome at discharge. Interestingly, 5/15 patients with GCS≤8 at the time of surgery had a favorable 6-month outcome in contrast to 14/17 patients with GCS>8 (Table 5). We suggest that, in patients with cerebellar infarcts, surgery can be beneficial even when it is performed several days after ictus, provided that it is performed on the basis of an acute clinical deterioration.

Only a few studies have reported on the long-term outcome following surgical treatment of cerebellar infarcts. In one previous clinical series, 15 out of 47 operated patients (32%) had a favorable outcome at a median follow-up period of 8 years [15]. In another report, 21 out of 57 operated patients (37%) had a good outcome at a mean follow-up of 5 years [24]. In comparison, 53% of the operated patients had a favorable outcome at 67.5 months postoperatively in our series.

There is only limited information on factors influencing outcome after surgery for cerebellar infarction. Age and mRS score at discharge were previously identified as the strongest independent predictors of outcome [15]. The presence of brain stem infarction was also associated with a poor prognosis in a study of 57 surgically treated patients [24]. In a prospective non-randomized study, the level of consciousness before surgery was identified as a major predictor of clinical outcome, but medically treated patients were also included in this analysis [14]. Similarly, the preoperative GCS score was found to be a prognostic factor in our series.

Interestingly, approximately 50% of patients over 70 years old had a favorable short- and long-term outcome, and ~32% of long-term survivors were over 75 years old at time of surgery. Contrary to other reports on acute brain injury such as supratentorial stroke and traumatic brain injury [13, 32] and the recent results of Jüttler et al. [15], in the present study, age per se was not a significant prognostic factor. Since life expectancy is increasing, it is plausible that the incidence of cerebellar infarctions will become greater, and our data imply that old patients may also benefit from decompressive surgery and NCC.

One strength of the present study is the homogeneity in the surgical method used and the NCC management.

Table 5 Outcome at discharge, 6 months and at long-term according to GCS score at ictus, GCS score before surgery and timing for surgery

	GCS score (discharge)			Total	mRS score (6-month)			Total	mRS score (long-term)			Total
	3–8	9–13	14–15		0–2	3–5	6		0–2	3–5	6	
GCS score at ictus												
14–15	0	0	13	13	10	2	1	13	10	0	3	13
9–13	2	4	8	14	6	6	2	14	4	5	5	14
7–8	0	3	2	5	3	1	1	5	3	0	6	5
GCS score before surgery												
9–13	0	1	16	17	14	2	1	17	12	2	3	17
3–8	2	6	7	15	5	7	3	15	5	3	7	15
Timing for surgery												
≤24 h	0	4	5	9	5	4	0	9	5	2	2	9
<24 h	2	2	19	23	14	5	4	23	12	3	8	23

Importantly, 87.6% of patients in our series required NCC treatment with mechanical ventilation, ICP monitoring and, occasionally, CSF drainage. The number of days on mechanical ventilation was an independent negative prognostic factor reflecting the initially poor clinical condition and low GCS in these patients. However, the number of days on mechanical ventilation is guided by the level of consciousness and is thus a dependent variable. Several studies of the surgical management of cerebellar infarction have been published, but it is difficult to obtain a homogenous picture since the patient characteristics, the indications for surgery, the surgical methods and the follow-up periods are different [1, 4, 12, 14, 15, 19–21, 23–26, 28, 36] (Table 6). The overall results, prognostic factors of significance and surgical methods

Table 6 Literature summary of cerebellar infarcts (series including ≥4 patients) operated on with suboccipital decompressive craniectomy with or without external ventricular drainage and infarct resection published in the English literature

Reference	Type of study	No. cases.	Surgery	Follow-up period	Outcome
Auer et al. [1]	Retrospective, double center	7	SC + EVD (n=7)	Not applicable	All patients survived
Chen et al. [4]	Retrospective, single-center	11	SC + Res + EVD (n=9)	7th day, 42.9 months	7th day (GCS: 13.1)
			SC + EVD (n=2)		Long-term (Barthel Index: 75)
Hornig et al. [12]	Retrospective, multi-center	30	SC + Res + EVD (n=22)	At discharge	Good:14
			SC + Res (n=8)		Poor: 12
					Deaths: 6
Jauss et al. [14]	Prospective, multi-center	34	SC*	90 days after ictus	Good: 22
					Poor: 12
Jüttler et al. [15]	Retrospective, multi-center	47	SC alone (n=8) **	5 months–11 years	Favorable: 15
			SC + EVD (n=39) **		Independent: 19
					Deaths: 13
Krieger et al. [19]	Retrospective and prospective, single-center	7	SC (n=7)	Not applicable	Good: 5
					Poor: 2
Kudo et al. [20]	Retrospective, multi-center	22	SC alone (n=2)	Not applicable	Good: 10
			SC + Res (n=3)		Moderate: 6
			SC + Res + EVD (n=14)		Poor: 4
			SC + EVD (n=3)		Deaths: 2
Laun et al. [21]	Retrospective	4	SC + EVD (n=3)	5 weeks–10 months	Good: 1
			SC (n=1)		Moderate: 3
Mohsenipour et al. [23]	Retrospective, single-center	19	SC + Res***	Not applicable	Poor: 2
					Moderate: 11
					Deaths: 6
Pfeffekorn et al. [24]	Retrospective, single-center	57	SC (n=57)	1- 11 years	Good: 21
			SC + Res (n=32)		Moderate: 6
			EVD (n=47)		Poor: 4
					Deaths: 21
Raco et al. [25]	Retrospective, single-center	9	SC + Res + EVD (n=5)	At discharge	Good: 3
			SC + Res (n=4)		Moderate: 2
					Poor: 1
					Deaths: 3
Taneda et al. [28]	Retrospective, single-center	10	SC + Res (n=7)	Not applicable	Good: 7
			SC + Res + EVD (n=3)		Moderate: 1
					Poor: 1
					Deaths: 1
Wood and Murphey [36]	Retrospective, single-center	5	SC + Res	5 weeks, 7 months, 1 year	Good: 1
					Moderate: 2
					Deaths: 2
Current study 2011	Retrospective, single-center	32	SC + Res + EVD (n=32)	At discharge, 6 months, 67.5 months	Good: 17
					Poor: 5
					Deaths: 10

SC suboccipital craniectomy; *EVD* external ventricular drainage; *Res* resection of infarct tissue; *GCS* Glasgow Coma Scale score; *possible infarct resection not specified; **53.2% of the patients operated with suboccipital craniectomy underwent infarct resection; ***not specified applied must be thoroughly evaluated with the ultimate goal of providing guidelines for patient selection, surgical indications and treatment strategies.

There are some limitations to our study. It was a retrospective analysis of a relatively small number of patients (n=32). Additionally, only a minority of our patients underwent an MRI scan before and/or after surgery, and thus, the actual incidence of brain stem involvement is unknown. Parts of the outcome analysis relied on subjective analysis of short-term and long-term outcome, and a recall bias cannot be excluded. However, other objective prognostic factors such as age and level of consciousness were analyzed providing additional strength to our study. We argue that the present findings provide valuable information since the surgical methods used were standardized and the main indication for surgery was a reduced level of consciousness.

Conclusion

We evaluated the clinical results in 32 patients operated on for clinically significant unilateral cerebellar infarcts. A reduced level of consciousness prior to surgery and at discharge from our unit was the most important negative prognostic factor, although a subset of patients with GCS≤8 at surgery fared well. In contrast, high age did not negatively influence outcome. Complications were rare, and we conclude that surgical treatment should also be considered in elderly patients with clinically significant cerebellar infarcts.

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Conflicts of interest None.

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