

Case Series

Salvage decompressive craniectomy in malignant MCA infarcts - results of local experience at Shifa International Hospital, Islamabad, Pakistan

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Abstract

Malignant infarctions of the middle cerebral artery (MCA) have high mortality. Recent studies showed decreased mortality with good functional outcome in young people with decompressive surgery. We report prospective, non-randomized case series of live patients in whom successful life saving decompressive craniectomy was performed. All five were males. Mean age was 59.2 ± 13 years. Four had right MCA infarction while I had left MCA infarction. Ipsilateral temporoparietal craniectomy with duraplasty was performed in mean time of 76 ± 27 hours after onset of symptoms. Four (80%) patients were discharged to home in awake, alert, conversant, hemiparetic state. One patient developed status epilepticus, and was transferred to another facility in intubated, sedated state. Three month follow-up on three patients showed moderate improvement in neurological status. Early craniectomy was life saving in all of our patients. Neurosurgical intervention should be considered early in large MCA infarcts, especially in young patients.

Introduction

Malignant middle cerebral artery (MCA) infarction is a devastating disease with mortality rates reported up to 80% in larger intensive care based prospective series.^{1,2} Most of the conservative medical therapies including hyperventilation, sedation, osmotic therapy, and steroids have failed to prove effective and even found detrimental in some reports.^{3,4} Neurological deterioration is mainly due to progressive swelling of the infarct, increase in the intracranial pressure and extension of ischaemia to adjoining vascular territories. Decompressive surgery in malignant MCA infarction has been performed with intention that by creating a compensatory space, the intracranial pressure will be normalized and the midline position of the brainstem and diencephalon will be restored. It was rarely performed earlier because of the fear that it will improve survival with severe neurological impairment and handicap.⁵ Several recent randomized trials have shown to increase survival with good functional outcome. The first reported trial was the Hemicraniectomy and Durotomy on Deterioration from Infarction Related Swelling Trial (HeADDFIRST) that randomized 26 patients. It showed a

non significant reduction in mortality from 46% with medical therapy to 27% in the surgically treated group.⁶ Then three randomized trials were conducted in Europe.⁷⁻⁹ The pooled analysis of all 3 trials included 93 patients and reported absolute risk reduction of 49% that was highly significant. Regarding functional outcome, the proportion of patients who had less residual disability (mild to moderate disability; mRS =3), increased from 21% to 43%.¹⁰ However it was dependent on age with better functional outcome in younger patients. Pillai et al. from India have reported a 73% survival rate 1 year post surgery in a non-randomized study and 33.3% of the survivors were independent at 1 year with none in a vegetative state.¹¹ Decompressive craniectomy experience for stroke has not been previously reported from Pakistan, and anecdotal experience suggests that it is rarely performed mainly because of several myths prevalent in our population regarding brain surgery and doctors are reluctant because of fear of postoperative complications and poor functional outcome. We report our experience in five patients with malignant middle cerebral artery infarction in whom successful life saving craniectomy was performed.

Patients and Methods

This is a prospective, non-randomized case series with surgeries performed between October 2007 and March 2008 in Shifa International Hospital, Islamabad, Pakistan, a tertiary care, multi-specialty 500 bed private teaching hospital. Five adult patients with massive middle cerebral artery infarction with impending herniation or early signs of herniation confirmed on neuroimaging and progression of neurological deterioration were included. Salvage decompression was performed after taking informed consent from the family. Four of the five patients had craniectomy with duraplasty; and one patient had craniotomy with removal of part of the infarcted tissue. Decompressive surgery consisted of removal of large bone flap including temporal, frontal and parietal bones ipsilateral to the stroke. Duramater was opened and duraplasty was done using periosteum and temporal fascia. Bone flap was buried in anterior abdominal wall to be reimplanted after 12 weeks of surgery. All patients were initially co-managed in intensive care unit by neurologist,

neurosurgeon, and intensivist. NIHSS score was recorded at the time of presentation and at discharge. Functional outcome was assessed with modified Rankin scale (mRS) score at discharge, and 3 months.

Results

The demographic and clinical characteristics of patients are summarized in Table. Case summaries of all the 5 patients are provided below.

Table. Demographic and clinical characteristics of patients.

	Number	Percentage
Mean age in years	59.2	
Gender		
Male	5	
Female	0	
Side of stroke		
Right	4	80
Left	1	20
Risk factors		
Hypertension	4	80
Diabetes mellitus	2	40
Ischaemic heart Disease	2	40
Smoking	3	60
Dyslipidemia	3	60
Hypercoagulable state	1	20
Indications of surgery		
Mass effect	3	60
Cushing reflex	1	20
Pupillary dilatation	1	20
Time of surgery		
≤ 48 hours	2	40
49-95 hours	2	40
96 -110 hours	1	20
mRS score at discharge		
0-3	0	-
4	3	60
5	2	40
6	0	-
Complications		
Aspiration pneumonia	3	60
Sepsis	2	40
Seizures & Status epilepticus	1	20
Venous thromboembolic events	0	-
Urinary tract infections	0	-

Patient 1:

A 56 years old right handed man, admitted with sudden onset of left sided numbness followed by weakness

about 10 hours after a motor cycle accident. He was taken first to a local hospital but as his condition worsened, he was transferred to our hospital two days after symptom onset. On examination, he was drowsy but arousable on verbal commands with mild dysarthria. He had right gaze preference; pupils were 3 mm symmetric and reactive. There was flaccid left hemiplegia including face, extensor plantar response and decreased perception of pain. Initial CT scan brain performed at outside facility showed early right MCA infarction. CT scan approximately 72 hours after onset of symptoms showed large right MCA infarction with mass effect. CT angiography showed dissection of right internal carotid artery. Due to increased mass effect and impending herniation right craniotomy was performed, along with removal of part of infarcted tissue, 78 hours after onset of symptoms. Next day, he was slightly better, opened eyes to verbal commands, followed one step commands and there was no gaze preference. On day 5, he was awake, alert, followed commands, and had extensor posturing of left arm and flexion withdrawal of leg. He was discharged home on day 12 with a mRS of 4. After three months, he was able to move left leg against gravity and walk with support, with a mRS score of 4.

Patient 2:

Sixty five years old right handed man, with ischaemic heart disease and hypertension, admitted with unstable angina, had emergency CABG. Postoperatively he developed left hemiparesis. On examination, he was lethargic, responded to verbal commands but did not follow. There was right gaze preference, left upper motor neuron (UMN) type facial palsy, flexion withdrawal on pain and extensor plantar on left side. CT scan brain showed large right MCA infarction with no midline shift. He was managed in ICU, with hyperventilation and intravenous mannitol. His conscious level deteriorated next day, so CT scan was repeated that showed mass effect with midline shift. Right craniectomy with duraplasty was performed. Following day, he had partial eye opening to pain, no gaze preference, pupils were 3 mm bilaterally symmetric and reactive. He made gradual neurological recovery, however, developed septicaemia that prolonged hospitalization. He was discharged on day 42 with a mRS score of 4. At 3 months follow up, he was fully alert, talked with slight hoarseness, left arm still plegic, left leg had some voluntary activity. Replacement of bone flap was done at that time. The mRS score was 4.

Patient 3:

A 64 years old right handed man, diabetic, hypertensive, and smoker admitted with sudden onset of left sided weakness on awakening two days prior to coming to

our hospital. On examination, he was conscious, obeyed simple commands but was mute. Pupils were 3 mm, symmetric, reactive, had left hemineglect, and flaccid hemiparesis including face with extensor plantar. CT scan performed 72 hours after onset of symptoms showed massive right MCA infarction with compression of the ipsilateral ventricle. He was managed in ICU. Next day he developed bradycardia with increased blood pressure so his CT scan was repeated that showed increased mass effect. Urgent right sided craniectomy with duraplasty was performed about 96 hours after the onset of symptoms. Postoperatively, he was awake but hemiparesis was unchanged. He developed aspiration pneumonia that improved with antibiotics and supportive therapy. He made gradual recovery and at the time of discharge, he was talking, facial palsy had almost resolved but there was no change in hemiparesis. He was discharged on day 13 with a mRS score of 4.

Patient 4:

Thirty nine years old right handed man, hypertensive came with sudden onset of left sided weakness 4 days prior to admission. On examination, he was conscious, oriented. There was mild dysarthria, pupils were symmetric and reactive, had left facial UMN palsy, power was 0/5 in left arm and 1/5 in leg with brisk reflexes and extensor plantar on left and normal sensory examination. Brain imaging including CT head and MRI brain from outside facility showed right subcortical infarct. Diagnostic evaluation revealed deficiency of protein C and S. On day 5 of admission he complained of headache with two episodes of vomiting overnight, so CT scan was repeated that showed complete right MCA infarction. Next day, repeat scan showed worsening midline shift. Meanwhile his right pupil dilated and became fixed. Urgent craniectomy was done approximately 48 hours after the onset of symptoms (Figure 1A, 1B, and 1C). His postoperative course was complicated by the development of generalized tonic clonic seizures that were managed with intravenous phenytoin, valproate and propofol infusion. Patient developed aspiration pneumonia and sepsis, and was treated with broad-spectrum antibiotics.



Figure 1. CT scan of patient 4.
 A. after onset of headache and vomiting
 B. after 36 hours of symptom onset
 C. 24 hours post surgery

He was shifted to UK on family's request on day 7 with a mRS of 5. At one month, we received phone call and a mail from his father that he was stable and slowly recovering. Three months phone follow-up suggested that he was talking, and was making steady recovery in a rehabilitation unit.

Patient 5:

A 72 years old right handed man, hypertensive, diabetic, smoker, with ischaemic heart disease was admitted with sudden onset right sided weakness and aphasia for three days. Initially he was managed in a local hospital and then transferred to our facility. On examination, he was drowsy, and globally aphasic. Pupils were 3 mm symmetric and reactive with flaccid hemiplegia and equivocal plantar response on right side. Initial CT brain done at outside facility showed large left MCA infarction with no midline shift. Repeat scan 72 hours after the onset of symptoms showed interval development of midline shift but neurological examination was unchanged. He was managed medically initially but his conscious level deteriorated so urgent left craniectomy with duraplasty was performed approximately 108 hours after the onset of symptoms. Next day, he was slightly more awake, had partial eye opening to pain and flexed left arm on pain. He gradually recovered and on 6th post operative day he was alert, globally aphasic and right hemiplegic. He also developed sepsis and was treated with broad spectrum IV antibiotics. He was discharged to home on day 10 with a mRS of 5.

Discussion

Management of malignant middle cerebral artery infarction is a challenging issue. Hemicraniectomy with duraplasty has shown to improve survival in several nonrandomized case series,^{12,13} and recently proved its effectiveness in randomized controlled trials also.⁷⁻⁹ Decompressive Craniectomy In Malignant Middle Cerebral Artery Infarcts (DECIMAL) showed 52.8% absolute reduction of death after craniectomy ($P < 0.0001$) with improved functional outcome at 6 months and 1 year, modified Rankin Scale (mRS) score of = 3 (25% vs. 5.6%; 50% vs. 22%).⁷ Similarly, Decompressive Surgery for the Treatment of Malignant Infarction of the Middle Cerebral Artery (DESTINY) reported 30 day survival of 88% in the surgical group vs. 47% in the conservative group. The probability of survival with a mRS = 4 increased from 24% to 75% and with a mRS score = 3 almost doubled.⁸ Hemicraniectomy After Malignant Middle Cerebral Artery Infarction With Life Threatening Edema Trial (HAMLET) is still ongoing.⁹ Initial results were included in pooled analysis recently published in March 2007.¹⁰ Another Asian trial is currently recruiting patients.¹⁴ In our series, the

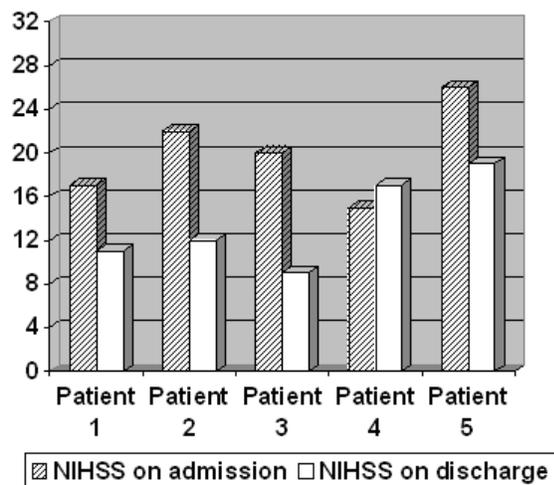


Figure 2. Comparison of NIHSS score of patients at admission and at discharge.

decompressive surgery was life saving in all patients. The outcome at discharge showed improvement in NIHSS score in 4 out of 5 patients (Figure 2). Most of our patients have not completed 6 months after surgery; hence it is too early to comment on long term outcomes. However, available information suggests that none of the patients have deteriorated since discharge and modest improvement have been seen in neurological status since leaving hospital.

Age was found to be a crucial factor in determining functional outcome in most of the studies.^{10,15} The mean age of our patients was 59 years and 2 patients were = 65 years, but all of them made a favourable recovery with no patient left in vegetative state. Our results suggest that in selected patients, the desired outcome can be seen even in advanced age. The optimal timing of craniectomy is controversial. In our series, the mean time for surgery was 76 ± 27 hours from symptom onset. A systematic review of 129 published cases found no difference in outcome if surgery was performed within 24 hours or at a later time¹⁵ except for one study that reported better results with early surgery.¹⁶

All our patients were males, which is likely a chance occurrence as we have just started to do this procedure after publication of results of randomized studies. Eighty percent of our patients had right sided infarct. A large Chinese study and a systematic review also showed bigger number of surgeries done on right side^{15,17} however, DESTINY showed larger but statistically insignificant preference for left hemisphere.⁸ This may represent selection bias in non-randomized series. Initially, aphasia was considered to be a limiting factor in outcome of decompressive surgery; however, the recent randomized data suggests that aphasia does not affect the outcome.⁷

The major post-operative complication included

aspiration pneumonia in 60% and septicaemia in 40% of our patients, while one patient (20%) developed seizures and status epilepticus. None of these complications were fatal. None of our patients developed venous thromboembolic complications. DECIMAL trial has reported 25% pneumonia, 10% urinary tract infection, 5% seizures, and 5% venous thromboembolic complications. None of these were fatal.⁷ In our patients, the hospitalization was prolonged, and neurological recovery was possibly delayed due to complications.

Our study has several limitations because of small sample size and non-randomization. Three month follow up was available for three patients only and longer follow-up may show further improvement in neurological outcomes. This is the beginning and in future, we hope that bigger studies with larger sample size and longer follow up period will provide more information on safety and efficacy of this procedure in our patient population. More trials including patients more than 60 years are also needed.

Conclusion

Decompressive craniectomy/craniotomy was life saving in all of our patients. Infections and seizures are potentially treatable complications and did not cause mortality in our small series. All patients with clinically large middle cerebral artery infarctions should be closely monitored both radiologically and clinically and early decompression should be considered, particularly in young patients.

Disclosures and Conflicts Of Interest

This paper was presented in part in the 15th Annual Meeting of Pakistan Society of Neurology, April 5 and 6, 2008, in Peshawar, as platform presentation.

All the authors have nothing to disclose.

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