



SURGICAL MANAGEMENT OF MALIGNANT MCA INFARCT - AN INSTITUTIONAL EXPERIENCE.

Neurosurgery

Dr Dibyojyoti Bora Institute of Neurosurgery, Madras Medical College, Chennai

Dr P. Anbazhagan* Institute of Neurosurgery, Madras Medical College, Chennai*Corresponding Author

ABSTRACT

Introduction: Ischemic stroke is a medical Punctuation- emergency, it is one of the most important cause of morbidity and mortality. Decompressive hemicraniectomy (DC) has a well-established role in treating malignant MCA infarct. The purpose of this article is to share our experience with DC in patients of malignant MCA infarct at our institute over a period of one year, with an insight into the problems faced at a tertiary care centre in a developing country and the lessons learnt in the process. **Materials and Methods:** This is a retrospective study, describing the results of decompressive hemicraniectomy in 38 patients with malignant MCA infarct at the Institute of Neurosurgery, Madras Medical College, Chennai, from January 2019 to January 2020. Outcome was assessed in terms of mortality and modified Rankin scale (mRS). **Results:** A total of 38 patients underwent DC for malignant MCA infarct between January 2019 and January 2020 at our institute. The mean age of the study group was 48.6 ± 10 yr. Left MCA territory infarct was seen in 23 (60.5%) patients while 15 (39.5%) patients had right MCA territory infarct. There was no statistically significant difference in terms of favourable outcome following surgery between the two groups. Overall, 34% patients in this series had an mRS of 0-3 at discharge and 18.4% had mRS of 4 and more. Forty percent patients operated within 24 h had mRS 0-3 at discharge while only 32% patients operated after 24 h had mRS 0-3 at discharge. However, this difference is not statistically significant ($p=0.653$). **Conclusion:** DC reduces mortality and morbidity but also there is a subset of patients who survive but lead bedridden life. Improving the quality-of-life and eventual neurological outcome in these patients pose a constant challenge for the treating doctor. Mortality and functional outcome can be improved by timely access to medical care and prompt intervention. Interval between clinical deterioration and surgery is more relevant than early surgery in determining the outcome. Although age is an impediment to a favourable outcome in the present series, however deserving candidates should not be denied surgery irrespective of age.

KEYWORDS

Malignant middle cerebral artery infarct, Decompressive hemicraniectomy, modified Rankin scale

INTRODUCTION:

Ischemic stroke is a medical emergency it is the leading cause of morbidity and the second leading cause of mortality worldwide.¹ Space-occupying massive middle cerebral artery (MCA) territory infarction accounts for over 10% of supra-tentorial strokes. Life threatening brain edema with signs of elevated intracranial pressure (ICP) and brain herniation develops usually in the second to fifth day leading to a mortality rate of 70% to 80% despite maximal intensive care treatment.^{2,3,4} Therefore, the term "malignant MCA infarct" was introduced for these massive cerebral infarcts.⁷ Conservative intensive care treatment strategies like osmotherapy with glycerol, mannitol, or hydroxyl-ethyl starch, ICP lowering therapies with barbiturates, buffer solutions or hyperventilation, and neuroprotective therapies such as moderate hypothermia are widely used. None of these therapies are supported by adequate evidence from clinical trials.⁵

The benefit of decompressive hemicraniectomy (DC) in malignant MCA infarct has been demonstrated in the pooled analysis of three randomised trials (DECIMAL, DESTINY, HAMLET). With timely surgery the probability of survival increases from 28% to nearly 80% and the probability of survival with an mRS of ≤ 3 doubles.⁶

We report our experience with DC in patients of malignant MCA infarct at our institute over a period of one year, with an insight into the problems faced at a tertiary care centre in a developing country and the lessons learnt in the process.

AIMS:

Role of decompressive craniectomy in patients with malignant MCA infarct and assessment of outcome in terms of mRS score.

To assess the factors influencing the outcome following surgery at a tertiary health care centre.

METHODS:

Study design:

This is a retrospective study, describing the results of decompressive hemicraniectomy in 38 patients with malignant MCA infarct at the Institute of Neurosurgery, Madras Medical College, Chennai, from January 2019 to January 2020.

On admission, cerebral pathology was revealed by - computed tomography [CT]/magnetic resonance imaging [MRI].

Presence of a midline shift was measured by observation of the

distance of septum pellucidum that deviated from the line between anterior and posterior falx cerebri at its attachment to the inside of the calvarium.

Clinical characteristics that were included- age and gender, preoperative clinical condition, timing of surgery, location and extension of infarction, time delay from the onset of symptoms to surgery, preoperative signs of herniation and their relation to the final Complete sentence- outcome. Outcome was assessed... in terms of mortality and modified Rankin scale (mRS).

Functional outcome.. divided into two groups:

- Favourable outcome (mRS score 0-3) versus
- Poor outcome (mRS score 4-6).

Patient selection:

The decision to perform DC was based on the presence of a large MCA infarction on CT scan and clinical status of the patients. Patients with GCS >13 and no midline shift or basal cistern compression at initial evaluation were managed in the ICU.

Determining criteria for carrying out DC in malignant MCA infarction in our study were large MCA infarct - ischemic lesion volume >150 cm³ on diffusion-weighted MRI or CT evidence of at least 50% MCA territory infarction by visual inspection, clinical or radiological evidence of herniation, decrease in level of consciousness.

Patients with Glasgow coma scale (GCS) <4 , coma with two dilated pupil and absent brainstem reflexes were excluded from the study.

Surgical technique:

A question mark-shaped skin flap based on the ear was made and a wide craniotomy was performed on the affected side with partial removal of the frontal, temporal, and parietal bones, so that the floor of the middle fossa could be exposed and the bone flap have a minimum of 12 cm diameter. Hitches were taken at the bony edges, sylvian based durotomy was done which was converted into a stellate. Temporal fascia was used for dural repair and bone flap was discarded. Titanium mesh was used for cranioplasty at a later date.

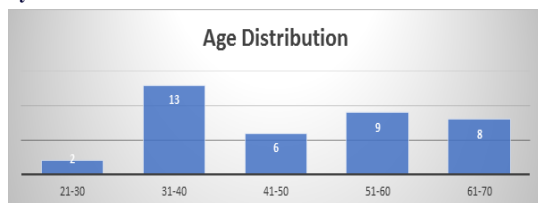
Statistical analysis:

All data are expressed as mean $\pm$ standard deviation (SD). T tests and Fisher's exact test were used for analysis of statistical evidence, with $p<0.05$ considered significant. Statistical software SPSS 14.0 was used for statistical analysis.

RESULTS:

A total of 38 (30 male and 8 female) patients underwent DC for malignant MCA infarct between January 2019 and January 2020 at our Institute. Age of the patients ranged between 30 and 70 years (mean age was 48.6 ± 10 yrs). The majority of patients aged between 31-40 (13 patients).

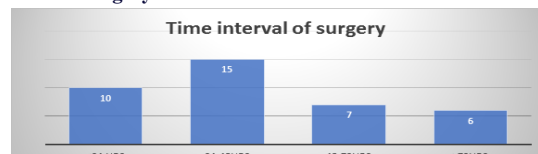
Table 1: Showing the age distribution of patients in the present study.



Left MCA territory infarct was seen in 23 (60.5%) while 15 patients (39.5%) had right MCA territory infarct. There was no statistically significant difference in terms of favourable outcome following surgery between the two groups ($p=0.8091$). Mean GCS score at the presentation of all patients was 8.75 while mean GCS at surgery was 6.56.

Time interval between onset of symptoms and DC was less than 24 hours in 10 (26.3%), 24-48 hours in 15 (39.4%), 48-72 hours in 7 (18.4%) and more than 72 hours in 6 (15.7%) patients. Overall, 13 (34.2%) patients in this series had an mRS of 0-3 at discharge and 7 (18.4%) had mRS of 4 and more. Forty percent patients operated within 24 hours had mRS 0-3 at discharge while only 32% patients operated after 24 hours had mRS 0-3 at discharge. However, this difference is not statistically significant ($p=0.653$). In the present study 8 (21%) patients were above 60 years of age; two patients recovered however they had a poor outcome with mRS score of 4-6.

Table 2 : Distribution of patients according the onset of symptoms and time to surgery.



A total of 18 patients (47.3%) died in the postoperative period secondary to the presenting brain lesion, hemodynamic failure and complications arising out of prolonged ventilation; nine patients developed ventilator associated pneumonia.

Diabetes was present in 12 (31.5%) patients. Systemic hypertension was found in 16 (42%) patients. Coronary artery disease was present in 3 patients and one patient had RHD. These factors did not significantly influence the mortality rates or functional outcomes in our study. We assume that this was caused by the relatively small number of patients ($n=38$) in our study.

DISCUSSION:

Although, over a period of time various studies have established the superiority of DC over conservative therapy in the setting of malignant MCA infarct. Its applicability is still debated in terms of quality of life in the survivors, benefits in cases of elderly patients, outcomes in dominant hemispheric infarct and the timing of surgery.

The important issue pertaining to DC in MCA infarct is not mortality alone, the clinical outcome and quality of life in the survivors are the major concerns. In our study, 34% patients had an mRS of 0-3 at discharge and 18.4% had mRS of 4 and more.

Table 3: Showing mortality and outcome following DC in MCA infarct in various studies:

Study	Design of study	No of patients in surgical group	Mortality	Good outcome in surgical group	Poor outcome in surgical group
Holtkamp et al ⁷	Retrospective descriptive study	12	33%	-	67%

Kuroki et al ⁸	Retrospective/ prospective descriptive study	8	12%	44%	44%
Uhl et al ⁹	Multicentre retrospective descriptive study	188	37%	24%	37%
Woertgen et al ¹⁰	Retrospective descriptive study	48	25%	25%	50%
Kilincer et al ¹¹	Non-randomised prospective study	32	50%	-	50%
Gupta et al ¹²	Metanalysis of non-randomised trials and retrospective study	138	24%	42%	34%
Vahedi et al ⁶	Metanalysis of 3 randomised trials	51	22%	43%	35%
Our study	Retrospective descriptive study	38	47.3%	34%	18.4%

As shown by various studies in the table, decompressive craniectomy does improve the survival. However, the percentage of people surviving with severe disability also increases. In our scenario, the unfavourable outcomes can be attributed to some extent to the delay of the patients in reaching a proper health care facility. In many cases there were unnecessary hospitalisation and conservative management at local hospitals without proper neurological evaluation which led to critical delay in initiation of treatment. These factors can be addressed by educating and creating awareness about the disease among the masses.

The time of surgery from the onset of stroke, for an optimal outcome, is controversial. Schwab et al. found that patients undergoing decompression before 24 hours after stroke showed a better outcome⁵. However, no benefits of early surgery were observed in a review by Gupta et al.¹², this can be due to a large number of patients with signs of preoperative herniation¹². In a systematic review Vahedi et al.⁶ concluded that the outcome is not affected by the timing of surgery. In our study 40% patients operated within 24 h had mRS 0-3 at discharge while 32% patients operated after 24 h had mRS 0-3 at discharge, however this is not statistically significant ($p=0.653$). In practise immediate pre-operative GCS and interval between clinical deterioration and surgery are more relevant factors in determining the outcome.

The benefits of decompressive craniectomy in patients above 60 years is controversial. Various observational trials have shown that mortality in older patients is in the range of 50-80% and there is no significant benefit of surgery over conservative management.^{2,3} Uhl et al reported an independent outcome in 12% of patients older than 50-years while 37% died or were severely disabled⁹. In a review by Gupta et al. it was seen that 80% patients above 50 years had died or were severely disabled and only 1% had an independent outcome¹². Pre-existing disabilities and severe comorbid conditions which are common in elderly also contribute to the poor outcomes in this age group. Kuroki et al. reported a reduction in mortality and improved functional performance in terms of ADL, in patients undergoing decompressive surgery as compared to conservative treatment in patients more than 70 years old⁸. In our series 8 patients were above 60 years and the mortality rate in this group was 75%. The survivors had a poor functional outcome. Pre-existing comorbidities although present were not statistically significant.

DC in cases of large dominant hemispheric infarcts is controversial, mainly because surgery may leave patients with an unacceptable quality of life. The hemispheric location of the infarct did not have any statistically significant influence on the functional outcome in our study. Gupta et al. found similar functional outcomes in patients undergoing decompression of the dominant hemisphere when compared to those of the non-dominant hemisphere¹². Brainstem compression is proportional to the size of infarct, indicating that mortality is more influenced by the size of infarct rather than the hemispheric location. Therefore, we believe that the location of the infarct should not be an exclusive criterion for surgery.

CONCLUSION:

DC reduces mortality and morbidity but also there is a subset of patients who survive but lead bedridden life. Improving the quality-of-life and eventual neurological outcome in these patients pose a constant challenge for the treating doctor. The family and caretakers should be taken into confidence at each step as most of the patients may

require prolonged rehabilitative therapy and lifelong assistance. Mortality and functional outcome can be improved by timely access to medical care and prompt intervention. In our setting, creating public awareness and education will prompt people to seek health care services in a timely manner. Interval between clinical deterioration and surgery is more relevant than early surgery in determining the outcome. Although age is an impediment to a favourable outcome in the present series, however deserving candidates should not be denied surgery irrespective of age. Outcome is seldom guided by the location of infarct, rather size of infarct and preoperative signs of brainstem compression are more reliable predictors.

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