

**ORIGINAL RESEARCH**

# Outcome Analysis of Decompressive Craniectomy for Malignant Middle Cerebral Artery Infarction at a Tertiary Care Hospital

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**ABSTRACT**

**Background:** The present study was conducted for assessing the outcome following decompressive craniectomy for malignant middle cerebral artery infarction. **Materials & Methods:** A total of 50 patients with presence of malignant infarct [space-occupying total infarction in the region of the MCA or both the MCA and the anterior cerebral artery (ACA)] and who received a decompressive craniectomy were enrolled. Another set of 50 patients who received medical treatment were enrolled as a conservative care group. All patients were treated within 48 hours of the stroke event. For the craniectomy group, the principal surgical technique was a large decompressive craniectomy with duroplasty. Follow-up was done and clinical status of all the patients was evaluated and compared using NIHSS (National Institutes of Health Stroke Scale) scoring. **Results:** Non-significant results were obtained while comparing the NIHSS score among the patients of the two study groups. Favorable outcome was seen in 30 percent of the patients of the conservative care group and in 60 percent of the patients of the craniectomy group (p-value < 0.05). Mortality was seen in 42 percent of the patients of the conservative care group and in 28 percent of the patients of the craniectomy group (p-value < 0.05). **Conclusion:** In cases of malignant MCA infarction, early decompressive hemicraniectomy has been shown to improve functional prognosis.

**Key words:** Decompressive Craniectomy, Malignant, Middle cerebral artery infarction.

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**INTRODUCTION**

Stroke remains an important cause of death and disability, and occlusion of the middle cerebral artery (MCA) or one of its branches is one of the more common causes of ischaemic stroke. Space occupying oedema is the leading cause of mortality in the first week following stroke, and clinical features usually manifest between the second and fourth day.<sup>1, 2</sup> However, neurological deterioration may occur more rapidly within 24 h of symptom onset, and when associated with involvement of the whole MCA territory has been termed 'malignant MCA infarction'. The annual incidence is between 10 and 20 per 100 000 people, and females are more commonly affected.<sup>3,4</sup>

Recently, guidelines for the management of patients with malignant MCA infarction were published, and therefore, only recent advances in the therapy of malignant infarction are reviewed in the following. Of the general conservative measures, only hypothermia showed some beneficial effects: hypothermia reduces postischemic hyperperfusion, delayed postischemic

hypoperfusion, blood brain barrier disruption, brain edema and volume of neuronal damage after focal cerebral ischemia in animal models.<sup>6,7</sup> Decompressive craniectomy (DC) is a surgical technique developed over the centuries, and Kocher described it in detail more than a century ago. The DC has still today an essential role in the neurosurgical practice and represents a life-saving surgical option to treat elevated intracranial hypertension (ICP).<sup>7,8</sup> Hence; the present study was conducted for assessing the outcome following decompressive craniectomy for malignant middle cerebral artery infarction.

**MATERIALS & METHODS**

The present study was conducted in the Department of Neurosurgery, Patna Medical College, Patna, Bihar (India) for assessing the outcome following decompressive craniectomy for malignant middle cerebral artery infarction.

A total of 50 patients with presence of malignant infarct [space-occupying total infarction in the region of the MCA or both the MCA and the anterior cerebral

artery (ACA)] and who received a decompressive craniectomy were enrolled.

Complete demographic and clinical details of all the patients were obtained. Imaging findings of all the patients were recorded and analyzed separately. Another set of 50 patients who received medical treatment were enrolled as a conservative care group. All patients were treated within 48 hours of the stroke event. For the craniectomy group, the principal surgical technique was a large decompressive craniectomy with duroplasty. Follow-up was done and clinical status of all the patients was evaluated and compared using NIHSS scoring.

All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

## RESULTS

Mean age of the patients of the conservative care group and craniectomy group was 62.3 years and 58.7 years respectively. Majority proportion of patients of both the study groups were males. Mean NIHSS score among patients of conservative care group and craniectomy group was 16.5 and 17.3 respectively. Non-significant results were obtained while comparing the NIHSS score among the patients of the two study groups. Favorable outcome was seen in 30 percent of the patients of the conservative care group and in 60 percent of the patients of the craniectomy group (p-value < 0.05). Mortality was seen in 42 percent of the patients of the conservative care group and in 28 percent of the patients of the craniectomy group (p-value < 0.05).

**Table 1: Comparison of NIHSS score**

NIHSS score	Conservative care group	Craniectomy group
Mean	16.5	17.3
SD	2.8	2.9
p-value	0.458 (Non-Significant)	

**Table 2: Outcome**

Outcome	Conservative care group		Craniectomy group	
	n	%	n	%
Favorable	15	30	30	60
Poor	35	70	25	50
p-value	0.001 (Significant)			

**Table 3: Comparison of 6 months mortality rate**

Mortality 6 months	Conservative care group		Craniectomy group	
	n	%	n	%
Absent	29	58	36	72
Present	21	42	14	28
p-value	0.000 (Significant)			

## DISCUSSION

The term "malignant" was first used by Hacke et al to characterize the complete infarction of the middle cerebral artery (MCA) territory accompanied by space-occupying mass effect that develops during the first 5 days after presentation and that is associated with about 80% mortality. Malignant evolution of an infarct is consistently related to the volume of ischemic brain. Malignant cerebral infarction (MCI) usually denotes a large MCA infarction, with or without involvement of the ipsilateral anterior and posterior cerebral artery territories, that presents with acute brain swelling in the first 48 h after stroke, resulting in elevated intracranial pressure (ICP) or brain herniation.<sup>9-11</sup> Meta-analyses supported this finding; however, as some primary outcome measures were neutral, there are fundamental questions about trial design and interpretation and about the benefits of this surgery on functional outcome in surviving patients. Moreover, although the survival benefit from hemicraniectomy is undisputed, the functional

outcome of surviving patients treated with this procedure is variable and often poor, raising important ethical considerations.<sup>12, 13</sup> Hence; the present study was conducted for assessing the outcome following decompressive craniectomy for malignant middle cerebral artery infarction.

Mean age of the patients of the conservative care group and craniectomy group was 62.3 years and 58.7 years respectively. Majority proportion of patients of both the study groups were males. Mean NIHSS score among patients of conservative care group and craniectomy group was 16.5 and 17.3 respectively. Non-significant results were obtained while comparing the NIHSS score among the patients of the two study groups. The clinical and radiological outcome of decompressive craniectomy in the setting of malignant MCA infarctions was evaluated in a previous study conducted by Mohamed Ibrahim Refaat et al. Twenty-five patients were included in this study. The mean age was 64.4 years. The mean preoperative GCS score was 8.14. The mean preoperative midline shift was 7.9 mm. All cases

showed radiological improvement in the early follow-up period. Good functional outcome based on mRS was achieved in 64% and poor outcome in 36% of cases. The overall mortality in this study was 28%.<sup>14</sup> In the present study, favorable outcome was seen in 30 percent of the patients of the conservative care group and in 60 percent of the patients of the craniectomy group (p-value < 0.05). Mortality was seen in 42 percent of the patients of the conservative care group and in 28 percent of the patients of the craniectomy group (p-value < 0.05). In a similar study conducted by Raffiq MA et al, authors compared patients treated with medical therapy and decompressive surgery for malignant MCA infarction. Decompressive craniectomy resulted in a significant reduction in mortality rate at 30 days and favorable GOS outcome at discharge. Good functional outcome based on mRS was seen in 48.9% of patients at 3 months and in 64.4% of patients at 6 months. Factors associated with good outcome include infarct volume of less than 250 ml, midline shift of less than 10 mm, absence of additional vascular territory involvement, good preoperative Glasgow Coma Scale (GCS) score, and early surgical intervention. Age and dominant hemisphere infarction had no significant association with functional outcome.<sup>15</sup> In a previous study conducted by Elsayed A et al, authors evaluated the impact of DC in reducing mortality rate and improving the functional outcome in the patients who underwent DC surgery for malignant MCA infarction. All patients on admission have the GCS of 5–12 score (mean 8). Fourteen patients underwent DC in the first 48 h while 10 patients were operated upon after 48 h. Postoperatively, two patients (9%) had a score of 3 on the modified Rankin Scale, six patients (25%) had a score of 4, and eight patients (33%) had a score of 5. Mortality occurred in eight patients (33%) with the worst score of 6. Similar unfavorable outcome was reported at 6- and 12-month follow-up with different degrees of disability.<sup>16</sup>

## CONCLUSION

In cases of malignant MCA infarction, early decompressive hemicraniectomy has been shown to improve functional prognosis.

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