International Surgery Journal
Mathew S et al. Int Surg J. 2022 Feb;9(2):313-316
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20220069

Original Research Article

Redefining the upper age limit of decompressive craniectomy surgery for malignant middle cerebral artery infarct

Shaju Mathew, P. K. Balakrishnan, Parth V. Prakash*, Ajax John, Haris Thottathil Pareed, Tom Jose

Department of Neurosurgery, Kottayam Medical College, Kerala, India

Received: 30 December 2021
Revised: 07 January 2022
Accepted: 11 January 2022

***Correspondence:**
Dr. Parth V. Prakash,
E-mail: valaparth7@gmail.com

ABSTRACT

Background: Decompressive craniectomy is an effective treatment for malignant middle cerebral artery (MCA) territory infarct. But the age limit for surgery is not well defined. The time window of the surgery is considered less than 96 hours.
Methods: This retrospective study of 60 patients of MCA territory infarct who underwent decompressive craniectomy surgery is selected in this study and using modified Rankin score.
Results: In this study 36 patients were less than 60 years and were above 60 years. 38 patients were right sided and 22 were left sided MCA infarct. Out of 60 patients, 22 patients were operated within 48 hours of onset of symptoms and 38 were operated between 48 to 96 hours. 49% patients operated within 48 hours had modified Rankin score (mRS) 0–3 at 3 months follow up while only 37% patients operated after 48 hours had mRS 0–3 at 3 months follow up.
Conclusions: Decompressive craniectomy in malignant MCA infarction can reduce the case fatality rate but the favorable outcome is questionable. Hence the surgical decision should depend on social and patient factors.

Keywords: Decompressive craniectomy, Modified Rankin score, Malignant MCA infarction

INTRODUCTION

Malignant middle cerebral artery (MCA) infarction is the ischemic brain tissue which is large enough to cause considerable increase in intracranial pressure (ICP) and may result in potential cerebral herniation. Once ICP reaches above the critical value of >30 mm hg brain herniates. The conventional treatments like glycerol and mannitol often fails to reduce the herniation of the brain.[1-3] In literature reviews 80% of patients have mortality in the absence of neurosurgical intervention.[4-6] The surgical intervention recommended in many international articles were decompressive craniectomy with undoubtful survival benefits. However, the results are good in patients who had surgery in optimal time window.[7,8] European randomized clinical trials (RCTs) form the basis of current surgical management, in which they observed clear survival benefits in patients less than age 60 years and operated within 48 hours of stroke.[9,10] The detection of early MCA infarction is less sensitive in computed tomography scan, while diffusion weighted imaging is more capable of detecting the infarct territory in short time after onset of 5 minutes.[11-13] This study aims whether decompressive craniectomy is effective in older patients.

Objective

Objective of the study was to assess whether decompressive craniectomy is effective in elderly patients more than 60 years.

METHODS

This was a prospective study done in department of neurosurgery from August 2019 to August 2021. After selection of the patients according to inclusion and exclusion criteria, well informed consent will be taken. A detailed questionnaire will be used to collect required data from the patient. Detailed preoperative assessment will be done including Glasgow coma scale (GCS) and blood investigations, computed tomography (CT) brain, comorbidity, clinical signs and symptoms. Time interval between onset of 1st symptom and surgery to be noted operative time, post-operative ventilation how long needed, hospital stay and post-operative assessment will be done after surgery, at 2 week and at 3 month after surgery in terms of GCS and mRS post-operative complications with revision surgeries if needed will also be noted.[14]

Inclusion criteria

Patients with MCA infarct, with midline shift more than 5 mm; more than 50 % of MCA territory involvement on CT scan brain; and age, >18 years and <65 years.

Exclusion criteria

Patients with multiple vessel infarct; patients with hemorrhagic infarcts; GCS score 14 to 15; and patients with GCS score <4, or absent brain stem reflexes.

Sample size calculated according to the equation given.

$$N = \frac{\left(Z\alpha_1^2 + Z_{1-\beta}\right)^2 pq(\alpha+1)}{\alpha(P_1 - P_2)^2} = 46$$

Data management and statistical analysis

The quantitative data will be presented as their mean±standard deviation (SD) for normal distribution categorical and nominal data (like socio demographic parameters) will be expressed in frequency and percentage. Outcome of the operated cases will be evaluated on the basis of Likert scale analysis. For analysis of qualitative data Chi square test will be used for analyzing quantitative data. The significance threshold of p value is set at <0.05. Data will be coded and entered in Microsoft excel 2016 and analyzed using IBM statistical package for the social sciences (SPSS) software version 21.0.

RESULTS

In this study age of patients ranged from 29 to 75 years were there with 36 (66%) were less than 60 years and 24 (44%) were above 60 years. 38 patients were right sided and 22 were left sided MCA infarct. The age data is depicted in Figure 1.

Out of 60 patients, 22 patients were operated within 48 hours of onset of symptoms and 38 were operated between 48 to 96 hours. 49% patients operated within 48 hours had mRS 0–3 at 3 months follow up while only 37% patients operated after 48 hours had mRS 0–3 at 3 months follow up. But this difference was not statistically significant. The mean pre-op GCS, post-operative ventilatory support, ICU care days, mortalities were depicted in Table 1.

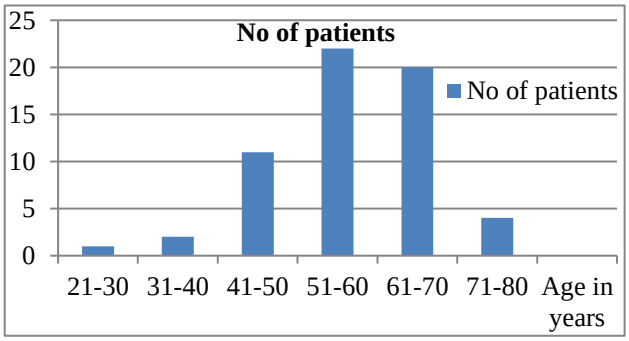

Figure 1: Age groups and number of patients.

Table 1: Comparison of patients according to age.

Parameters	<60 year (36 patients)	>60 year (24 patients)
Mean GCS in pre-operative	10.5	10.3
Post-operative ventilator support (hours)	38	75
ICU care (days)	5.5	8.9
Incidence of chest infection (%)	12	18
Mortality at 3 months	16% (6 patients)	50% (12 patients)
Patient with favourable outcome (mRs 0-3) at 3 months follow up	19 patients (53%)	4 patients (16%)

Sixteen percentage of patients of age group less than 60 years died, while 19 patients had mRS 0-3 with favorable outcome which comes to be about 53% of total. In elderly age group, 12 patients died within 3 months of surgery and 4 patients had favorable outcome at 3 months of follow up, rest of 8 patients have unfavorable outcome. Eight patients had history of CAD, 2 patients had CKD, 2 patients developed pulmonary embolism.

DISCUSSION

The mortality of patients in group age >60 years is 50 % while in age group <60 years is 16%. DESTINY study showed similar results with decreased mortality in age group <60 years.[15] In DECIMAL trial, 38 patients were studied in which the proportion of patients with a mRS score ≤3 at the 6-month and 1-year follow-up was 25% and 50%, respectively.[16] There was a 52.8% absolute reduction

of death after craniectomy compared with medical therapy. And they have concluded that early decompressive craniectomy significantly reduced mortality compared to medical therapy. DECIMEL trial observed patients below age 60 years and their results are similar results to this study.

HAMLET trial observed, DC reduces the case fatality and morbidity in patients with space occupying infarction who are treated within 48 hours of stroke onset.[17,18] But no evidence of good functional outcome if surgery done after 96 hours of stroke onset. This study also studied the significance of time after symptom onset to the surgery and observed significant reduction in morbidity operated before 48 hours.

In this study, elderly age group patients who expired had comorbidities like renal failure and CAD. Mortality rate was about 50% and only 16% patients have good favorable outcome.

Limitations

The sample size is not adequate to recommend that decompressive craniectomy is not needed for age more than 60 years.

CONCLUSION

Decompressive craniectomy is a lifesaving procedure in malignant MCA infarct. Treatment should be individualized considering age, comorbidities (cardiac, renal factors) and the probable functional outcome with the care givers. Surgery should not be deferred in view of old age (>60 years) and late presentation (>48 hours) of a patient. The surgical decision should depend on relative attributing factors of dependency and survival.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Gupta R, Connollyes MS, Elkind MSV. Hemicraniectomy for massive middle cerebral artery territory infarction: a systematic review. Stroke J Cereb Circ. 2004;35(2):539-43.
2. Kamran S, Akhtar N, Salam A, Alboudi A, Kamran K, Ahmed A, et al. Revisiting hemicraniectomy: late decompressive hemicraniectomy for malignant middle cerebral artery stroke and the role of infarct growth rate. Stroke Res Treat. 2017;2507834.
3. Mckenna A, Wilson CF, Caldwell SB, Curran D. Functional outcomes of decompressive hemicraniectomy following malignant middle cerebral artery infarctions: a systematic review. Br J Neurosurg. 2012;26(3):310-5.
4. Dasenbrock HH, Robertson FC, Vaitkevicius H, Aziz-Sultan MA, Guttieres D, Dunn IF, et al. Timing of decompressive hemicraniectomy for stroke: a nationwide inpatient sample analysis. Stroke. 2017;48(3):704-11.
5. Agarwalla PK, Stapleton CJ, Ogilvy CS. Craniectomy in acute ischemic stroke. Neurosurgery. 2014;74(1):151-62.
6. Uhl E, Kreth FW, Elias B, Goldammer A, Hempelmann RG, Liefner M, et al. Outcome and prognostic factors of hemicraniectomy for space occupying cerebral infarction. J Neurol Neurosurg Psychiatry. 2004;75:270-4.
7. Huttner HB, Schwab S. Malignant middle cerebral artery infarction: clinical characteristics, treatment strategies, and future perspectives. Lancet Neurol. 2009;8:949-58.
8. Frank JI. Large hemispheric infarction, deterioration, and intracranial pressure. Neurology. 1995;45:1286-90.
9. Steiner T, Ringleb P, Hacke W. Treatment options for large hemispheric stroke. Neurology. 2001;57(2):61-8.
10. Schwab S, Steiner T, Aschoff A, Schwarz S, Steiner Hh, Jansen O, et al. Early hemicraniectomy in patients with complete middle cerebral artery infarction. Stroke J Cereb Circ. 1998;29(9):1888-93.
11. Fandino J, Keller E, Barth A, Landolt H, Yonekawa Y, Seiler RW. Decompressive craniotomy after middle cerebral artery infarction. Retrospective analysis of patients treated in three centres in switzerland. Swiss Med Wkly. 2004;134(29-30):423-9.
12. Cho D-Y, Chen T-C, Lee H-C. Ultra-early decompressive craniectomy for malignant middle cerebral artery infarction. Surg Neurol. 2003;60(3):227-32.
13. Uhl E, Kreth FW, Elias B, Goldammer A, Hempelmann RG, Liefner M, et al. Outcome and prognostic factors of hemicraniectomy for space occupying cerebral infarction. J Neurol Neurosurg Psychiatry. 2004;75(2):270-4.
14. Schirmer CM, Ackal AA, Malek AM. Decompressive craniectomy. Neurocrit Care. 2008;8(3):456-70.
15. Juttler E, Schwab S, Schmiedek P. Decompressive surgery for the treatment of malignant infarction of the middle cerebral artery (destiny): a randomized, controlled trial. Stroke. 2007;38:2518-25
16. Vahedi K, Vicaut E, Mateo J. Sequential-design, multicenter, randomized, controlled trial of early decompressive craniectomy in malignant middle cerebral artery infarction (decimal trial). Stroke. 2007;38:2506-17.
17. Vahedi K, Hofmeijer J, Juettler E. Early decompressive surgery in malignant infarction of the middle cerebral artery: a pooled analysis of three randomised controlled trials. Lancet Neurol. 2007;6:215-22.

18. Hofmeijer J, Kapelle Lj, Algra A. Surgical decompression for space-occupying cerebral infarction (the hemicraniectomy aftermiddle cerebral artery infarction with life-threatening edema trial [hamlet]): a multicentre, open, randomised trial. Lancet Neurol. 2009;8:326-33.

Cite this article as: Mathew S, Balakrishnan PK, Prakash PV, John A, Pareed HT, Jose T. Redefining the upper age limit of decompressive craniectomy surgery for malignant middle cerebral artery infarct. Int Surg J 2022;9:313-6.