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RESEARCH ARTICLE

A COMPREHENSIVE STUDY OF PREDICTORS OF POST SURGICAL OUTCOME IN ISCHEMIC STROKE PATIENTS UNDERGOING DECOMPRESSIVE CRANIECTOMY

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ABSTRACT

Introduction: Large ischemic strokes producing mass effect over the brain remains a challenge in the treatment. The Decompressive hemicraniectomy at an earlier time significantly reduces the mortality. **Materials & Methods:** About 812 patients who underwent any type of craniectomy from May 2016 to May 2018, at the Institute of Neurosurgery, Madras Medical College, Chennai, TamilNadu, India were retrospectively studied. Various pre-operative prognostic factors were studied. **Observation:** Post operatively, the outcomes were assessed by univariate and multi variate analysis. **Results:** History of Diabetes, hypertension, Myocardial infarction, midline shift more than 10mm, involvement of dominant hemisphere carried grave post operative prognosis.

INTRODUCTION

Patients with large ischemic strokes may develop progressive brain edema and cerebral herniation. Malignant infarct treated by conservative measure results in about 80% mortality. Decompressive hemicraniectomy is a life saving procedure in stroke patients, with malignant brain swelling. Many studies have demonstrated that Decompressive hemicraniectomy can result in a reduction of mortality to 30%. The eligibility of patients with ischemic stroke to undergo Decompressive hemicraniectomy might be further informed by functional outcome, mortality and quality of data. The current study inspects an array of clinical variables of potential predictors of functional outcome in patients who underwent Decompressive hemicraniectomy for ischemic stroke.

MATERIALS AND METHODS

A total of about 812 patients, who underwent any type of Decompressive Craniectomy from May 2015 to May 2018 at The Institute of Neurosurgery, Madras Medical College, Chennai, Tamil Nadu, India were retrospectively screened. The Inclusion criteria was the Decompressive Hemicraniectomy, secondary to ischemic stroke involving Middle cerebral artery (MCA), Internal Carotid Artery (ICA) or both.

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The Exclusion criteria was the patients who underwent Decompressive hemicraniectomy for some other reasons. The radiographic, demographic and treatment characters were recorded. All patients with suspected acute ischemic stroke were initially diagnosed with CT Brain. They were monitored in ICU, by treating hyperglycemia, hypertension, associated cardiac illness. Decompressive hemicraniectomy was performed in patients with malignant infarct with mass effect. Worsening clinical status was defined by pupillary asymmetry, signs of increased intracranial pressure. The timing of Decompressive hemicraniectomy procedure depended on the treating neurosurgeon and on patient characteristics.

Observation

The primary outcome was functional status assessed by modified Rankin Scale (mRS) at 90 days and at the latest follow up. The mRS ranges from 0 (no symptoms) to 6 (death), with intermediate values (1-5) representing increasing functional and cognitive disability. Poor functional outcome was defined as an mRS score of 4 (moderately severe disability), 5 (severe disability) or 6 (death). In comparison, scores of 0 (no symptoms), 1 (no substantial disability despite the presence of symptoms), 2 (slight disability, but not requiring assistance) and 3 (moderate disability necessitating some help) were considered as favourable outcomes. This categorization was based on physician's attitudes regarding disability, with most physicians considering an mRS score of 3 as the cutoff between favourable and unfavourable outcome.

Data are presented as mean Standard Deviation for continuous variables and as frequency for categorical variables. Analysis was carried out using unpaired t-test, Chi-Square test, and Fischer exact tests. Univariate analysis was used to test the co-variables predictive of the following dependant variable: survival and poor functional outcome (mRS scores of 4-6).

Factors predictive in univariate analysis ($p < 0.20$) were entered in a multivariate logistic regression analysis. A p-value of < 0.05 was considered statistically significant. Statistical analysis was carried out with Stata10.0

RESULTS

There were 95 patients who presented with ischemic stroke involving the MCA (72%), ICA (7%) or both MCA & ICA (21%) and underwent Decompressive hemicraniectomy. About 29 patients had infarction involving the dominant hemisphere (30.5%) and about 66 patients had infarct in the non dominant hemisphere (69.5%). The mean age was 57 years. About 60% were male and the Body Mass Index was 28.3. Atrial fibrillation was diagnosed in about 25% of patients, hypertension in 81%, prior stroke in 20%, diabetes in 33% and a previous myocardial infarction in about 14% patients. Thrombolysis with rt-PA was done in about 28% of patients. Peak MLS measurements were based on radiological assessments. The mean time from stroke onset to Decompressive craniectomy was about 5 days. Tracheostomy was done in 36% and percutaneous Endoscopic Gastrostomy in about 63% of patients. Deep Vein Thrombosis (DVT) occurred in about 36% of patients. The patients were hospitalized for a mean total of about 25 days. Most patients were discharged to a rehabilitation centre (58%) Poor functional outcome was observed in about 58% of patients, with mRS scores of 4 (31%), 5 (9%) and 6 (18%). At the latest follow-up, poor functional outcome was observed in about 52% of patients. Patient demographics and clinical characters were investigated in relationship to mRS scores to identify the potential predictors of functional outcome. In Univariate analysis, patients with a history of stroke, history of myocardial infarction, Midline shift > 10 mm were significantly, more likely to have a poor functional outcome. Patients with a history of stroke were predicted to be 6.54 times, more likely to develop poor functional outcome, whereas the patients with a history of myocardial infarction predicted a 9 times greater likelihood of poor functional outcome. In the multivariate analysis, patients with an Midline shift > 10 mm, adjusting for age, history of stroke, Diabetes mellitus, papillary dilatation were 5.5 times, more likelihood of developing poor functional outcome, after Decompressive hemicraniectomy. Thus, Midline shift > 10 mm is a strong predictor of poor functional outcome, irrespective of age, prior stroke, diabetes etc., Similarly, patients with a history of stroke, adjusting for age, Midline shift > 10 mm, diabetes, papillary response and hemisphere involved were 9.14 times more likely to have poor outcome than those without a history of stroke (95%, $p = 0.008$). Patients with cerebral infarction involving the dominant hemisphere had higher odds of unfavourable functional outcome at 90 days than their counterparts.

DISCUSSION

The present study describes the clinical variables & functional outcomes in patients who underwent Decompressive hemicraniectomy. The mortality rates were 18% and 20% at

90 days and at the latest followup respectively. A good clinical outcome (mRS score of < 3) was observed in about 40% of patients at 90 days and 48% after more than a year of follow-up. These results are comparable to the results reported by the major clinical trials like DECIMAL trials, DESTINY trials, HEADDFIRST trials & Vahedi et al trials. The ages of patients who underwent Decompressive hemicraniectomy ranged from 24 to 80 years in the present study. Time from onset of stroke to decompression is a crucial factor in the management of malignant cerebral infarction. In this study, there was a wide variation in time, with a mean of 3 days after symptom onset. Surgery was done in 60% of patients within first 48 hours and 73% of patients within the first 72 hours. The HAMLET trial, reported that the surgical decompression reduced case fatality and poor outcome in patients with space occupying infarctions, who were treated within the first 48 hours, but found no significant benefit after 96 hours. The mean midline shift for patients, who had a favourable outcome was 7.4mm, whereas in the patients with poor outcome, the shift was > 10 mm. The role of surgery in ICA infarcts are less well established. At 90 days following presentation, about 75.9% of patients with a dominant hemisphere infarction had poor outcome, compared to 53.2% of patients with non dominant hemisphere. Intravenous rtPA was not a significant predictor of poor outcome. In this study, about 29% of patients received intravenous rtPA, prior to Decompressive hemicraniectomy. At 90 days post surgery, most patients had disability requiring assistance (mRS scores of (3-5), a minority of patients (4%) were considered functionally independent. The main limitations of this study include its retrospective single centre nature and the subjective nature of mRS scoring system that was used as a measure of outcome.

Conclusions

Clinical markers such as history of stroke, diabetes Myocardial infarction, midline shift > 10 mm, time from onset of symptoms to surgery and evidence of papillary dilatation may provide important prognostic information for the prediction of post surgical functional outcome. Clinical decision making of whether to perform Decompressive hemicraniectomy takes into account of a variety of factors that cannot always be rigidly defined. As such, additional considerations must be weighed and are combined with objective clinical predictive information to guide decision making.

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