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DECOMPRESSIVE HEMICRANIECTOMY FOR PATIENTS WITH MALIGNANT CEREBRAL VENOUS SINUS THROMBOSIS

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ABSTRACT

Background and objective:

Cerebral venous sinus thrombosis (CVST) is a rare cause of stroke and may lead to the development of raised intracranial pressure due to edema, infarct or bleed. These patients may require decompressive hemicraniectomy to reduce the raised intracranial pressure. However, the evidence for hemicraniectomy in these patients is scanty. Our objective was to perform a retrospective chart review to describe the clinical characteristics of patients who underwent decompressive hemicraniectomy for malignant CVST and their outcomes.

Methods:

We retrospectively analyzed the medical records of patients with CVST who underwent decompressive hemicraniectomy between 2013 and 2020 at Shifa International Hospital. All patients with CVST diagnosed on the basis of clinical and radiographic findings were included in the study. Patients with primary or metastatic brain tumors were excluded from the study.

Results:

A total of 138 patients with CVST presented to our hospital. Twenty-seven (19.6%) developed malignant CVST. Of these patients, 10 underwent decompressive hemicraniectomy (7.2% of total). None of the patients died and seven patients (70%) had a modified Rankin scale score of 2 or less at three months.

Conclusion:

Decompressive hemicraniectomy should be considered for patients presenting with malignant CVST who do not respond to medical treatment.

Key words: Cerebral venous sinus thrombosis, Decompressive hemicraniectomy, Stroke

INTRODUCTION

Cerebral venous sinus thrombosis (CVST) results from occlusion of the venous sinuses leading to poor drainage of blood from the brain and increased venous pressure.[1] It accounts for 0.5% of all strokes.[2] CVST may lead to an infarct, hemorrhage, reduced cerebral perfusion or cerebral edema. The edema associated with CVST is predominantly vasogenic rather than cytotoxic so patients with CVST have a better chance of recovery compared with patients who develop an ischemic stroke.[1] Although patients with edema due to CVST are preferably treated medically, some patients develop impending or manifest brain herniation and therefore may require surgical intervention.[3] The mortality rate of CVST has improved significantly over the decades, however the current studies still report a mortality rate of 3.3–7.7% and 2.8–6.8% at six months.[4-7] An intracranial hemorrhage is seen in 34.6% of patients with CVST.[8] Although edema is seen in around 4% of the patients with CVST (i.e. malignant CVST), transtentorial herniation due to mass effect and edema represent the most frequent cause of death in CVST.[9] Many such patients require decompressive hemicraniectomy but decompressive hemicraniectomy has not been frequently reported in cases with CVST.[10] Our objective was to perform a retrospective chart

review to describe the clinical characteristics of patients who underwent decompressive hemicraniectomy for malignant CVST and their outcomes.

METHODS

Study design: Retrospective cross-sectional observational study.

Place and duration of study: We conducted a retrospective analysis of the medical records of patients with CVST who underwent decompressive hemicraniectomy at Shifa International Hospital, Islamabad. We included all the patients coming with CVST in between January 2013 and December 2020.

Sample size: The total number of CVST patients in our department during the study period was 138.

Sampling technique: Non-probability consecutive sampling.

Malignant CVST: Malignant CVST was defined as any CVST with mass effect or raised intracranial pressure due to hemorrhage or edema, which was severe enough to cause brain herniation and deterioration in neurological function.[9]

Data collection: Patients were diagnosed on the basis of clinical findings and radiological features on CT venogram or MR venogram, along with CT and MRI brain, respectively, to identify mass effect, edema, hemorrhage, and brain herniation. The medical records were screened retrospectively and the decision to perform surgery was made by the treating physician and operating surgeon after discussing with the patients' families. In general, patients were considered for surgery if there was impending herniation due to mass effect from edema or hemorrhage and deteriorating GCS which was not attributable to other causes. The decision for surgery was taken by the neurosurgeon, neurologist, and patient's family. Patients with a history of primary or metastatic cancer of the CNS or with post-traumatic CVST were excluded from this study. Any patients who did not require surgical management for reducing intracranial pressure were also excluded from the study. The baseline demographic data, pre-operative GCS, post-operative GCS and modified ranking scale (mRS) at three months after CVST were noted. The mRS was assessed either through the documentation of the follow-up visits or over a brief telephone interview. Modified Rankin scale is a quantitative non-linear scale used for evaluation after stroke with a higher score signifying increasingly severe disability.[11] An mRS of 0 correlates with no symptoms, 1 with no significant disability, 2 with slight disability, 3 with moderate disability, 4 with moderately severe disability, 5 with severe disability and 6 with death.

Statistical analysis: Data was analyzed on SPSS 25.0. Qualitative data was presented as frequencies and percentages. Quantitative data was presented as mean and standard deviation.

Ethical considerations: This study was approved by the Institutional Review Board of Shifa International Hospital.

RESULTS

A total of 138 patients with CVST presented to our center. Of these 138 patients, 27 patients developed malignant CVST (19.6%). Of these 27 patients, 17 (62.96%) had malignant CVST at admission, whereas the remaining patients developed malignant CVST during the hospital stay. Ten patients underwent decompressive hemicraniectomy (7.2%) due to raised ICP not responding to medical treatment. The remaining patients responded to medical treatment or their families did not agree for surgical treatment.

There were four male patients (40%) and six female patients (60%) among the ones who underwent surgery. The mean age of those patients was 29 ± 10.1 years. All patients had extensive edema with hemorrhage and raised intracranial pressure with impending or manifest herniation. Two patients also had coexisting subarachnoid hemorrhage (20%). The pre-operative GCS ranged between 6 and 13, with a mode GCS of 8. None of the patients had asymmetry in pupillary size or reactivity. All patients had been receiving optimal medical treatment either with mannitol or hypertonic saline. Additionally, all patients received therapeutic anticoagulation. Four patients (40%) underwent bilateral decompressive hemicraniectomy whereas six patients (60%) underwent unilateral decompressive hemicraniectomy. Patients with predominantly unilateral edema, hemorrhage, or mass effect underwent unilateral hemicraniectomy, whereas those with bilateral edema, hemorrhage, or mass effect underwent bilateral hemicraniectomy. At the three-month follow-up, seven patients (70%) had an mRS score between 0 and 2, and three patients (30%) had an mRS score of 3 or

more (Figure 1). None of the patients died during the three months follow up.

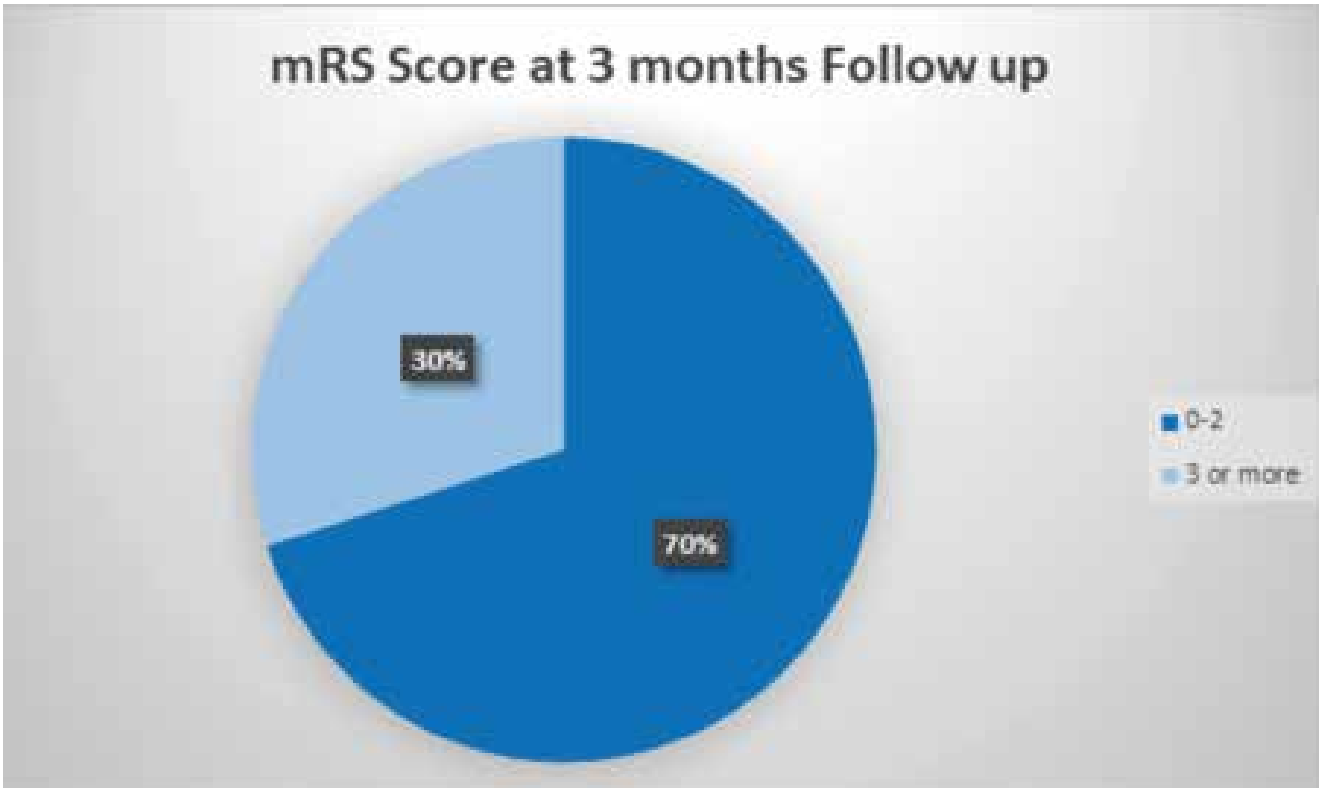

Figure 1: mRS Score at three months follow up

DISCUSSION

Patients with malignant CVST are initially managed medically. However, many patients fail to respond to best medical treatment for reducing intracranial pressure. Treatment failure refers to worsening edema, raised ICP, hemorrhage, and/or neurological dysfunction. Decompressive hemicraniectomy is a useful strategy for reducing the risk of brain herniation in these patients. Based on our results, we recommend that initial medical therapy should be attempted for patients with malignant CVST along with careful monitoring for worsening edema, mass effect, raised ICP, and neurological dysfunction. If required based on the aforementioned features, decompressive hemicraniectomy may lead to a good outcome. The evidence for decompressive hemicraniectomy in patients with malignant CVST comes from case reports and case series.[12,13] However, the limited data that is available suggests that there may be a mortality and morbidity benefit of decompressive hemicraniectomy in these patients.[14] Patients with CVST have both vasogenic and cytotoxic edema, with a predominance of vasogenic edema, which is considered to be more readily reversible as compared with cytotoxic edema.[1] These patients therefore should be treated aggressively to facilitate functional recovery. Previous studies also support earlier use of neurosurgical interventions .[15] A previous study showed that patients who underwent decompressive hemicraniectomy for malignant CVST before loss of pupillary reactivity recovered fully but those who underwent surgery after loss of pupillary reactivity had worse outcomes.[16] None of our patients had loss of pupillary reflexes prior to undergoing surgery, which may explain why most patients had a good functional recovery. However, even in patients with loss of pupillary reflexes after malignant CVST, many patients benefit with decompressive hemicraniectomy and may have functional recovery.[17] Therefore, loss of pupillary reflexes should not be an absolute contraindication to surgery for malignant CVST. It is unlikely that randomized trials could be performed for evaluating the efficacy of decompressive

hemicraniectomy for patients with malignant CVST so consensus guidelines should be based on the best available evidence from small studies and case reports. Until the availability of consensus guidelines, it is probably best to evaluate patients with malignant CVST for decompressive hemicraniectomy before loss of pupillary reactivity. Another issue is the resumption of anticoagulants after decompressive hemicraniectomy for patients with CVST. Although there is a lack of high-quality evidence, we suggest that this decision should be based on the extent of the CVST and risk of postsurgical bleeding in the patient. However, in most cases, it may be useful to resume therapeutic anticoagulation within 24 hours of achieving bleeding control.

There were several limitations of our study. First, the sample size was very small. Second, the study had a retrospective design. Third, the study did not use a control group composed of patients with malignant CVST who did not undergo decompressive hemicraniectomy. However, considering the low frequency of malignant CVST that requires decompressive hemicraniectomy, our study provides a useful reference for future clinical practice and research studies. Further studies with a larger sample size and prospective study design are required to confirm our results.

CONCLUSION

CVST is a rare cause of stroke. Patients with CVST may develop a raised intracranial pressure due to venous infarct, hemorrhage or cerebral edema. Patients with malignant CVST may have mortality and morbidity benefits from decompressive hemicraniectomy, especially when performed before the loss of pupillary reactivity.

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Authors' contribution:
Waseem Tariq Malik; Concept, Data collection, data analysis, manuscript writing, manuscript revision
Sadaf Majid; Data collection, data analysis, manuscript writing, manuscript revision
Asfandyar Khan Niazi; Data collection, manuscript writing, manuscript revision
Ehsan Ul Haq; Data collection, data analysis, manuscript revision
Hina Yousuf; Data collection, manuscript writing, manuscript revision
Raja Farhat Shoaib; Data collection, manuscript writing
Maimoona Siddiqui; Concept, manuscript revision

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