ABSTRACT

Objective: To analyse the functional outcome after inpatient rehabilitation in survivors of cerebral venous thrombosis (CVT) treated with decompressive craniectomy

Method: Design: A retrospective study, Setting: Neurological Rehabilitation unit of a tertiary care university research center Participants and Study Period: The diagnosed case of CVT being treated with decompressive craniectomy and admitted for inpatient rehabilitation during the period from January 2012 to May 2020. Assessment and outcomes: All participants underwent inpatient rehabilitation in the same setting. The functional outcomes were assessed at admission and discharge by using Barthel Index (BI), Scandinavian Stroke Scale (SSS) and modified Rankin Scale (mRS).

Results: Out of all participants, the male: female ratio was 1:1 with a mean age of 34.2 ± 12 years. The mean (±SD) of the duration of illness at admission and mean (± SD) duration of hospital stay for inpatient rehabilitation were 42 ± 30.7 days and 22.5 ± 10.4 days, respectively. The most common risk factor was haematological abnormality (83.2%), with superior sagittal sinus (66%) being the common site of venous thrombosis. All participants showed better functional outcomes at the time of discharge as compared to admission; BI improved by three times (from the mean of 20.8 ± 14.2 to 60 ± 27.5) while SSS improved by nearly two times (from the mean of 20 ± 10 to 38 ± 12) on average. Half of the participants improved functional outcomes with mRS score < 3 at discharge.

Conclusion: After inpatient rehabilitation, survivors of CVT following decompressive craniectomy showed improvement in the functional outcomes measures.

KEYWORDS Cerebral venous thrombosis, decompressive craniectomy, inpatient rehabilitation

Introduction

Cerebral venous thrombosis (CVT) is a rare cerebrovascular disease that accounts for 0.5% to 1.0% of all strokes and often affects young women [1]. In contrast to arterial stroke, the outcome in CVT is generally considered good, with 80% of patients usually regaining functional independence [2]. The mortality rate following CVT ranges from 6% to 15% [3,4], and the leading cause of death is the hemorrhagic conversion of large venous infarcts resulting in herniation [5]. In such cases, decompressive surgery is a life-saving procedure and may allow good functional outcomes [6]. One study mentioned that the patient with CVT who required decompression craniectomy was 7.4% [5]. To the best of our knowledge, the role of inpatient rehabilitation in postoperative patients with CVT has not been studied. Therefore, this study was conducted to analyze the functional outcomes in individuals diagnosed with CVT treated with decompression surgery and who underwent inpatient rehabilitation.

Material and Methods

A retrospective study was conducted in a rehabilitation unit of a tertiary care hospital. The patients with CVT who had undergone decompression surgery and were admitted to the neurological rehabilitation unit during the period from January 2012 to May 2020 were identified from records, and the data was
then collected from the electronic records (discharge summaries). The demographic details and neurological examination findings, risk factors, site of CVT, indications for surgery, and management details were recorded. The functional outcomes on day 1 of admission and at the time of discharge after inpatient rehabilitation were also recorded. During inpatient rehabilitation, all the patients received daily neurological rehabilitation programs in the same unit, including 1 hour each of physiotherapy, occupational therapy, clinical psychotherapy and psychosocial counselling. The physiotherapy program included exercises for range of motion, stretching and strengthening the affected limb, and balance and gait training with an assistive device. The occupational therapy program comprised modification and training to perform activities of daily living, functional abilities training, fine motor activities (etc.), which a trained occupational therapist did. The psychotherapy was focused mainly on cognitive assessment and retraining of affected domains by the clinical psychologist. Psychosocial counselling, including awareness and counselling about the illness, was also given to all the patients by a psychiatric social worker.

Assessment and Outcome measures

The diagnosis of CVT was based on MRI/MRV findings. The Barthel Index (BI) score was used to assess the functional ability of the individuals [7]. It was a 10-item scale, which assesses a person’s ability to perform daily living activities (ADL), including feeding, bathing, grooming, dressing (both upper and lower half), bladder and bowel care, personal toilet, and transfers, stair negotiation abilities and mobility. It was a 100-point scale, with the higher score suggesting more functional independence.

Scandinavian Stroke Scale (SSS) was used to assess impairment after CVT. It consisted of nine items generating a minimum score of 2 (worst neurological compromise) and a maximum score of 58 (without neurological compromise), with 9 items based on consciousness, eye movement, arm motor power, hand motor power, leg motor power, orientation, speech, facial palsy and gait [8].

The Modified Rankin Scale (mRS) was used to assess functional outcomes regarding the degree of disability or dependence. The score ranges from 0-6, measuring from perfect health without symptoms (score 0) to death (score 6) [9].

Statistical analysis

The data collected was analyzed, and basic descriptive statistics were computed. The continuous variables were described using mean and range, while the categorical variables were described using percentages.

Result

Over the period from January 2012 to May 2020, 12 CVT survivors treated with decompressive craniectomy had undergone inpatient rehabilitation in the neurological rehabilitation unit. There were 6 (50%) males and 6 (50%) females, with a male to female ratio of 1:1. The mean age of the participants was 34.2 ±12.1 years (range 20-55 years). The mean duration of illness at the time of admission for inpatient rehabilitation was 42 ± 30.7 days (range 20 – 108 days), and the mean duration of inpatient rehabilitation was 22.5 ±10.4 days. A cause or risk factor was found in all the individuals. Five individuals (41.6%) had anaemia, while another 5 (41.6%) had hyperhomocysteinemia. Among females, 2 (33.3%) were presented during the postpartum period. The aphasia was present in 7 (58%) individuals, while the remaining 5 (42%) did not have aphasia. The most common dural venous sinus involved was the superior sagittal sinus (66%). In addition, many of them (75%) presented with right hemiplegia (table.1).

The radiological feature of mass effect with midline shift and herniation was the common indication for undergoing decompressive craniectomy (table.2). Table 3 shows the functional outcomes scores of the individuals at admission and discharge. The mean functional outcomes scores for BI, SSS, mRS at admission were 20.8 ±14.2; 20 ±10; and 4.5± 0.5 respectively. There was an improvement in all the functional outcome scores at the time of discharge with a mean score of BI 60 ± 27.5; SSS 38±12; and mRS 3.4 ± 0.6. At discharge, half (6/12) of the participants had improvement in functional outcomes with mRS score < 3 (table. 4).

Discussion

The current study focused on the functional outcomes of CVT survivors being treated with decompressive craniectomy and undergoing inpatient rehabilitation. Most of them were young with a mean age of 34±12 years and male to female ratio of 1:1. The haematological abnormality was found to be the most common risk factor. Théaudin, M et al. reported in their case series the mean age of 45±15 years, 1:3 of male to female ratio and common risk factors of oral contraceptive/hormonal therapy [6]. The difference in the findings with our study might be due to unequal age distribution and a small number of cases.

Superior sagittal sinus was reported as the commonest sinus to be involved in the case of CVT, with an incidence of 72% [10]. In our study, the superior sagittal sinus was the most commonly involved venous sinus with 66%. Aaron S et al. reported that 75% of patients of CVT who underwent decompressive craniectomy had midline shift and features of herniation on radiological examination [5]. In our study, radiological features of midline shift and herniation were found in 75% of the individuals.

In the current study, the functional outcome scores of all the participants were better at the time of discharge than the score measured at the time of admission. The functional abilities of the participants measured by the Barthel index score improved by three times on average at the discharge as compared to admission scores. The mean of stroke functional outcomes score of the participants measured by SSS was also found nearly double at the discharge compared to admission score.

None of the participants had an mRS score of ≤ 3 at admission; however, half of them achieved a score ≤ 3 at the time of discharge. The mean duration of hospital stay for inpatient rehabilitation was 22.5±10 days. In a study, Aaron S et al. reported that patients of CVT with decompressive craniectomy showed improvement in functional outcomes as measured by mRS; 1/3 of them had mRS score ≤ 3 at 3 months followed up, and 1/2 of them achieved the same score at 6 months followed up [5]. Similar findings were also observed by Théaudin, M et al., where they found that 1/3 of participants had mRS ≤3 at 6 months, and ½ of them achieved the same score at 1 year [6]. Zuurbier et al. also found that ¾ of the CVT with post-surgery patients had achieved mRS score of ≤ 3 at 12 months [11]. In a systematic review study conducted by Ferro JM et al. among the 69 patients from 22 centres who had undergone decompressive surgery for CVT, the unfavourable outcome (mRS score of 5 or death) was seen in 12/69 (17.4%) at the consequent followed up.
Table 1  Demographic characteristics of the individuals

|                         | n = 12          |
|-------------------------|-----------------|
| Age (mean ± SD) years   | 34.2 ±12.1      |
| **Gender (%)**          |                 |
| Male                    | 6 (50%)         |
| Female                  | 6 (50%)         |
| **Duration of CVT at admission for inpatient rehabilitation (mean ±SD) days** | 42 ± 30.7 |
| **Risk factors (%)**    |                 |
| Anaemia                 | 5 (41.6%)       |
| Hyperhomocysteinemia    | 5 (41.6%)       |
| Postpartum              | 2 (16.6%)       |
| Multiple (more than two of the above risk factors) | 6 (50%) |
| **Aphasia (%)**         |                 |
| Superior sagittal sinus | 8 (66%)         |
| Superior sagittal sinus and transverse sinus | 1 (8.3%) |
| Superior sagittal sinus and sigmoid sinus | 1 (8.3%) |
| Others                  | 2 (16.8%)       |
| **Side of hemiplegia (%)** |             |
| Right                   | 9 (75%)         |
| Left                    | 3 (25%)         |
| **Treatment (%)**       |                 |
| Decompression surgery   | 12              |
| Conservative treatment  | 0               |

CVT – Cerebral venous thrombosis, SD- standard deviation

Table 2  Indication for decompression surgery

|                                | n = 12          |
|--------------------------------|-----------------|
| Mass effect with midline shift impending herniation | 09 (75%) |
| Haemorrhagic transformation    | 03 (25%)        |

Table 3  Functional outcomes

| Outcomes                        | Admission      | Discharge     |
|---------------------------------|----------------|---------------|
| Barthel Index score             | 20.8 ±14.2     | 60 ± 27.5     |
| Scandinavian Stroke Scale       | 20 ± 10        | 38±12         |
| Modified Rankin Scale           | 4.5± 0.5       | 3.4± 0.6      |

Table 4  Modified Rankin Scale of 12 individuals of CVT with post decompression craniectomy who underwent inpatient rehabilitation

| Modified Rankin Scale | At admission (number of patients) | At discharge (number of patients) |
|-----------------------|----------------------------------|-----------------------------------|
| 1                     | 0                                | 0                                 |
| 2                     | 0                                | 1                                 |
| 3                     | 0                                | 5                                 |
| 4                     | 5                                | 6                                 |
| 5                     | 7                                | 0                                 |
| 6                     | 0                                | 0                                 |
till 24 months [12].

In our study, no participants had unfavourable outcomes (mRS score of 5 or 6) at the time of discharge after the inpatient rehabilitation (22.5 ± 10.4 SD days). Our study’s speedy recovery of functional outcomes might be due to the positive effect of neurological rehabilitation either directly or as an adjuvant to natural recovery. To our knowledge, this is the only study where post decompressive craniectomy in CVT patients underwent inpatient rehabilitation in a neurological rehabilitation unit.

Limitations of our study are:
1. one-centre study with a limited number of cases
2. retrospective analysis of the cases
3. no follow up was done
4. only the cases who underwent inpatient rehabilitation were included

Conclusion

Functional outcomes in survivors of CVT treated with decompressive craniectomy showed faster and better recovery after inpatient rehabilitation. However, a better study like a randomized controlled trial may be required in the future to observe whether the recovery occurred was due to the natural phenomenon or due to inpatient rehabilitation or both.

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Conflict of interest

There are no conflicts of interest to declare by any of the authors of this study.

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