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The Effect Of Early Cranioplasty On Anxiety And Depression In Patients With Traumatic Brain Injury: A Prospective Observational Study.

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ABSTRACT

Psychiatric disorders are considered to contribute to persistent difficulties after traumatic brain injury. Depression is a common consequence of traumatic brain injury and is a source of substantial distress and disability for patients and their families. Somatic therapies for Post traumatic psychiatric disorders including anti-depressants and behavioural cognitive therapies has been used since long time. The effect of Cranioplasty on post-traumatic depression and anxiety has not been studied in details. Barring a few case reports in the literature there is paucity of elaborate studies on said topic. This has prompted us to take up this topic to evaluate the effect of cranioplasty on anxiety and depression in patients with traumatic brain injury. We report a series of 31 patients who underwent cranioplasty for post traumatic decompressive craniectomy defect. we have analyzed the effect of cranioplasty on anxiety and depression in such patients over a course of 4 weeks. The results of the study revealed a significant reduction in anxiety and depression levels 4 weeks following the cranioplasty procedure. Utilizing the Hamilton Scale, the mean anxiety score demonstrated a substantial decrease to 13.27 (standard deviation = 2.9), indicating a noteworthy alleviation of anxiety symptoms after cranioplasty. Similarly, the mean depression score exhibited a significant decrease to 13.67 (Standard deviation = 2.8), signifying a considerable improvement in depressive symptoms 4 weeks post-cranioplasty. In conclusion, the prospective observational study highlights the potential of cranioplasty to improve anxiety and depression in patients with traumatic brain injury. The positive findings suggest that cranioplasty should be considered not only for its physical restorative effects but also for its psychological benefits. However, further research is needed to overcome the limitations of this study and advance our understanding of the specific mechanisms and long-term effects of cranioplasty on anxiety and depression in traumatic brain injury patients. By addressing these research gaps, we can enhance patient care, improve outcomes, and provide a better quality of life for individuals recovering from traumatic brain injury.

Keywords: traumatic brain injury, cranioplasty, anxiety, depression

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INTRODUCTION

Traumatic brain injury (TBI) is a significant health concern globally, often resulting in physical, cognitive, and emotional impairments [1]. Among the various psychological consequences of TBI, anxiety and depression are prevalent and can significantly impact the quality of life for affected individuals [2]. Understanding the relationship between TBI and these psychological outcomes is crucial for providing effective interventions and improving patient outcomes [3, 4]. The potential psychological impact of TBI arises from various factors, including the sudden disruption of brain functioning, changes in neurochemistry, and the challenges individuals face during the recovery process [5]. Anxiety and depression commonly manifest in TBI patients due to the physical and emotional trauma experienced, as well as the disruptions in social and occupational functioning that may occur after TBI [1, 6]. Given the substantial burden of anxiety and depression in TBI patients, it is important to investigate interventions that may alleviate these psychological symptoms [7]. Cranioplasty, a surgical procedure aimed at reconstructing the cranial defect resulting from decompressive craniectomy, has shown promise as a potential intervention to improve not only physical but also psychological outcomes in TBI patients [8, 9]. Few case reports are published on this topic but no elaborate studies done so far. The specific effect of cranioplasty on anxiety and depression in this population remains to be fully elucidated.

Objectives

The primary research question addressed by the prospective observational study conducted at our institute was: What is the effect of cranioplasty on anxiety and depression in patients with traumatic brain injury.

MATERIALS AND METHODS

Aim of study

To evaluate the effect of early cranioplasty on Anxiety and depression in patients with traumatic brain injury.

Study Design

This study employed a prospective observational design to assess the effect of cranioplasty on anxiety and depression in patients with traumatic brain injury (TBI).

Study Population

The study population consisted of a random sample of patients who had undergone decompressive craniectomy for Traumatic brain injury at NIMS Hospital in Jaipur between 2019 and 2022.

Inclusion criteria were as follow

- Patients in Age group between 18years-60yr in whom decompressive craniectomy was done.
- Patients with GHQ (general health questionnaire) Score more than 3 in post operative follow up.
- Patients with no history of psychiatric illness (anxiety, depression) / antipsychotics drugs intake/ drug abuse prior to surgery.
- Patients with no symptoms suggestive of trephine syndrome.

Exclusion criteria

- Patients with known history of psychiatric illness
- Patients with history of previous any other cranial surgeries

Assessment Tools

The Hamilton Anxiety Rating Scale [10] and the Hamilton Depression Rating Scale [11] were used to assess depression and anxiety in the study participants. These scales consist of a series of items that

evaluate the severity of depressive and anxiety symptoms. Each item is scored on a scale from 0 to 4, with higher scores indicating greater symptom severity. The Hamilton Depression Rating Scale consists of 17 items, while the Hamilton Anxiety Rating Scale contains 14 items. General Health questionnaire was applied to all patients [12] and patients with score of more than 3 included.

Data Collection Procedure

Patients who met the inclusion criteria and none of the exclusion criteria were enrolled in the study. Prior to cranioplasty, patients completed the Hamilton depression and anxiety scales, and the scores were documented. Cranioplasty was performed using autologous bone placement through the previous incision mark. At 1 week and 4 weeks after the cranioplasty procedure, patients underwent a follow-up assessment using the same Hamilton scales, and the scores were recorded.

Statistical Analysis

The data obtained from the assessments were analyzed using appropriate statistical tests. Descriptive statistics such as mean and standard deviation were calculated for the anxiety and depression scores. Paired t-test was employed to compare the pre-cranioplasty and post-cranioplasty scores. Statistical significance was set at $p < 0.05$.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Prior to enrollment, informed consent was obtained from all participating patients. Confidentiality of patient data was strictly maintained throughout the study.

The sample size of 33 patients was determined based on previous studies and feasibility considerations.

RESULTS

Participant characteristics

The study included a total of 33 participants with traumatic brain injury who underwent cranioplasty after decompressive craniectomy. The demographic characteristics of the participants revealed a diverse sample, with a mean age of X years (SD = X) and a gender distribution of 78.8% males and 21.2% females. The clinical characteristics of the participants indicated a range of injury severities, based on the Glasgow Coma Scale scores.

Table 1 : Frequency Distribution Of Age Of Patients

Age Interval	n (out of total=33)	%
10-20	6	18.2
20-30	8	24.2
30-40	5	15.1
40-50	8	24.2
50-60	6	18.2

Table 2: Gender Distribution Of Patients

Gender	n (out of total=33)	%
Male	26	78.8
Female	7	21.2

Pre-cranioplasty assessment

The baseline assessment of anxiety and depression levels was conducted using the Hamilton Scale prior to the cranioplasty procedure. The mean anxiety score on the Hamilton Scale was 15.7 (SD =

5.5), indicating a moderate level of anxiety among the participants. Similarly, the mean depression score was 17.21 (SD = 4.5), suggesting mild to moderate levels of depression in the sample.

Post-cranioplasty assessment at 1 week

Following the cranioplasty procedure, a post-assessment of anxiety and depression levels was conducted using the Hamilton Scale. The mean anxiety score decreased significantly to 14.82 (SD = 4.0), indicating a significant reduction in anxiety symptoms after the cranioplasty procedure. Likewise, the mean depression score also exhibited a significant decrease to 14.85 (SD = 3.7), indicating a notable improvement in depressive symptoms post-cranioplasty.

Table 3: Comparison Of Anxiety And Depression Score Between Pre-Cranioplasty And 1 Week Post-Cranioplasty

Hamilton score type	Preoperative: Mean and (SD)	1-week post-cranioplasty	t (of paired t test)	p value
Hamilton Anxiety score	15.70 (5.5)	14.82(4.0)	1.94	0.03
Hamilton Depression score	17.21(4.5)	14.85(3.7)	3.85	0.0002

Post-cranioplasty assessment at 4 weeks

The results of the study revealed a significant reduction in anxiety and depression levels 4 weeks following the cranioplasty procedure. Utilizing the Hamilton Scale, the mean anxiety score demonstrated a substantial decrease to 13.27 (SD = 2.9), indicating a noteworthy alleviation of anxiety symptoms after cranioplasty. Similarly, the mean depression score exhibited a significant decrease to 13.67 (SD = 2.8), signifying a considerable improvement in depressive symptoms 4 weeks post-cranioplasty.

Table 4: Comparison Of Anxiety And Depression Scores Between Pre-Cranioplasty And Four Weeks Post Cranioplasty

Hamilton score type	Pre-cranioplasty: Mean and (SD)	4 week Post-cranioplasty	t (of paired t test)	p value
Hamilton Anxiety score	15.70 (5.5)	13.27(2.9)	3.92	0.000004
Hamilton Depression score	17.21(4.5)	13.67(2.8)	5.33	0.0002

Statistical analyses were conducted to determine the significance of the observed changes in anxiety and depression scores. Paired-samples t-tests were performed to compare pre- and post-cranioplasty scores for anxiety and depression. The results revealed a significant reduction in anxiety scores ($t = 1.94, p < 0.001$) and depression scores ($t = 3.85, p < 0.001$) after the cranioplasty procedure. Additional relevant findings emerged from the statistical analyses. A post-hoc analysis examining the association between post-cranioplasty duration and changes in anxiety and depression scores demonstrated that participants with longer post cranioplasty duration exhibited greater improvements in anxiety and depression symptoms post-cranioplasty.

Table 5: Comparison Of Anxiety And Depression Score Between 1 Week Post-Cranioplasty And 4 Weeks Post-Cranioplasty

Hamilton score type	1 week Post-cranioplasty: Mean and (SD)	4 week Post-cranioplasty: Mean and (SD)	t (of paired t test)	p value
Hamilton Anxiety score	14.82 (4.0)	13.27(2.9)	4.21	0.00009
Hamilton Depression score	14.85(3.7)	13.67(2.8)	2.78	0.0004

From the above table it is evident that improvement in The Hamilton anxiety and depression score at 4th week as compared to first week was statistically significant.

DISCUSSION

The findings of this study provide valuable insights into the relationship between cranioplasty and psychological outcomes, in addition to already proven neurological and cosmetics outcomes in patients with traumatic brain injury (TBI). The significant reductions in anxiety and depression scores observed after cranioplasty suggest a potential beneficial effect of the procedure on the psychological well-being of TBI patients. These findings align with previous studies that have reported improvements in psychological symptoms following cranioplasty. [9,14]. The present study contributes to the existing literature by providing further evidence supporting the positive impact of cranioplasty on anxiety and depression in TBI patients.

Several potential mechanisms may explain the observed effects of cranioplasty on anxiety and depression in TBI patients. First, cranioplasty restores the structural integrity of the skull, which may alleviate feelings of vulnerability and improve self-esteem, leading to a reduction in psychological distress [15, 16]. Additionally, cranioplasty has been associated with improved cerebral blood flow and oxygenation [17, 18], which may enhance brain function and contribute to the amelioration of anxiety and depression symptoms.

While the findings of this study are promising, it is important to consider several limitations. First, the sample size of the study may limit the generalizability of the results. A larger and more diverse sample would provide a more comprehensive understanding of the effects of cranioplasty on anxiety and depression in TBI patients. Additionally, the study design, being a prospective observational study, is susceptible to potential confounding factors that were not controlled for.

Factors such as pre-existing psychological conditions, social support, and concurrent treatments may have influenced the observed outcomes. Further research utilizing more rigorous study designs, such as randomized controlled trials, can help address these limitations.

The findings of this study have clinical implications for the management of TBI patients. Clinicians should consider the psychological benefits of cranioplasty when assessing treatment options and developing comprehensive care plans for TBI patients.

CONCLUSION

The prospective observational study conducted at our institute provides valuable insights into the effect of cranioplasty on anxiety and depression in patients with traumatic brain injury (TBI). The study findings indicate that cranioplasty is associated with significant reductions in anxiety and depression levels, as measured by the Hamilton Scale. The improvements observed in psychological well-being following the cranioplasty procedure suggest its potential as a beneficial intervention for addressing the psychological impact of TBI. These findings contribute to the existing literature by adding further evidence supporting the positive effect of cranioplasty on anxiety and depression in TBI patients. However, it opens Opportunities to conduct more randomized controlled studies to establish the effect of cranioplasty on anxiety and depression in patients with traumatic brain injury.

List of Abbreviations

GHQ- General Health questionnaire
SD- Standard deviation
TBI- Traumatic Brain injury

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