ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 01 | January - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EVALUATION OF RADIOLOGICAL UNION OF CALVARIA FOLLOWING CRANIOTOMY

Surgery

Dr. Majida Begum Command Hospital (Eastern Command) Kolkata -700027.

Dr. (col) Sudip Kumar Sengupta* Associate Professor, Dept of Surgery Command Hospital (EC), Kolkata -700027. *Corresponding Author

Dr. (lt Col) Parvesh Malik Assistant Professor, Dept Of Surgery, Command Hospital (EC), Kolkata -700027

Dr.Debarshi Jana Young Scientist, IPGMER and SSKM Hospital, Kolkata.

ABSTRACT

INTRODUCTION: This is an Am bidirectional observational study. Study population is the patients who have undergone craniotomy for any indication in the department of neurosurgery of CH (EC) from September 2016 to Aug 2019. A list of patients who have undergone NCCT/CECT head during their follow up period, due to any clinical indication, drawn. All such patients interviewed and clinically examined for pain at the craniotomy site.

AIMS AND OBJECTIVES: The incidence of non-union and Correlation between non-union and predisposing factors via primary pathology, fixation technique, age, sex, comorbidities such as DM, TB and radiotherapy. Correlation with postoperative headache

MATERIALS AND METHODS: Study area Command Hospital Eastern Command. Study population- Patients who have undergone craniotomy for any indication in the department of neurosurgery of CH (EC) from September 2016 to Aug 2019. Sample size is the number of patients who have undergone CT Scan evaluation based on clinical indications in the post operative period. Am bidirectional observational study

RESULT AND ANALYSIS: We showed that ICSOL was significantly higher in non union and bad union patients; Head Injury was significantly higher in good union patients. It was found that carcinoma patients were higher in non union and bad union which was statistically significant. Radiation patients were higher in good union which was statistically significant. Present study found that Post-Op Headache was significantly higher in non union and bad union and mean Rate of union was higher in good union. Association of Fixation Technique with Non Union, Good Union and Bad Union was statistically significant.

CONCLUSION: We can conclude that patients are more likely to have their craniotomy fuse if they did not undergo radiation treatment or have sutures secure the free flap. Craniotomy fusion rates after free flap increases steadily over time, as expected. We were not able to demonstrate that clinical factors such as age, sex, BMI, diagnosis, fixation material, and radiation have an impact on fusion rate when time to fusion was considered.

KEYWORDS

Radiological union, Calvaria, Craniotomy, Predisposing factors, Primary pathology

INTRODUCTION

This is a bidirectional observational study. Study population is the patients who have undergone craniotomy for any indication in the department of neurosurgery of CH (EC) from September 2016 to Aug 2019.[1]

A list of patients who have undergone NCCT/CECT head during their follow up period, due to any clinical indication, drawn. All such patients interviewed and clinically examined for pain at the craniotomy site .Their post operative CT scan images collected in CDs and analyzed on suitable software at the end of the study in respect to the incidence of bony non union and bone flap settling. The operative techniques used for fixing the bone flaps recorded retrospectively from the operative notes. [2]

The result compiled, clinical and radiological data compared and tabulated against the age, sex and comorbidities of the patient and bone fixation technique (rigid fixation, suture fixation or no fixation) employed as also the time interval between the surgery and clinico-radiological evaluation and presented as thesis.[3]

Less than 30% union is considered as no union, 30%-less than 60% union is considered as bad union and ≥60% union is taken as good union Paucity of adequate number of study, only one study on human being available till now, has left ambiguity and lack of knowledge in this field.[4]

To study the incidence of non-union

1. Correlation between non-union and predisposing factors via primary pathology, fixation technique, age, sex, comorbidities such as DM, TB and radiotherapy.
2. Correlation with postoperative headache

MATERIALS AND METHODS

A. **Study period** - Study is intended to be completed within a period of two years AT Command Hospital Eastern Command. Subject recruitment completed within the 1st year. Total period of study was of three years. Of which retrospective data was collected from Sep 2016 to Aug 2018 and prospective data collection was done for one year (Sep 2018 to Aug 2019). All patients were interviewed telephonically for their symptoms. Clinical findings at the time of evaluation were noted down from the medical records.

B. **Parameters studied** Specific objective—union/nonunion of calvaria ---NCCT head finding based.

Correlation of non-union with:-

(i) Post operative history of headache over the craniotomy site
(ii) Age
(iii) Sex
(iv) Indication for craniotomy
(v) Bone fixation technique employed
(vi) Co morbidity—DM, TB
(vii) Time interval between the craniotomy and radiological evaluation.

C. **Analysis plan-**

Data was summarized by routine descriptive statistics Categorical variables were expressed as number Of patients and percentage of patients and compared across the groups with Pearson's Chi Square test for Independence of attributes and Fisher's Exact Test as appropriate.

Continuous variables were expressed as Mean ±Standard Deviation and compared across groups using unpaired t test/one way ANOVA if the data follows normal distribution and Mann-Whitney U Test /Kruskal Wallis Test if the data does not follow normal distribution.

The statistical software SPSS version 20 was used for the analysis. An alpha level of 5% has been taken, that is if any P value is less than 0.05 was considered as significant.

RESULT AND DISCUSSION

Above table showed that, 10(6.5%) patients were 21-30 years old,

18(11.6%) patients were 31-40 years old, 17(11.0%) patients were 41-50 years old, 64(41.3%) patients were 51-60 years old, 38(24.5%) patients were 61-70 years old and 8(5.2%) patients were <71 years old in age. Difference of mean Age with Non Union, Good Union and Bad Union groups was statistically significant (p=0.0010).

Adaaquah D et al [5](2018) found that Fusion rates and time to fusion were evaluated. When time to fusion was taken into consideration, univariate and multivariate analyses of the impact of clinical factors on fusion rate were also examined. Of 171 patients with postoperative computed tomography of over 2200 patients undergoing craniotomy, 103 (60%) demonstrated solid fusion, 26 (15%) had probable fusion, and 42 (25%) had not achieved fusion. There were no significant differences when fusion was compared with demographics such as age, sex, body mass index, and history of tobacco use. Radiation therapy had a significant impact on fusion: those receiving radiation were less likely to achieve fusion (P = 0.0082).

In our study, 76(49.0%) patients had Post-Op Headache. In our study, 11(7.1%) patients had Post-Op Vertigo. 41(26.5%) patients had No Fixation, 78(50.3%) patients had Rigid Fixation and 36(23.2%) patients had Suture Fixation. The mean Age (mean±s.d.) of patients was 53.1032 ± 12.0912 years. The mean BMI (mean ± s.d.) of patients was 24.7226 ± 2.7253 kg/m^2. The mean Percentage of Union (mean ± s.d.) of patients was 60.3226 ± 27.7142. The mean Month of Follow-up (mean ± s.d.) of patients was 11.8065 ± 3.3770. We found that association of Age in Years with Non Union, Good Union and Bad Union was statistically significant (p=0.0473). Association of Sex with Non Union, Good Union and Bad Union was not statistically significant (p=0.4299). In Non Union group, 7(17.1%) patients had Head Injury and 34(82.9%) patients had ICSOL.

Lappalainen OP et al [6](2016) found that micro-computed tomography (micro-CT) was used to analyze healing of the defects. Micro-CT analysis revealed that defects filled with tricalcium phosphate granules showed new bone formation in the order of 3.89 (SD 1.17)% whereas defects treated with solid bioactive glass scaffolds showed 0.21 (SD 0.16)%, new bone formation.

Honma T et al [7] (2008) found that the bone production of osteoblasts and osteocytes was assessed by molecular histology with in situ hybridization for type I collagen and osteocalcin. Formation of repaired bone ceased within 24 weeks in both critical– and non– critical– size defects i.e. regardless of completion of the defect repair. The results suggested that osteoblasts and osteocytes cease bone formation, and the differentiation of osteoblast progenitors declines in 24 weeks. Also, bone repair proceeds from the periosteum on both sides of the parietal bone but not from the surface of the bony edge around the original defect. The results could provide useful information for clinical research on bone repair.

Schmitz JP et al [8](1990) showed that transmission electron microscopy of this region at 14 days demonstrated a dense collage nous extracellular matrix with matrix vesicles infiltrating the collagen bundles. There was no evidence of crystal formation in the matrix vesicles nor of calcification in the collagenous matrix. At 21 days both the central and peripheral regions of the 8-mm calvarialnonunions were characterized by dense fibrous connective tissue repair and inactive fibroblasts. The collagen became more densely packed throughout the region of the defect by 42 days.

Our study showed that in Non Union group, 2(4.9%) patients had Co-morbidity DM and 3(7.3%) patients had Co-morbidity HTN. In Good Union group, 4(4.4%) patients had Co-morbidity DM and 12(13.3%) patients had Co-morbidity HTN. In Bad Union group, 3(12.5%) patients had Co-morbidity DM and 3(12.5%) patients had Co-morbidity HTN. Association of Other Co-morbidity with Non Union, Good Union and Bad Union was not statistically significant (p=0.4930). In Non Union group, 26(63.4%) patients had Post-Op Headache. In Good Union group, 31(34.4%) patients had Post-Op Headache. In Bad Union group, 19(79.2%) patients had Post-Op Headache. Association of Post-Op Headache with Non Union, Good Union and Bad Union was statistically significant (p<0.0001).

Lutman B et al [9] (2018) showed that pre- and intraoperative locoregional anesthesia should be the mainstay of prophylaxis; the role of opiates co-administered with analgesics, corticosteroids, and antiepileptic therapy in the acute perioperative phase is of paramount importance. Treatment of chronic PCH is less well-defined but should involve trials of analgesic, antineuropathic, and antiepileptic medications before enlisting experimental treatments. Comorbid psychiatric, musculoskeletal, or seizure disorders should be managed distinctly from post-craniotomy headaches. In patients failing all extant therapies, experimental approaches should be considered. These include subanesthetic ketamine infusion or surgical site injection with local anesthetics, corticosteroids, or botulinum toxin.

We found in Non Union group, 29(70.7%) patients had No Fixation, 1(2.4%) patient had Rigid Fixation and 11(26.8%) patients had Suture Fixation. In Good Union group, 4(4.4%) patients had No Fixation, 74(82.2%) patients had Rigid Fixation and 12(13.3%) patients had Suture Fixation. In Bad Union group, 8(33.3%) patients had No Fixation, 3(12.5%) patients had Rigid Fixation and 13(54.2%) patients had Suture Fixation. Association of Fixation Technique with Non Union, Good Union and Bad Union was statistically significant (p<0.0001).

Thibault M et al [10](2007) showed that the severity of post-craniotomy pain was assessed by collecting scores obtained using an 11-point verbal rating scale and calculating the cumulative analgesic requirements for the first 48 hr postoperatively. Data were compared according to the craniotomy location. Data from 299 patients was available for analysis. On average, 76% of patients experienced moderate to severe postoperative pain. Frontal craniotomy was associated with lower pain scores than four of six craniotomy sites analyzed, with 49% of patients reporting mild pain, a significant difference (P < 0.05) compared with all other groups except for parietal craniotomies. Frontal craniotomy patients also had lower opioid analgesic requirements compared to patients who underwent posterior fossa craniotomy (P < 0.05).

We showed that in Non Union group, the mean percentage of Union (mean± s.d.) of patients was 20.0000 ± 3.7081. In Good Union group, the mean percentage of Union (mean± s.d.) of patients was 82.0000 ± 7.4502. In Bad Union group, the mean percentage of Union (mean± s.d.) of patients was 47.9167 ± 2.5181. Difference of mean percentage of Union with Non Union, Good Union and Bad Union was statistically significant (p<0.0001). In Non Union group, the mean Month of Follow-up (mean± s.d.) of patients was 11.0976 ± 2.8355. In Good Union group, the mean Month of Follow-up (mean± s.d.) of patients was 12.1222 ± 3.5941. In Bad Union group, the mean Month of Follow-up (mean± s.d.) of patients was 11.8333 ± 3.3319. Difference of mean Month of Follow-up with Non Union, Good Union and Bad Union was not statistically significant (p=0.2748).

Table: Distribution of Final Diagnosis, Carcinoma, Radiation, Other Co-morbidity and Radiation

		Frequency	Percent
Final Diagnosis	**Aneurismal Clipping**	4	2.6%
	Head Injury	62	40.0%
	ICSOL	89	57.4%
	Total	155	100.0%
Carcinoma	**No**	76	49.0%
	Yes	79	51.0%
	Total	155	100.0%
Radiation	**No**	117	75.5%
	Yes	38	24.5%
	Total	155	100.0%
Other Co-morbidity	**DM**	9	5.8%
	HTN	18	11.6%
	No	128	82.6%
	Total	155	100.0%
Radiation	**No**	117	75.5%
	Yes	38	24.5%
	Total	155	100.0%

SUMMARY AND CONCLUSION

We showed that ICSOL was significantly higher in non union and bad union patients; Head Injury was significantly higher in good union patients.

It was found that carcinoma patients were higher in non union and bad union which was statistically significant.

Radiation patients were higher in good union which was statistically significant.

Present study found that Post-Op Headache was significantly higher in non union and bad union and mean Rate of union was higher in good union.

Association of Fixation Technique with Non Union, Good Union and Bad Union was statistically significant.

We can conclude that patients are more likely to have their craniotomy fuse if they did not undergo radiation treatment or have sutures secure the free flap. Craniotomy fusion rates after free flap increases steadily over time, as expected. We were not able to demonstrate that clinical factors such as age, sex, BMI, diagnosis, fixation material, and radiation have an impact on fusion rate when time to fusion was considered.

REFERENCE

1. Reponen E, Korja M, Niemi T, Silvasti-Lundell M, Hernesniemi J, Tuominen H. Preoperative identification of neurosurgery patients with a high risk of in-hospital complications: a prospective cohort of 418 consecutive elective craniotomy patients. J Neurosurg. 2015 Sep. 123 (3):594-604. [Medline].
2. Winn H Richard. Youmans Neurological Surgery. 6th Ed. Philadelphia: Elsevier; 2011.
3. Rengachary, Setti S, Ellenbogen, Richard G. Principles of Neurosurgery. 2nd Ed. New York: Elsevier Mosby; 2005.
4. Elward A, Yegge J, Recktenwald A, Jadwisiak L, Kieffer P, Hohrein M, et al. Risk Factors for Craniotomy or Spinal Fusion Surgical Site Infection. Pediatr Infect Dis J. 2015 Sep 7. [Medline].
5. Adaaquah D, Gates M, Van Gompel JJ. Rate of craniotomy fusion after free bone flap. World neurosurgery. 2018 Oct 1;118:e283-7.
6. Lappalainen OP, Karhula SS, Haapea M, Kauppinen S, Finnilä M, Saarakkala S, Serlo W, Sándor GK. Micro-CT analysis of bone healing in rabbit calvarial critical-sized defects with solid bioactive glass, tricalcium phosphate granules or autogenous bone. Journal of oral & maxillofacial research. 2016 Apr;7(2).
7. Honma T, Itagaki T, Nakamura M, Kamakura S, Takahashi I, Echigo S, Sasano Y. Bone formation in rat calvaria ceases within a limited period regardless of completion of defect repair. Oral Diseases. 2008 Jul;14(5):457-64.
8. Schmitz JP, Schwartz Z, Hollinger JO, Boyan BD. Characterization of rat calvarial nonunion defects. Cells Tissues Organs. 1990;138(3):185-92.
9. Lutman B, Bloom J, Nussenblatt B, Romo V. A contemporary perspective on the management of post-craniotomy headache and pain. Current pain and headache reports. 2018 Oct 1;22(10):69.
10. Thibault M, Girard F, Chouinard P, Boudreault D, Ruel M, Moumdjian R. Craniotomy site influences postoperative pain following neurosurgical procedures: a retrospective study. Canadian Journal of Anesthesia. 2007 Jul 1;54(7):544-8.