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Surgical Outcome of Decompressive Craniectomy: Study of 32 Cases

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Abstract

Background: Decompressive craniectomy gives space for brain to allow outward herniation, prevents compression of brainstem structures and reconstruct brain perfusion Duroplasty further decreases ICP. **Objectives:** The objectives of this study was to asses overall outcome of decompressive craniectomy in intracerebral hematoma (ICH), traumatic brain injury (TBI), malignant cerebral infarction and acute subdural hematoma. **Methodology:** This was a cross-sectional observational study conducted over patients who were undergone decompressive craniectomy subsequently from 2007 to 2014 for a period of seven (07) years. Parameter of outcome was categorized into death, favorable (Glasgow outcome scale GOS 4 or 5) and unfavorable (GOS 2 or 3). Outcome was also assessed according to preoperative GCS. The mean time of measuring outcome was 3 month. **Results:** The pathology for which DC done was ICH in 19 cases malignant MCA infarction in 3 cases ASH 3 cases TBI 7 cases. Decompressive craniectomy was performed in 32 cases of which 19 cases were intracerebral haematoma, 7 cases were traumatic brain injury, 3 cases were malignant cerebral infarction and 3 cases were acute subdural hematoma. Mean age was 52 years. Male female ratio was 5:3. ICH was more common in elderly age group and age range of TBI was lower than ICH. Preoperative GCS was categorized into two group 3 to 6 and 6 to 9. 14(43.25%) patients were between 3 to 6 and 18 patients 3 to 9 55(25.0%). 11(37.5%) patients died postoperatively, outcome was favorable in 12(37.5%) cases and unfavorable in 9(28.0%) cases. Outcome in relation GCS was in 3 to 6 group 3(21.0%) cases was favorable unfavorable 4(29.0%) and 7(50.0%) cases died in 6 to 9 GCS group. Outcome was favorable in 9(50.0%) cases unfavorable in 5(27.0%) cases and 4(23.0%) patients died post operatively. **Conclusion:** Decompressive craniectomy bears better outcome in term of survival but the problem is quality of life issue after survival especially in poor GCS (3-6) group. [Journal of National Institute of Neurosciences Bangladesh, 2017;3(2): 80-83]

Keywords: Surgery; outcome; decompressive craniectomy.

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Introduction

Decompressive craniectomy (DC) is a surgical technique used as a last resort option in the management of refractory intracranial hypertension caused by severe head injury, cerebral infarction, acute subdural hematoma, intracerebral hemorrhage and so on. It is

known over century but reappear after paper of Guera used for wide range of pathologies from traumatic, vascular and tumoural causes[1]. The first decompressive craniectomy is described by Kocher in 1901; then Kushing 1903 and Victor Horsley 1906[2].

Decompressive hemi-craniectomy and durotomy is a surgical technique used to relieve the increased intracranial pressure and brain tissue shifts that occur in the setting of large cerebral hemisphere mass or space-occupying lesions. [5 17 22] In general, the technique involves removal of bone tissue (skull) and incision of the restrictive dura mater covering the brain, allowing swollen brain tissue to herniate upwards through the surgical defect rather than downwards to compress the brainstem. [5 11 13] Roughly 10 percent of ischemic strokes are classified as malignant or massive because of the presence of space-occupying cerebral edema that is severe enough to produce elevated intracranial pressure and brain herniation [7 13]. The etiology of the majority of these infarcts is cardio embolic or thrombotic occlusion of the internal carotid artery or the proximal segment (stem, or M1) of the middle cerebral artery (MCA The rationale behind decompressive craniectomy is to convert an injury within a closed box, with a fixed volume and limited reserve, into an open system with increased capacity to accommodate mass. [11] After bone removal, there is an increase in brain compliance and a shift of the pressure volume curve to the right.[9 10]

Surgical technique: There are two types of craniectomy; bilateral and hemi-craniectomy. Hemi-craniectomy is removal of bone of one hemisphere, bilateral is removal of bones [11, 22] from both hemispheres, seldom used. Removal of an ipsilateral bone flap ≥ 12 cm in diameter and including parts of the frontal, parietal, temporal and occipital squama plus Duraplasty (fig 1A 1B 2) To relieve ICP Inadequate craniectomy size is associated with parencymal haemorrhage ± infarction and increased mortality.[7 9 22]Mortality rates have also been reported as elevated in small diameter craniectomies (Wagner S 2001). [2 3 4]This is due to the venous congestion that occurs in the herniated brain tissue as it is restricted and compressed by the bony boundary of the skull defect. [19 21] Brain parenchyma herniates through the bony defect which in essence is the desired effect but compression of parenchyma adjacent to the bony boundary in a small craniectomy leads to venous congestion, venous infarction and further damage to brain tissue. [5 8] This is more common in craniectomies smaller than 8cm in diameter. [413.11] . We performed cranioplasty after 3 month (approx).

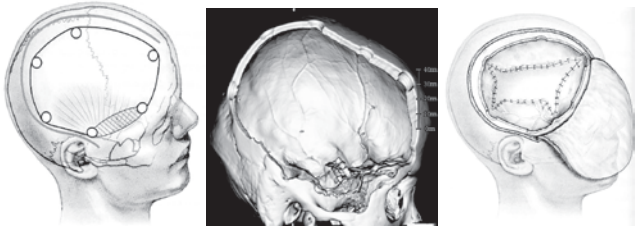

Figure IA, Skin incision for craniotomy

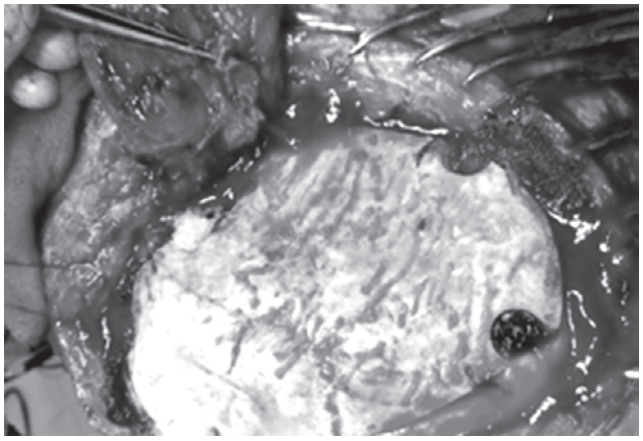

Figure IB: Craniotomy flap

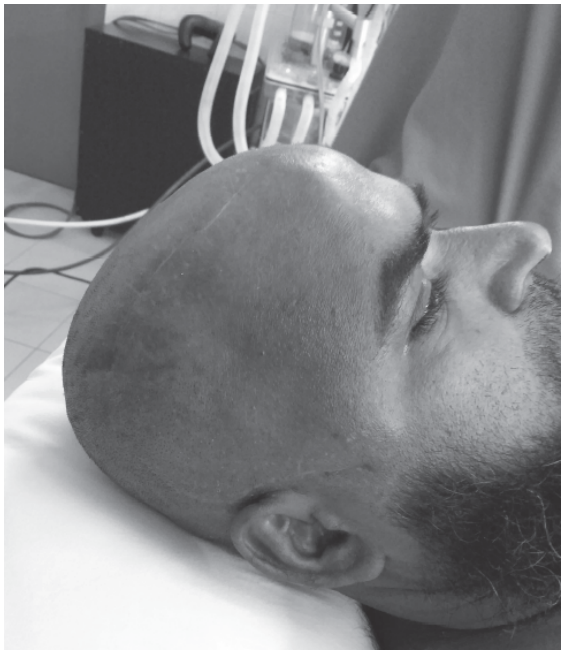

Figure II: Cranioplasty by own bone after 3 months

Methodology

This was a cross sectional observational study conducted over patients who undergone decompressive craniectomy subsequently from 2007 to 2014 for a period of seven (7) years. The pathology for which DC done was ICH in 19 cases malignant MCA infarction In 3 cases ASH 3 cases TBI 7 cases. Parameter of

outcome was categorized into Death, favorable (Glasgow outcome scale GOS 4or5) and unfavorable (GOS 2 or 3). Outcome was also assessed according to preoperative GCS. The mean time of measuring outcome was 3 month.

Results

A total number of 32 cases were recruited for this study. Out of 32 cases the indication of decompressive craniectomy was intracerebral haematoma in 19 cases 59.(37%) traumatic brain injury 7 cases 21%, Malignant cerebral infarction 3 cases(9.37%) acute subdural hematoma in 3(9.37%) Mean age was 52 Years, 20 cases were male and 12 cases were female and male female Ratio was 5:3. ICH was more common in elderly age group and age range of TBI was lower than ICH. Regarding GCS (categorized into two group 3-6) and (6-9)14 (43.25%) patients were between 3-6 and 18 patient 3-9 55.(25%). Regarding outcome 11(37.5%) patients died postoperatively, favorable in (12 37.5%) cases and unfavorable in9 cases(28%) Outcome in relation GCS Was: in 3-6 group 3 cases was favorable (21%) unfavorable 4(29%) and 7cases died (50%). In 6-9 GCS group Out come was favorable in 9 cases 50%) unfavorable in 5 cases (27%) and 4 patients died post operatively (23%).

Table 1: Distribution of patients according to indication, mean age, sex and pre operative GCS

Indication	Frequency	Percentage
Intra cerebral Hemorrhage	19	59.37
Traumatic brain injury	7	21.87
Malignant infarct	3	9.37
Acute subdural haematoma	3	9.37
Total	**32**	**100.0**

Table 2: Distribution according to Gender

Indication	Male	Female
Intra cerebral Hemorrhage	11	8
Traumaic Brain Injury	4	3
Malignant Infarct	3	0
Acute Subdural Haematoma	2	1
Total	**20(62.0%)**	**12(38.0%)**

Table 3: Distribution of Preoperative GCS

GCS	Frequency	Percentage
3 to 6	14	43.75
6 to 9	18	55.25
Total	**32**	**100.0**

Table 4: Over All Outcome of the Patients

Outcome	Frequency	Percentage
Favorable(GOS 1or 2)	12	37.5
Unfavorable (GOS 3 or 4)	9	28.12
Death	11	34.37
Total	**32**	**100.0**

Table 5: Outcome according to GCS

GCS	Favorable	Unfavorable	Death	Total
3 to 6	3(21.0%)	4(29.0%)	7(50.0%)	14
6 to 9	9(50.0%)	5(27.0%)	4(23.0%)	18
Total	**12**	**9**	**11**	**32**

Discussion

Decompressive craniectomy is performed in our country for many years but there is less data regarding outcome. There is individual variation of outcome of ICH, TBI, malignant cerebral infarction, acute sudural hematoma. There is also variation in respect of GCS, age, sex, comorbidity. In this study, outcome of decompressive craniectomy of ICH, TBI, malignant cerebral infarction, acute sudural hematoma was studied combindly, this is a limitation of this study. Mean age of this study was 52 years. Reviewing other literature mean age was Qusmi et al 2015 32years olivecrona et al 2007,37 years thomas et al 2016 56years. [5 6 9] In our study Male female ratio was 5:2. Overall mortality of this study was 34.37%. Mortality of other studies Thomas 14.93%, Qusmi 23.03% olivecrona 14% Haward 2008 more than 40%. In this study 28.12 % had unfavorable outcome. In other studies it was observed 70 % (death included) by Thomas, 15.0% by Qusmi, 33.0% by Haward. Overall 37.5% of patients shown favourable outcome in this study. .Reviewing literature there are many studies regarding outcome of DC shown favorable outcome by Olivecorna et al 2007, 71% haward et al 2008 30% Qusmi 54% suggesting that outcome of decompressive craniectomy is better in TBI than CVA cases. Death of this study was 50.0% in GCS 3-6 group whereas 23 % in 6-9 GCS group. Out come is poor in 3 to 6 GCS Group that was similar to most of the studies in the literature. Favorable outcome was 50% In GCS 6-9 group, where as 21% in GCS 3-6 Group in our study.. Most of the studies in the literature showed that outcome is better if decompressive craniotomy done within 24 hours of incidence literature showed that late decompression surgery after onset of herniation is not beneficia.l [7 810] Similar effects were seen in the prospective study of Malm et al[18 20].. most of our

surgery could not be performed within 24 hours because of delayed presentation this is also a limitation of our study. Despite considerable rates of physical disability and depression, the vast majority of patients are satisfied with their quality of life after treatment and do not regret having undergone a surgery [11, 18].

Conclusion

Decompressive craniectomy bears better outcome in term of survival but the problem is quality of life issue after survival especially in poor GCS (3-6) group. Large scale study is necessary for further conclusion.

References

1. Guerra WK, Gaab MR, Dietz H, Mueller JU, Piek J, Fritsch MJ. Surgical decompression for traumatic brain swelling: indications and results. Journal of neurosurgery. 1999;90(2):187-96
2. Cushing H. The establishment of cerebral hernia as a decompressive measure for inaccessible brain tumors: with the description of intermuscular methods of making the bone defect in temporal and occipital regions. Surg Gynecol Obstet 1905;1:297-314
3. Rengachary SS, Batnitzky S, Morantz RA, Arjunan K, Jeffries B. Hemicraniectomy for acute massive cerebral infarction. Neurosurgery 1981;8(3):321-8
4. Wagner S, Schnippering H, Aschoff A, Koziol JA, Schwab S, Steiner T. Suboptimum hemicraniectomy as a cause of additional cerebral lesions in patients with malignant infarction of the middle cerebral artery. Journal of neurosurgery. 2001;94(5):693-6
5. Thomas et al International Journal of Current Research Vol. 8, Issue, 01, pp.25578-25583, January, 2016
6. Qasmi, Shahzad Ahmed; Ghaffar, Abdul; Hussain, Zahid; Akram, Maqsood Pakistan Armed Forces Medical Journal . 10/31/2015, Vol. 65 Issue 5, p674-678. 5p
7. Hitchings L, Delaney A. Decompressive craniectomy for patients with severe non-traumatic brain injury: a retrospective cohort study. Critical Care and Resuscitation. 2010;12(1):16-23
8. Howard JC, Thorson MA. Society of trauma nurses position statement on the role of the clinical nurse specialist in trauma. Journal of Trauma Nursing 2008;15(3):91-3
9. Olivecrona M, Rodling-Wahlström M, Naredi S, Koskinen LO. Effective ICP reduction by decompressive craniectomy in patients with severe traumatic brain injury treated by an ICP-targeted therapy. Journal of neurotrauma. 2007 Jun 1;24(6):927-35
10. Albanèse J , et al C. Outcome after decompressive craniectomy for the treatment of severe traumatic brain injury ,Crit Care Med. 2003 Oct;31(10):2535-8
11. Adewumi D, Colohan A. Decompressive Craniectomy: Surgical Indications, Clinical Considerations and Rationale. In: Brain Injury-Pathogenesis, Monitoring, Recovery and Management 2012. InTech
1. Eghwrudjakpor P, A. A. (2010). "Decompressive Craniectomy Following Brain Injury:
2. Factors Important to Patient Outcome." Libyan Journal of Medicine 5(4620).
3. Forsting M, R. W., Schabitz W, et al (1995). "Decompressive Craniectomy for cerebral infarction: An experimental study in rats." Stroke 26: 259-264.
4. Gaa M, R. M., Lorenz M, et al (1990). "Traumatic brain swelling and operative decompression: A prospective investigation." Acta Neurochirugica Supplementum 51: 326-328.
5. Guresir E, V. H., Schuss P, Oszvald A, Raabe A, Seifert V, Beck J (2011). "Rapid closure technique in decompressive craniectomy." Journal of Neurosurgery 114: 954-960.
6. Krieger DW, Demchuk AM, Kasner SE, et al. Early clinical and radiological predictors of fatal brain swelling in ischemic stroke. Stroke 1999; 30:287.
7.10. Kasner SE, Demchuk AM, Berrouschot J, et al. Predictors of fatal brain edema in massive hemispheric ischemic stroke. Stroke 2001; 32:2117.
19. Williams JL, Furlan AJ. Cerebral vascular physiology in hypertensive disease. Neurosurg Clin N Am 1992; 3:509.
20Reith J, Jørgensen HS, Pedersen PM, et al. Body temperature in acute stroke: relation to stroke severity, infarct size, mortality, and outcome. Lancet 1996; 347:422.
21Hitchings L, D. A. (2010). "Decompressive Craniectomy for patients with severe non-traumatic brain injury: a retrospective cohort study." Critical Care Resuscitation 12: 16
22 Balan C Aliez B, Decompressive craniectomy from option to standardpart 1, Romanian Neurosurgery Vol XVI 2 20-26