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We do not have conflict of interest.

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Ways to Improve outcome of Decompressive Craniectomy: Judicious Utilization of Microneurosurgical technique Adjuncts

To the Editor,

Sir,

We read with interest the article "Measurement of bone flap surface area and midline shift to predict overall survival after decompressive craniectomy ".[1] Decompressive craniectomy is associated with multitude of therapeutic effects including enlargement of the intracranial volume , re-opening up of perimesencephalic cisterns, improvement of cerebral compliance, increase in cerebral blood flow and cerebral perfusion, improvement of cerebrovascular regulation and reduction in midline shift, and intracranial pressure . However, outcome of decompressive craniectomy depends on various factors i.e. age of patient, primary intracranial pathology, size of decompressive craniectomy, preoperative midline shift, preoperative rise in intracranial pressure level, co-morbid illness, neurological status, mass effect and still controversy exists regarding size of decompressive craniectomy, optimal patient group, timings and surgical technique.[2,3,4]

Morselli et al. reported a technique to measure the surface area of the bone falp removed during decompressive craniectomy and analyzed the role of size of decompressive craniectomy and also evacuated midline line shift reduction observed in the early postoperative cranial CT scan following the surgical procedure affecting the outcome.[2] Morselli et al analyzed 73 cases, who underwent decompressive craniectomy, the mean surface area of removed bone flap was 7759 mm^2. However, authors concluded surface areas of decompressive craniectomy bone flap did not influence survival rate but the reduction of midline shift, which were observed in the postoperative cranial CT scan was considered as the principal key factor affecting outcome of successful decompressive craniectomy surgery. [1] Morselli et al further concluded ideal surface area for a particular patients with "large" square bone flaps should ideally cause reduction in final midline shift well within the range of less than or at least should be 5 mm and further advocated , revision of decompressive craniectomy for enlargement of the craniectomy edges should be considered for patients , who had persisting midline shift of more than 5mm noted in the early post-op computed tomography scans. [1] As for regarding optimal craniectomy bone flap size, the smaller bone flap is associated with inadequate decompression, external brain herniation and propensity to cause venous infarct, while on the other hand , too large craniectomy is associated with increasing risk of subdural collection, hydrocephalus development , syndrome of the trephination, sinking skin flap syndrome and rarely paradoxical reverse brain herniation. [2,3] In this complex scenario, however, a bundle of micro-neurosurgical technique adjuncts exists in the neurosurgical armamentarium to improve the final surgical outcome of decompressive craniectomy. It is highly imperative to utilize these technique for better outcome and commoner microneurosurgical techniques includes augmenting duraplasty [4] , creation of "vascular tunnel" [5], lattice duraplasty [6] , opto-chiasmatic cisternostomy and fenestration of lamina terminalis[7] , preservation of inferior temporal lobe venous drainage , and removal of part of temporalis muscle above the inferior edge of the bone window formed by the craniectomy can also lead to augmented space of decompression. As these microneurosurgical technique adjunct act synergistically with decompressive craniectomy as both procedures aim for reduction of the intracranial pressure and should be utilized as much as possible and judiciously.

Augmenting duraplasty allows for further expansion of the oedematous brain into a durotomy bag under the loosely closed scalp without restriction by the bony calvarium and further, the dura also protect the underlying brain tissue with prevention from over bulging. Duraplasty can be carried out utilizing autologus temporal fascia, temporal muscle, or galea aponeurotica. The sources of artificial tissue are dura substitute or bovine pericardium. The advantages of augmenting duraplasty includes lower incidences of secondary surgical complications including development of hydrocephalus , subdural effusion, and epilepsy . [4]

Csokay et al introduced "creation of "vascular tunnel" in order to avoid compression of vessels at the edges of decompressive craniectomy to avoid further venous thrombosis and secondary brain infarct . Csokay et al. 5 described the procedure, following craniectomy flap raised , dural incisions made in a stellate fashion and at the entrance points of major vessels are close to the midpoint between the angles of the dural opening. A series of small supporting pillars are constructed of haemostatic sponge wrapped by absorbable thread are placed on bilateral sides of the vessels as they cross the edge of the dural window. [5]

Lattice duraplasty was introduced by Mitchell et al. [6] with aim to minimize the chances of herniation of the brain through the cranial calvarial defect, minimising the chances of cortical laceration , venous kinking on the craniectomy edge and increasing the tactility of the dura and to allow to stretch and expand. [6] Numerous cuts intersecting in a lattice pattern of dural incisions made each measuring about 2 cm length and placed at 1-cm intervals, which allow dura to expand in a gradual and controlled manner. Advantages include significant reduction by intracranial pressure with decompressive craniectomy . [6]

Cherian et al advocated cisternostomy as an adjunct for decompressive craniectomy, opening of inter-optic and optico-carotid cistern helps in drainage of CSF as well hematoma and later on opening is also made over the membrane of Liliequist , followed with constant irrigation is performed and the subarachnoid blood is washed out, which also reduces the chances of secondary development vasospasm by removal of blood degradation products . [7]

Other adjuncts includes, removal of part of temporalis muscle above the inferior edge of the bone window formed by the craniectomy with aim to augment the space of decompression, however, patients are more prone to suffer mastication problems in the postoperative period. Further, the preservation of inferior temporal lobe venous drainage should be attempted and the craniectomy should be extended down to the floor of the middle cranial fossa, at the root of the zygoma; which also ensures adequate lateral decompression of the temporal lobe, allowing it to “fall out” of its usual calvarial middle fossa boundaries

But never the less, present study provides important guideline for safely carrying out surgical decompressive craniectomy and minimizing morbidity and morbidity, which is possible at modern time, as newer neuroimaging technology advancement, growing wealth of surgical experience across the globe and advancement in understanding of microsurgical anatomy with and availability and of these microneurosurgical technical adjunct and its judicious practices in association of vigilant perioperative care can be further helpful in achieving targeted goal. [2]

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