ORIGINAL RESEARCH PAPER

Volume-7 | Issue-4 | April-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

HARVESTING THE BIFRONTAL PERICRANIAL GRAFT: A TECHNICAL NUANCE AND EVALUATION.

Neurosurgery

Dr.Krishna kumar.P* Assistant professor,Department of Neurosurgery.Government T.D Medical College, Alappuzha,Kerala. *Corresponding Author

Dr.Biju Bhadran Professor .Department of Neurosurgery.Government T.D Medical college, Alppuzha, Kerala

Dr.Harrison .G Assistant Professor,Department of Neurosurgery,Government T.D Medical Colege, Alappuzha,Kerala.

ABSTRACT

Background and purpose The purpose of this study was to introduce and evaluate a small technical nuance – the terminal subpericranial technique- while doing bifrontal craniotomy, to adequately protect the terminal twigs of the facial nerve.

Methods While doing bifrontal craniotomy the galeo aponeurotic flap is separated from the underlying pericranium in the loose areolar tissue only till 1.5 cms above the supraorbital margin. A single institutional retrospective review of 22 patients who underwent bifrontal craniotomy using bicoronal flaps between 2014 and 2017 were conducted. The patients were divided in to two groups based on whether this technique was adopted (group1) or not (group2). The two groups were compared in terms of post operative facial paralysis if any, graded by House-Brackman scale.

Results There were no facial palsy in group1, but two in group2 had facial palsy (15%).

Conclusion While doing bifrontal craniotomy, terminal facial nerve twigs can be adequately safeguarded by using the above technique.

KEYWORDS

Bifrontal craniotomy, terminal subpericranial technique, facial nerve twigs.

Introduction:

Bifrontal craniotomy is a major workhorse for the neurosurgeon for approaching the lesions in the anterior skull base. Low frontal exposure is often necessary to get access to many skull base lesions. Pedicled pericranial grafts when raised along with the procedure is an excellent autologous graft used for several purposes like anterior skull base reconstruction1, frontal sinus exclusions, or as dural substitutes etc. These pericranial grafts are easier to raise, has excellent blood supply, can be raised along with the flap without the need for an additional procedure and thus avoids donor site morbidity. While raising the pedicled pericranial graft, along with the bifrontal flap, preservation of the zygomatico-temporal twigs of the facial nerve deserves paramount importance. Often the anatomy of the terminal facial nerve twigs are ignored while raising the bifrontal flap. Permanent or temporary paresis of terminal facial nerve twigs can be a major source of morbidity. These twigs can be damaged either directly while raising the flap or as a result of traction when the flap is pulled anteriorly. Literature abounds with techniques for preservation of these branches lateral to the superior temporal line, but regarding its preservation medial to the superior temporal line not much emphasis has been given. The purpose of our study is to evaluate a simple technical nuance, while harvesting an anterior pedicled pericranial graft during a bifrontal craniotomy, to minimize injury to terminal branches of facial nerve.

Materials and methods:

Surgical technique

After preparation and draping a bicoronal incision is put. The extent of the incision is determined according to the surgeon's need. A point 1.5 cm above the supraorbital rim is marked on both sides. This roughly corresponds to one fingerbreadth above the supraorbital rim. The flap is elevated in the subgaleal plane with a combination of blunt and sharp dissection up to this point on both sides. [Fig1,Fig3] The pericranium is now incised as far posteriorly as needed and raised till the orbital rim. Thus in the terminal 1.5 cms of the flap, the pericranium and rest of galea are in apposition. [Fig2, Fig4, Fig5].

Authors retrospectively reviewed data of patients who underwent bifrontal craniotomy using bicoronal incision between June 2014 and June 2017.In all cases bifrontal free or pedicled pericranial graft was harvested. Those patients with preoperative eyelid oedema and trauma to orbit were excluded from the study. The patients were divided in to two groups. The first group consisted of patients who underwent craniotomy in the technique described above. The second group consisted of patients who underwent the procedure in classical fashion where the galeal flap was separated from the underlying pericranium till orbital margin. The patients were observed for facial weakness if any, in the post operative period assessed by House Brackmann grade (HB grade).

There were a total of twenty two cases, out of which twelve were males and ten were females. The patient demographics are given in table 1.The first group consisted of nine patients and the second group thirteen patients. There were no facial pareses in the first group. Two patients developed facial paresis HB grade 2 in the second group in the post operative period, which resolved spontaneously (15%).Thus the incidence of facial palsy was more in the second group.

Table 1: Patient characteristics

	Group1	Group2
Demographics		
No of patients	9	13
Mean age*	52.3(1.4)	50.6(1.3)
Male (%)	44.4	61.5
Indications (%)		
Trauma	44.4	53.8
Tumour	55.5	38.5
Others	0	7.7

* Age (SD)

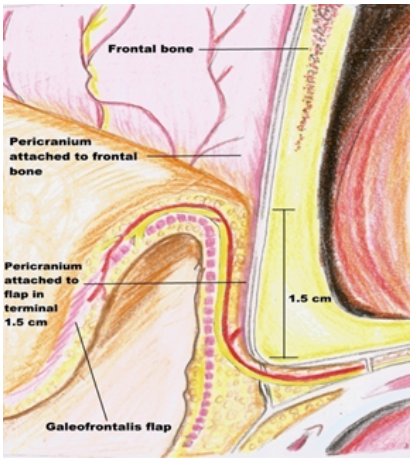

Fig 1: The galeo frontalis flap separated from underlying pericranium till 1.5 cm from the supraorbital margin

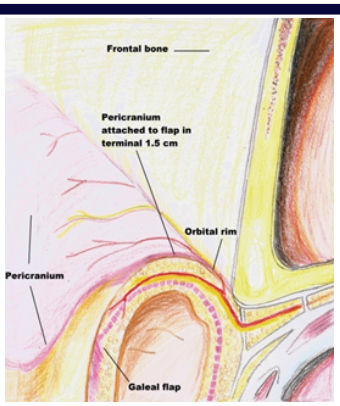

Fig 2: In second step pericranium is separated from the underlying bone down till supraorbital margin. Thus in terminal 1.5 cm of the flap, the two layers are in apposition.

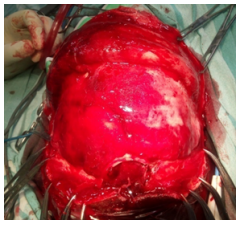

Fig 3: Bifrontal scalp flap raised in subgaleal plane up to 1.5 cm above supraorbital rim.

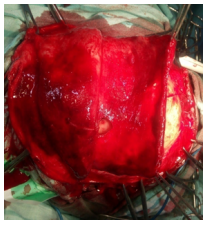

Fig 4: Starting to raise pericranium.

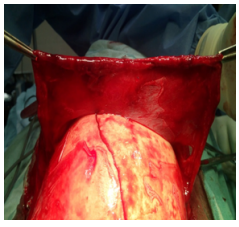

Fig 5 : Pericranium raised to supraorbital margin.

Discussion:

The classical acronym SCALP, which has been traditionally used to describe the five layers of the scalp, is an oversimplification. The skin and subcutaneous tissue with the superficial fascia forms the first two layers. The superficial temporal artery is in the superficial fascia. Next comes, the galea aponeurotica which contains the frontalis and occipitalis muscles. Deepest layer is the pericranium and between it, lies the sub aponeurotic tissue. The word periosteum has been reserved for this layer lateral to the superficial temporal line (STL) and pericranium medial to STL. Some people consider that pericranium and sub aponeurotic tissue together form a separate layer. The musculo-aponeurotic layers and their relationships in the fronto temporal area are complex. Different nomenclatures used by different authors further added to the confusion. Davidge K M et al[2] reviewed 69 articles and proposed the following names for the soft tissue layers of temporo parietal region-Temporo parietal fascia, loose areolar plane, superficial leaflets of temporal fascia, fat pad, deep leaflets of temporal fascia, temporalis muscle and pericranium.

In any surgery involving the fronto temporal area, it is of paramount importance that the facial nerve be preserved from its exit at stylomastoid foramen till its twigs reach the facial musculature. Inside the parotid gland the facial nerve divides in to five branches- frontal, zygomatic, buccal, mandibular, and cervical. The frontal branches are variably called as frontal, temporal, or fronto temporal branches (FTB). The divisions of facial nerve and its further course has been a subject of much study. After crossing the zygomatic arch, the FTB gives three branches. The auricular, frontalis and orbicularis[3,4,5].These FT branches pass within the temporo parietal fascia. Seda T Babakurban et al[6], however in their study found that the number of temporal twigs over the zygomatic arch varied. They also described three fat pads in the temporal region: the superficial fat pad between the temporo parietal fascia and superficial layer of temporal fascia, intermediate fat pad between the superficial and deep layers of the temporal fascia, and deep fat pad between temporal muscle and deep temporal fascia. Gosain et al[7] demonstrated that two to four (with a median of three) rami of temporal branch of facial nerve cross the zygomatic arch. In up to 75% of cases there can be anastomosis between these branches[8].In the anterior zygomatico temporal region where the loose areolar layer is thin, the twigs run in the superficial fat pad between the temporo parietal fascia and superficial layer of deep temporal fascia. In the area medial to superficial temporal line the lose areolar tissue is well developed and the twigs run over the outer surface of the pericranium.

Improper dissection of the fascial layers can result in FTB palsy reaching as high as 30%.This can be due to either retraction injury or direct injury to nerve twigs during surgery. In the temporal area lateral to superior temporal line dissection techniques are extensively described. The interfascial dissection was described by Yasargil for pterional craniotomy [9]. Here the dissection will go between the superficial and deep layers of the temporal fascia so that the FTB are taken care off. Ammirati et al [10] described an occasional twig for the frontalis muscle running intrafascially. They concluded that due to this anatomic variability an interfascial dissection can sometimes injure the terminal nerve twigs. Also they showed that one could mistake a subgaleal fat pad to the interfascial fat pad. Other methods described in this region are subfascial and sub muscular dissection techniques, which preserves the continuity of the terminal twigs of facial nerve. These are technically simpler also. In the supra orbital region, if dissection is attempted between pericranium and frontalis muscle in the loose areolar plane there is a chance of injury to terminal twigs of FTB. This has been a concern during minimally invasive supraorbital trans eyebrow (SOTE) approach also.

The frontal pedicled pericranial graft has a rich network of blood supply from supratrochlear and supraorbital vessels. Both these arteries give rise to superficial and deep branches. Yoshioka et al [11] in a landmark paper describes the vascular anatomy of the anteriorly based pericranial flap. They described that the perpendicular distance from the nasion to the origin of the deep branches ranged from 10 to 20 mm in supraorbital and 0 to 20mm in supratrochlear arteries. Based on their finding they have concluded that if the vascular supply is to be preserved for the anteriorly base pericranial flap, the separation of the galeo frontalis layer from the pericranium should not extend into one centimetre above the supra orbital rim if the arterial and venous pedicle of the flap has to be preserved. Vascularised pericranial grafts are preferred grafts for anterior skull base repair and reconstructions. Avascular or synthetic grafts are associated with higher risk of infection and flap failure [12, 13]. Fascia lata grafts are having donor site morbidity.

Bicoronal incisions are variably put depending up on the indication and needs. The two lateral limbs of the incisions usually will go in to the temporal area. In the area lateral to temporal line either the submuscular, interfascial or subfascial techniques will suffice to protect the FT branches of facial nerve. In the area medial to the superior temporal line a terminal sub pericranial technique described above will adequately protect the nerve. This is because the terminal twigs of facial nerve are safe since we are not disturbing the sub aponeurotic plane in this area. In our study the facial nerve paresis rate was lower when the terminal subpericranial technique was used. If a pericranial graft either free or pedicled is needed then the technical nuance described above can be safely adopted. The same technique can be used when the craniotomy has to be lowered to anterior skull base or for orbitozygomatic approaches.

Conclusion:

While doing a bifrontal craniotomy using this simple terminal subpericranial technique will not only help to preserve the pericranial blood supply but also the terminal twigs of facial nerve. The study reiterates the need to emphasize techniques to preserve facial nerve twigs medial to superficial temporal line in neurosurgical literature.

Acknowledgment:

We thank Dr.Jayalakshmi M.D for helping to prepare the diagrams.

REFERENCES

[1] Price JC, Loury M, Carson B, Johns ME. The pericranial flap for reconstruction of anterior skull base defects. Laryngoscope. 1988 Nov;98(11):1159-64.

[2] Davidge KM, van Furth WR, and Agur A, Cusimano M. Naming of the soft tissue layers of the temporoparietal region: Unifying anatomic terminology across surgical disciplines. Neurosurgery. 2010 Sep; 67(3 Suppl Operative):120-9.

[3] Krayenbühl N, Isolan GR, Hafez A, Yaşargil MG. The relationship of the fronto-temporal branches of the facial nerve to the fascias of the temporal region: A literature review applied to practical anatomy dissection. Neurosurg Rev. 2007 Jan; 30(1):8-15.

[4]. Toma Spiriev, Lars Poulsgaard, and Kaare Fugleholm. Technique for preservation of frontotemporal branch of facial nerve during orbito zygomatic approaches. J Neurol Surg B Skull Base. 2015 Jun; 76(3): 189–194.

[5] Coscarella E, Vishteh AG, Spetzler RF, SeraneE, Zabramski .Subfascial and submuscular methods of temporal muscle dissection and their relationship to the frontal branch of facial nerve. Technical note. J Neurosurg. 2000 May;92(5):877-80.

[6]. Seda T Babakurban, MD: Ozcan Cakmak, MD; Simel Kendir, MD. Temporal branch of the facial nerve and its relationship to the facial layers. Arch Facial Plast Surg. 2010 Jan-Feb; 12(1):16-23.

[7]. Gosain AK, Sewal SR, Yousif NJ, The temporal branch of facial nerve: How reliably can we predict its path? Plastic reconstructive surgery Plast Reconstr Surg. 1997 Apr; 99(5):1224-33.

[8]. Mathias RN, Lieber S, de Aguiar PH, Maldaun MV, Gardner P, Fernandez-Miranda JC. Interfascial dissection for protection of the nerve branches to the frontalis muscles during supraorbital trans-eyebrow approach: An anatomical study and technical note. J Neurol Surg B Skull Base. 2016 Jun;77(3):265-70

[9] Yasargil MG, Reichman, MV, Kubiks, Preservation of the frontotemporal branch of the facial nerve using the interfascial temporalis flap for pterional craniotomy.Technical article. J Neurosurg. 1987 Sep;67(3):463-6

[10] Ammirati.M, Spallone A, MaJ, CheathamM, Becker D.An anatomico surgical study of the temporal branch of the facial nerve. Neurosurgery 1993 Dec; 33(6):1038-43

[11]. Yoshioka N, Rhoton ALJr .Vascular anatomy of the anteriorly based pericranial flap. Vascular anatomy of the anteriorly based pericranial flap. Neurosurgery. 2005 Jul; 57(1 Suppl):11-6.

[12]. de Melo WM, Coléte JZ, Mariano RC, Shinohara EH, Souza FÁ, Garcia IR Jr.Anterior pericranial flap for frontal sinus duct obliterations: Is it a valuable resource? J Craniofac Surg. 2013 Mar; 24(2):147-9.

[13]. Kim YJ, KinoHR, Jun YJ, SeoBC .Usefulness of galeal frontalis myofascial flap as treatment for post operative infection in frontal sinus fracture. J Craniofac Surg. 2011 Sep;22(5):1968-71