The “Agnes Fast”* Craniotomy: The Modified Pterional (Osteoplastic) Craniotomy

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ABSTRACT

The “Agnes Fast” craniotomy is a fast and simple way of performing the pterional craniotomy while preserving the temporalis muscle, together with its fascia and bony attachment. Using this technique, the surgeon need not divide the temporalis muscle, separate it from its bony attachment, or perform an interfascial dissection. With a little practice, this craniotomy can be performed in less than 5 minutes and is highly recommended in emergent settings. The modified pterional craniotomy was performed in 10 cadaveric specimens, preserving the temporalis muscle with its attachment. An interfascial dissection was not performed while exposing the frontozygomatic process. The exposure gained, the length of the procedure, and the ease of application were recorded for all heads studied. In all heads studied, the Agnes Fast craniotomy was performed, with complete preservation of the temporalis muscle and its attachments. This procedure was performed quickly, with complete preservation of the fascial nerve and its branches. The muscle was put back in its natural place following the craniotomy. The Agnes Fast craniotomy offers a fast way of performing a pterional craniotomy while preserving the temporalis muscle, with its blood supply, neural innervation, bony attachment, and fascia intact. Replacing the muscle is also fast and simple and involves placement of two CranioFix (Aesculap, Inc., Center Valley, PA) holders to the bone, with no suture material. This approach does not limit the exposure gained and offers the same exposure as the “usual” pterional craniotomy.

KEYWORDS: Pterional craniotomy, temporalis muscle preservation, osteoplastic

The pterional craniotomy was termed “the most frequently used cranial approach.”² This craniotomy was reported by Yaşargil in a textbook in 1984.³ In 1987, Yaşargil et al modified this approach to include an

interfascial dissection to preserve the frontalis branch of the facial nerve.⁴ The morbidity of the pterional craniotomy includes fascial nerve palsies, temporomandibular joint pain, and temporal muscle atrophy.⁵ Trying

**Aganetha “Agnes Fast” Anderson (1883–1977) was a nurse known as “Florence Nightingale of Steinbach” and was born in 1883 in Canada. Agnes became a local hero in 1918 when she helped fight the Spanish flu epidemic in Steinbach. A local school was converted into a makeshift hospital where Agnes worked tirelessly from September to December in 1918. Her service and dedication saved many lives. Only one young woman was known to have died under her care. As the epidemic subsided in Steinbach, Agnes herself became ill. Eventually Agnes recovered and went on to finish her education, marry, and return to Steinbach, where she spent her retirement years.¹ The philosophy behind the “Agnes Fast” craniotomy encompasses this dedication, perfection, and prompt provision of care.*

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to decrease these complications rates is the intent of the current study. We describe a novel way of performing the pterional craniotomy, with complete preservation of the temporalis muscle with its attachment to its underlying bone. There is no need to cut the temporalis muscle or perform an interfascial dissection. The muscle is completely preserved, thus minimizing the associated morbidity. Moreover, given these advantages, the Agnes Fast craniotomy could be performed very quickly.

The Agnes Fast craniotomy is a safe and easy-to-perform osteoplastic pterional craniotomy; this technique also reduces the time needed for replacing the bone and its muscle attachment to less than 1 minute. Using this method in emergent surgeries, in which time is a crucial element, is highly recommended. The surgical exposure gained using this craniotomy is similar to other variations of the pterional craniotomy, described elsewhere.⁶ Cuts in the zygomatic arch, together with interfascial dissection, are added when the middle cranial base needs exposure.

OPERATIVE PROCEDURE IN SIX STEPS

Step 1 (Fig. 1): The skin incision is made in the anterior midline, just posterior to the hairline, a few centimeters back. A cleavage plain is developed using a periosteal elevator in the subgaleal plain, for the whole skin cut, to preserve the underlying muscle. The skin is then cut in a trauma flap manner on this periosteal elevator, thus preserving the muscle. The skin cut ends 0.5 cm anterior to the tragus on the zygomatic arch. Subgaleal dissection of the skin flap is performed to the line described by Yaşargil⁴ (to the fat pad). This fat pad, in the region of the fronto-temporal branch of the facial nerve, is left undissected.

Step 2 (Fig. 2): A periosteal elevator is inserted in the subperiosteal plane on the frontozygomatic process to separate the fat pad from the underlying bone. The

Figure 1 Step 1. The trauma flap skin incision.

Figure 2 Step 2. A periosteal elevator is inserted in the subperiosteal plane on the frontozygomatic process to separate the so-called "fat pad" from the underlying bone. M. temporalis, temporalis muscle.

facial nerve fibers in this area are very superficial, and using this plane will not involve them.⁷

Step 3 (Fig. 3): The temporalis muscle is separated from its frontozygomatic attachment. A periosteal elevator is inserted between the anterior part of the temporalis muscle and the frontozygomatic process, separating it from this attachment, in the subperiosteal plane.

Figure 3 Step 3. The temporalis muscle is separated from its frontozygomatic attachment. M. temporalis, temporalis muscle.

Step 4 (Fig. 4): A burr hole is placed above the most anterior part of the superior temporal line.

Step 5 (Fig. 5): A high-speed drill is used to perform a bone cut encircling the temporalis muscle and ending in the posterior zygomatic root. This same maneuver is used to connect the burr hole to the anterior superior temporal line.

Step 6 (Fig. 6): A bone flap elevator is used to break the squamosphenoid line. This should be a gentle maneuver, and there is no need for much force to break this thin line. In our experience, the break line is almost in the same place, every time, connecting the lateral part of the sphenoid ridge to the posterior bone cut line (Fig. 7). This osteoplastic flap should be enough to expose the sylvian fissure. If there is a need to approach the middle fossa base, a cut is performed in the anterior and posterior attachments of the zygomatic arch, following an interfascial dissection. The osteoplastic flap is now retracted away from the middle cranial base.

RESULTS

The Agnes Fast craniotomy was performed on five cadaveric heads, 10 cadaveric sides. The exposure gained, ease in application, length of the procedure, and complications were recorded in all specimens. The procedure was performed in all heads in less than 5 minutes, with replacement of the muscle in 1 minute. When we needed to expose the sylvian fissure or the sphenoid ridge, there was no need for an interfascial dissection (Fig. 7). The zygomatic arch cut was per-

Figure 4 Step 4. A burr hole is placed above the most anterior part of the superior temporal line. M. temporalis, temporalis muscle.

Figure 5 Step 5. A high-speed drill is used to perform a bone cut encircling the temporalis muscle and ending in the posterior zygomatic root. This same maneuver is used to connect the burr hole to the anterior superior temporal line. M. temporalis, temporalis muscle.

formed in five sides to expose the middle fossa base. In these cases, we added an interfascial dissection to the above-mentioned technique. No cut was made in the temporalis muscle in all the heads studied. The muscle

Figure 6 Step 6. A bone flap elevator is used to break the squamosphenoid line. This should be a gentle maneuver, and there is no need for much force to break this thin line. In our experience, the break line is almost in the same place every time, connecting the lateral part of the sphenoid ridge to the posterior bone cut line. M. temporalis, temporalis muscle.

Figure 7 (A) The osteoplastic flap. This image shows the exposure gained using the Agnes Fast craniotomy. (B) The osteoplastic flap. This image shows the exposure gained using the Agnes Fast craniotomy following removal of the temporal squama.

also preserved its bony attachment on the temporal and sphenoid bones.

Performing the Agnes Fast craniotomy without an interfascial dissection is very fast, and the resulting osteoplastic flap is quite thick. However, as is shown in Fig. 7, the osteoplastic flap is not in the surgical corridor. We recommend that surgeons who are uncomfortable with this bulk either retract it with a sterile cover or remove part of the temporal squama (Fig. 7B).

When there is no need to expose the middle cranial fossa, this option is the simplest, offering an exposure of the superior half of the temporal lobe and the whole frontal lobe. If there is a need for a larger exposure, an interfascial dissection is added, and the zygomatic arch is cut. This maneuver offers the ability to expose the middle fossa base and the temporal pole.

DISCUSSION

The need for a simple, fast, safe way to perform the pterional craniotomy emerges from its daily use in emergent and elective surgeries. The need for a way to perform this craniotomy without a cut in the temporalis muscle is derived from the functional and cosmetic problems noticed in patients following this craniotomy.⁸

Since its introduction, the pterional craniotomy and its modifications or extensions were used extensively all around the world. This approach, however, resulted in morbidity, mostly associated with damage to the frontal branch of the facial nerve and temporalis muscle atrophy.

Mobilizing the temporal muscle was termed “one of the most used neurosurgical maneuvers”; however, this mobilization frequently causes postoperative mastication problems and postsurgical muscle atrophy.⁵ The need for a simple, fast, and easy way to perform a pterional craniotomy while preserving the temporalis muscle entirely with its bony attachment is the result of these considerations.

Many neurosurgeons proposed revision for the pterional craniotomy. Spetzler et al⁹ and de Oliveira et al¹⁰ described a different way of mobilizing and replacing the temporalis muscle to the bone. Horimoto et al¹¹ described a subfascial dissection to preserve the facial nerve. Zager et al¹² used microscrews to return the temporalis muscle to its place, and later, another reapproximation technique was introduced, which utilized drilling the bone along the superior temporal line. This drilling was followed by suturing the muscle to these drilled holes.⁶ Matsumoto et al presented an alternative method, in which a split myofascial bone flap and a free bone flap are used; they used a Gigli saw, with two cuts in the temporalis muscle, to prevent dissection of the temporalis muscle from its bone.¹³ Matsumoto et al¹³ suggested leaving the upper anterior two-thirds of the pterional bone flap undissected from the temporalis muscle, by moving the unit as a myofascial bone flap.¹³ Using this technique, one can achieve a pterional craniotomy with mild dissection of the temporalis muscle. This technique, however, uses a Gigli saw to cut the bone, takes longer time, and does require a cut in the temporalis muscle. The Gigli saw, as described by these authors, is used on the bone below the temporalis muscle and probably causes laceration of this muscle, to a certain degree.

The Agnes Fast craniotomy preserves the temporalis muscle completely, with its vascular supply, nervous innervation, and bony attachment, together with its fascia. The temporalis fat pad is also completely preserved, without dissection. The exposure gained using this technique is described in Figs. 6A and 6B. We do not think that the osteoplastic flap is in the surgical corridor, and a simple draping of the flap with downward retraction seems adequate. The cut of the squamous part of the temporal bone decreases the flap size (Fig. 6B) and may be added, in some instances, requiring middle cranial fossa base exposure.

Neurosurgical emergencies pose a real challenge for neurosurgeons, and in many instances, time is a crucial factor. In these cases (e.g., epidural hematoma, uncal herniation, and so forth), the expedience of our modification might reduce the associated morbidity and mortality.

CONCLUSION

The Agnes Fast craniotomy offers a valid, simple, and fast way of performing a pterional craniotomy, without cutting or separating the temporalis muscle from the underlying bone. In addition, the need for an interfascial dissection is circumvented. Replacing the muscle is also fast, and the muscle regains its exact preoperative position.

This method should be used at least in emergent settings for its simple and rapid exposure of the dura.

REFERENCES

1. Brown SHH. Anderson, Aganetha "Agnes" Fast (1883–1977). Global Anabaptist Mennonite Encyclopedia Online June 2006. Available at: <http://www.gameo.org/encyclopedia/contents/A5351.html>. Accessed December 3, 2009
2. Salcman M, Kempe LG. Kempe's Operative Neurosurgery. 2nd ed. New York: Springer; 2004
3. Yaşargil MG. Microneurosurgery: In 4 Volumes. New York: Thieme Stratton; 1984
4. Yaşargil MG, Reichman MV, Kubik S. Preservation of the frontotemporal branch of the facial nerve using the interfascial temporalis flap for pterional craniotomy. Technical article. *J Neurosurg* 1987;67:463–466
5. Kadri PA, Al-Mefty O. The anatomical basis for surgical preservation of temporal muscle. *J Neurosurg* 2004;100:517–522
6. Day JD, Levy M, Fukushima T. Temporal muscle fixation. *J Neurosurg* 1995;82:701; author reply 701–702
7. Salas E, Ziyal IM, Bejjani GK, Sekhar LN. Anatomy of the frontotemporal branch of the facial nerve and indications for interfascial dissection. *Neurosurgery* 1998;43:563–568; discussion 568–569
8. Oikawa S, Mizuno M, Muraoka S, Kobayashi S. Retrograde dissection of the temporalis muscle preventing muscle atrophy for pterional craniotomy. Technical note. *J Neurosurg* 1996;84:297–299
9. Spetzler RF, Lee KS. Reconstruction of the temporalis muscle for the pterional craniotomy. Technical note. *J Neurosurg* 1990;73:636–637
10. de Oliveira E, Tedeschi H, Siqueira MG, Peace DA. The pretemporal approach to the interpeduncular and petroclival regions. *Acta Neurochir (Wien)* 1995;136:204–211
11. Horimoto C, Toba T, Yamaga S, Tsujimura M. Subfascial temporalis dissection preserving the facial nerve in pterional craniotomy—technical note. *Neurol Med Chir (Tokyo)* 1992;32:36–37
12. Zager EL, DelVecchio DA, Bartlett SP. Temporal muscle microfixation in pterional craniotomies. Technical note. *J Neurosurg* 1993;79:946–947
13. Matsumoto K, Akagi K, Abekura M, Ohkawa M, Tasaki O, Tomishima T. Cosmetic and functional reconstruction achieved using a split myofascial bone flap for pterional craniotomy. Technical note. *J Neurosurg* 2001;94:667–670