The Coronal Flap in Oral and Maxillofacial Surgery – A Case Report

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Abstract

The coronal scalp flap is a versatile and aesthetically pleasing approach for access to the cranial vault, cranial base, forehead, nose, upper and middle third of the face, and orbits. In spite of its extensive nature, it is associated with few complications when properly planned. Despite, its versatility of the coronal flap, its use by oral and maxillofacial surgeons is limited especially in Nigeria. A case of surgical remodeling of fibrous dysplasia of the right supra orbital bone region using coronal approach is reported. This article highlighted surgical technique of coronal flap and indications for the use of coronal flap in maxillofacial surgery. Similarly, possible complications of the procedure, prevention and management of such complications were also emphasised. Additionally, it is meant to serve as a guide to young practising surgeons in Nigeria. It is our hope that this will embolden young surgeons in Nigeria to employ its use when indicated.

Key words: Coronal; flap; maxillofacial; surgery.

Introduction

The coronal scalp flap is a versatile and aesthetically pleasing approach for access to the cranial vault, cranial base, forehead, nose, upper and middle face, and orbits, with minimal morbidity [1-5]. It can be easily combined with transconjunctival, subcilliary or mid-lower eyelid incisions to facilitate simultaneous exposure of the orbital floor[6-8]. These factors, coupled with the aesthetic advantage of a scar hidden in the hairline, account for its continued popularity[1]. It is an ideal incision for approach to upper one-third of facial skeleton and the anterior cranium for purposes of tumour removal, reconstruction following trauma or ablative surgery, frontal cranioplasty and cosmetic procedures[9] . Initially described by Hartley and Kenyon in 1907 and later by Babcock in 1912 [10,11] , it gained widespread popularity in craniomaxillofacial surgery after Tessier and later Henderson and Jackson used it for LeFort II and III osteotomies and reported excellent access for these procedures[10-13].

Maxillofacial surgeons have used the coronal flap for over five decades to gain access to the craniofacial skeleton[1]. Nevertheless, its employment in maxillo-facial surgical procedures in Nigeria is limited as few surgeons have reported its use for maxillofacial surgical procedures[14-18]. The extensive nature of the coronal flap and associated morbidity (particularly bleeding) are major concerns for young and inexperienced surgeons. We report a case of surgical paring down (modeling osteotomy) of craniofacial fibrous dysplasia of the right frontal bone in a young Nigerian female patient using this approach. The objective is to highlight the indications, contraindications, complications and pitfalls of the surgical procedure.

Case report

A 22 year old female presented with a 15 year history of right supra-orbital bony hard swelling secondary to trauma. The right supra-orbital swelling spans the full extent of the right eyebrow (mesio-laterally) and from the hair line to the superior extent of the eye lid (supero-inferiorly) measuring 5cm by 5cm. It was bony hard with normal overlying skin. There was no sign of inflammation or differential warmth. Normal eye movements and function were intact and medical history was not contributory. A diagnosis of Fibrous Dysplasia of the right supra-orbital frontal bone was made (Figures 1a and b). Modelling Osteotomy using a coronal flap was carried out under general anaesthesia.

a

b

Figure 1a and b: Pre Operatives Images (vertex and Frontal views) of right supraorbital Fibrous Dysplasia

The Operative Procedure

1. The patient was intubated trans-orally followed by routine scrubbing and draping.
2. The outline of incision was marked with indelible marker. The outline extends just anterior to the helix of the right ear through the temporal region, and about 2cm posterior to the hair line across the scalp to the left temporal region just anterior to the helix of the left ear (figure 2).

Figure 2: Incision markings after infiltration with 1:200,00 Adrenaline

3. The operative site was infiltrated with 1:200,000 Xylocaine with Adrenaline.
4. The incision was made along the surgical markings through skin, subcutaneous tissue, galeal; aponeurosis, pericranium to the bone.
5. Haemostasis was achieved with Raney clips and Cushing forceps.
6. The coronal muscoperiosteal flap was reflected anteriorly to expose the frontal bone bilaterally. The right lateral and superior orbital walls were inspected and found to be free of lesion.
7. Modelling Osteotomy: The margins of the lesion were delineated by drilling with a fissure bur to a depth of about 2-3mm at about 0.5cm from the expanded bone margin. This is to minimize the chances of uncontrolled splitting of the bone. The involved supraorbital bone was thereafter subdivided into segments and removed in sections with mallet and fine chisel/osteotome. Sharp bone edges were smoothened with round bur under copious irrigation with normal saline (Figure 3).

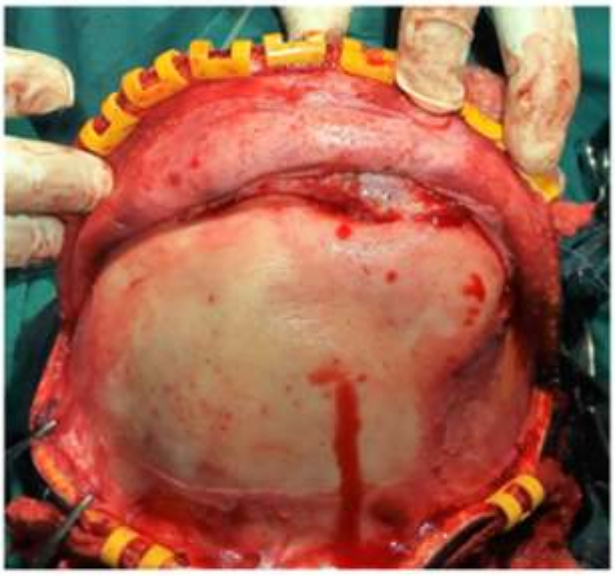

Figure 3a: Exposed lesion

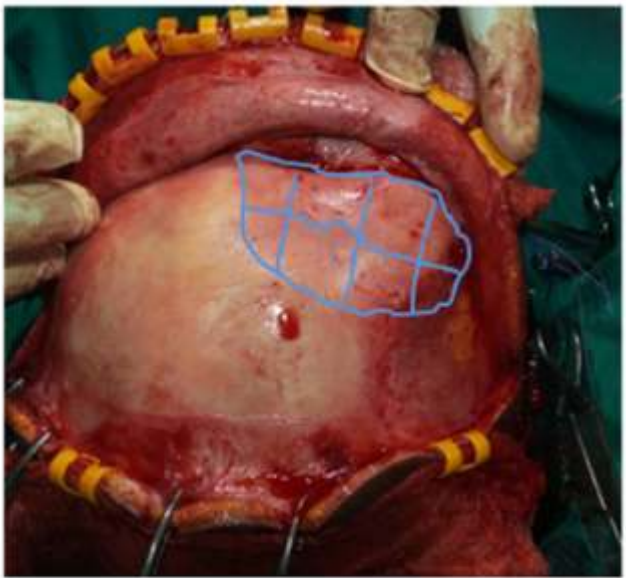

Figure 3b: The pilot bone cutting

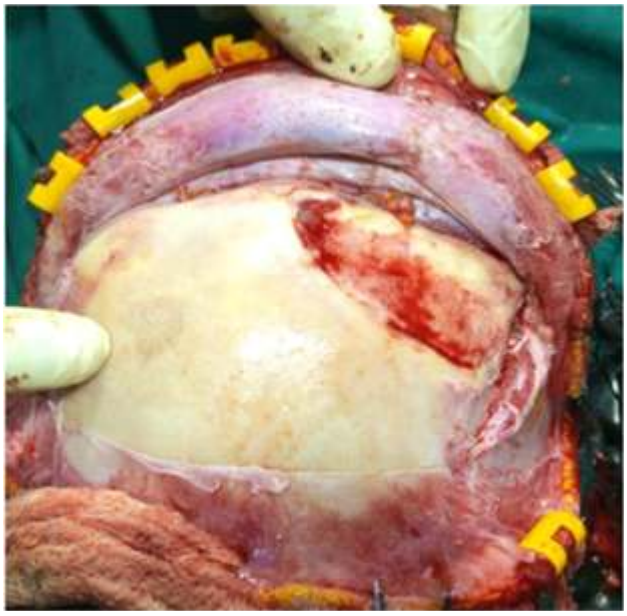

Figure 3a shows the exposed lesion, Figure 3b depicts the pilot bone cuttings while Figure 3c shows remodeled frontal bone

8. Haemostasis was achieved.
9. Closed suction surgical drain was inserted through untouched scalp about 3cm posterior to the incision line placed across the incision and the supraorbital region and secured with non absorbable suture.
10. The coronal musculoperiosteal flap was replaced and sutured in layers using absorbable suture for the galea/subcutaneous tissues with the skin closed using staple pins.
11. The wound was dressed with bandage with minimal pressure.

* To permit exposure of both (R) and (L) supra orbital bone for comparison during modelling osteotomy

Surgery was well tolerated and the drain was removed 48 hours postoperatively. Post-surgical assessment was satisfactory and the patient was discharged home on the 5th postoperative day (Figure 4)

Figure 4a: Patient on 5th post operative day

Figure 4b: Patient on one month post operative

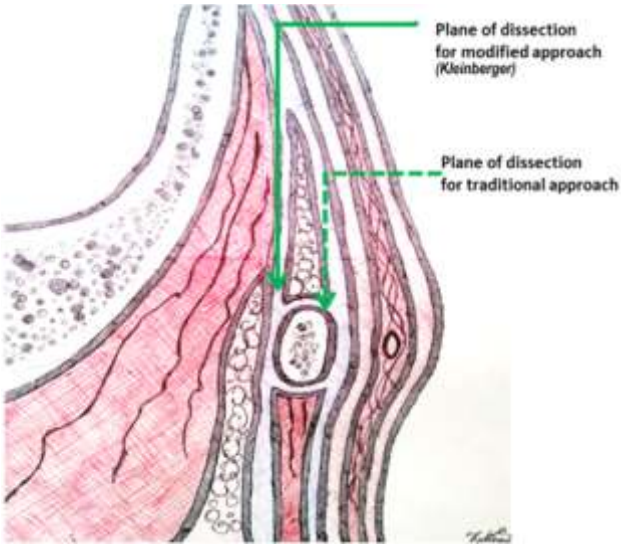

Figure 5: The planes of dissection using the traditional coronal(sub-temporoparietal fascia) approach (broken line) and surgical technique with dissection deep to the temporalis fascia (bold line). Pictures adapted from (Kleinberger et al. Otolaryngology--Head and Neck Surgery. 2015; 152(4):655-60.)

Figure 6: Stationery Paper Clip (a) and Raney Clips (b)

Discussion

The coronal incision is a well-recognised approach that provides very wide exposure of the entire frontal and mid facial region[2]. The exposure also provides access to calvaria grafting when indicated[7,19]. It provides access to the medial, superior and even lateral orbital walls where concomitant fractures requiring treatments may be present. It can be easily combined with transconjunctival, subcilliary or mid-lower eyelid incision to facilitate simultaneous exposure of the orbital floor[6-8]. Maximum exposure of upper one-third of facial skeleton and fronto-parietal region of cranium is achieved by this incision. This helps in management of extensive cranio-maxillofacial trauma and concomitant neurosurgical procedure, correction of craniofacial deformities, and facilitates harvest and placement of cranial bone grafts[2,20]. In addition, it provides access for osteotomies of upper and middle one third of face[13,21]. It is also indicated in the management of Le Fort fractures especially Le Fort II and III as well as Naso-Orbito (Ethmoidal (NOE) fractures[13-14]. Extension of coronal incision into preauricular area ensures access to temporomandibular joint (TMJ) and zygomatic arch and bone[22]. Therefore, this modified coronal approach can also be used in the management of zygomatic arch/complex fractures as well as TMJ and condylar fractures where necessary. In these cases, a preauricular extension will be mandatory for surgical access. Whenever such extensions are required the likelihood of trauma to facial nerve branches increases. Reports in the literature indicated a 2.7% to 15% incidence of facial nerve injury using the traditional approach[13-14].

In the traditional approach, the plane of dissection is deep to tempoparietal fascia within the underlying loose areolar tissue to avoid injury to frontal branch of facial nerve. Kleinberger et al[9] modified approach involves a deeper plane of dissection between temporalis fascia and muscle. The authors reported

0% injury to frontal branch of facial nerve using the sub-fascial approach in 271 cases for cosmetic procedures[9]. The classical approach to the frontal bone modeling osteotomy (pairing down) for fibrous dysplasia was described. This approach will also be adequate for frontal bone NOE and Le Fort III fractures. It also provides good cosmetic result as well as avoids injury to facial nerve structures. Therefore, there was no need for a preauricular extension of the incision. In this case, an alternative approach would have been a lateral eye brow incision. However, access would have been limited and the frontal bone on the left side will not be directly visualised to serve as a guide for modeling osteotomy.

Every surgical approach has its advantages and disadvantages; the coronal flap is not an exception. The major disadvantage is the complex anatomy/high vascularity of the temporoparietal scalp. This is responsible for the rather prolonged operative access time (which can be up to one hour). The temporalis fascia is the major anatomic structure that differentiates the suprafascial (traditional) approach from the subfascial (Kleinberger et al) approach (Figure 5). There is no doubt however, that the coronal flap offers wide surgical access to the upper and middle third of the facial skeleton with few serious long term complications[23].

Complications reported in the literature include scarring, bleeding, hematoma, alopecia, facial nerve injury (especially frontal and temporal branches), infection and seroma. Others included sensory disturbances, temporal hollowing, and ocular injury[9]. Despite these shortcomings, the rate of morbidity is low. Kerawala et al[1]reported generally low postoperative morbidity with few permanent complications in their study of 68 subjects with surgical modification in male pattern baldness.

Some of the morbidity and complications of coronal approach can be avoided through proper planning and modification of the incision. For instance dissection deep to temporalis fascia for the purpose of facial nerve preservation (Figure 5) has been proposed by Kleinberger et al[9]. This provides greater protection for the frontal branch of the facial nerve. A review of 271 patients with the modified approach by Kleinberger et al[9] recorded no facial nerve injury. The utilization of this approach also prevents development of temporal hollowing. Furthermore, damage to the supra-trochlear and infra-trochlear nerves with resultant sensory disturbance (anesthesia or paresthesia) of the affected regions can be prevented by avoiding injury to the respective nerves. The supraorbital nerves should be dissected out if they run through a groove or chipped out with an osteotome if they travel through a notch. Also, keeping the dissection in the sub-periosteal plane on the medial aspect of the orbit helps to prevent nerve injury[2].

Similarly, no ocular complication was noted as the lesion is limited to extra ocular bone. Other modifications of coronal flap techniques to avoid scar exposure involves placement of the incision posteriorly towards the occipital region in those with baldness or those that are prone to baldness (from family history)[1], a gull-wing or W-shaped incision and the use of six short linear incisions [1,24]. Although the coronal incision scar can be concealed within a hairy scalp; which is obtainable in black females as seen in this case. However, black men naturally have short hairs, and therefore the scar may not be easily concealed as they age. To overcome this a modified coronal flap (towards the occipital region) can be used[9] or it can be easily disguised with the use of a cap[14,25].

Other possible post-operative complications include hematoma due to wide dissection of scalp which can be prevented by meticulous hemostasis and the use of a suction drain. The scalp is highly vascularized and as such excessive hemorrhage may be a common challenge. Various methods have been used to achieve hemostasis of coronal incisions. These included the use of surgical (Raneys) clip, Cushing forceps, cautery, injection of lidocaine with epinephrine [2]. In this case a combination of these methods was used. Also the use of the stationery paper clips (Figure 6) as a simple method of controlling scalp bleeding has been reported by Waknis et al [26].

Proper closure of the detached tissues is critical to achieve optimal esthetic outcomes. For instance, stripping of temporalis muscle from the temporal surface of the orbit would require suspension of same to prevent a hollow appearance in the temporal region. This can be achieved by suturing the anterior edge of the temporalis muscle to a stable superior structure or through drilled holes at the posterior edge of the orbital rim. Similarly, suture resuspension of the soft tissue is necessary if there is wide exposure of the malar and infraorbital regions through suspension of suture through the deep surface of the periosteum of the malar region to the temporalis fascia or another stable structure to prevent "drooping" of the soft tissues[27].

In spite of the versatility of the coronal flap, its use in the maxillofacial surgery amongst oral and

maxillofacial surgeons in Nigeria is limited. Akadiri[14] reported that only 18.2% of the surgeons (OMFS, ENT and Plastic Surgeons) had used it for the treatment of NOE fracture. The proportion of the respondents in the study actually amounted to less than five surgeons[14]. Other documented cases are case reports for surgical excision of craniofacial mucoceole and osteoma[14-18].

Conclusion

The coronal flap has been found useful in the management of trauma and deformity of the mid and upper facial skeleton, particularly when combined with the need for access to the anterior cranial fossa. It is also a well-recognised technique for accessing upper and middle facial thirds. In spite of its extensive nature, it is associated with few complications, with good aesthetic outcomes and low morbidity when properly planned. Oral and maxillofacial surgeons in Nigeria need to use this approach more frequently and report their experiences. Interdisciplinary collaborations with the Neurosurgical team and anatomical cadaveric dissection sessions and courses with the Anatomy departments will enhance the skills of young oral and maxillofacial surgeons in this regards.

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