

Management of Large Dural Defect with CSF Leak in Hypertelorism Correction

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Abstract

The Rationale: Dural tear is a serious complication during hypertelorism corrective surgeries. Identifying the tear and managing requires considerable expertise. Managing large dural tears correctly is necessary to prevent cerebrospinal fluid (CSF)-related complications in craniofacial surgery. **Patient Concerns:** The patient presented with hypertelorism as a part of the Tessier Cleft 0 and sought to correct the widely placed eyes. **Diagnosis:** Large critical-sized dural tear during modified box osteotomy surgery. **Treatment:** Besides successful modified box osteotomy surgery, the critical-sized dural tear was managed with fascia lata and fibrin glue. **Outcomes:** There was no CSF leak or related complication postsurgically indicating successful sealing and healing of the dural tear. **Take-Away Lessons:** The synergistic mechanism by which fascia lata graft and fibrin glue help to hermetically seal the critical-sized defect, especially when there are variable amounts of hydrostatic-hydrodynamic forces of CSF exerting pressure on the patched area, is discussed.

Keywords: Anterior cranial fossa, box osteotomy, dural tear, fascia lata, fibrin glue, hypertelorism, midline facial cleft, CSF leak

INTRODUCTION

Craniofacial clefts are rare, disfiguring congenital anomalies, and have been classified by Prof. Paul Tessier. The type 0 cleft is the most common craniofacial cleft, is median craniofacial dysraphia, and involves the midline of the face and cranium. The condition may involve cleft lip and palate and may be associated with hypertelorism. When presenting for correction, the cleft lip/palate, if present, has to be corrected and reserving the hypertelorism to be corrected as the orbital growth stabilizes.^[1,2] Hypertelorism is corrected by a box osteotomy or a facial bipartition surgery. In these surgeries, the facial cleft is obliterated and the partial facial segments rotated medially in conjunction with advancement to create a harmonious face.^[3]

Cerebrospinal fluid (CSF) leakage is well-documented complication with cranial and neurosurgical procedures. Incidence of CSF leaks is reported to be ranging from 6.2% to 42% of cases. Depending on the degree of damage, the CSF leakage would be deducted on the table as a dura mater tear or during postoperative period as a leak or a symptomatic pseudomeningocele. When the dural tear is deducted intraoperatively, it could be repaired. The treatment

options include the use of interrupted sutures; muscular fascia; periosteum; and or dural replacement materials such as synthetic grafts, xenografts, or allografts, as well as other adjunctive measures, such as fibrin sealants. Combinations of these are also used widely.^[4-6] Of this, the use of fibrin sealants is the latest and such sealants are used for tissue sealing across a range of surgical procedures, including cardiothoracic, gastrointestinal, neurosurgery, and vascular surgeries.^[7,8]

The purpose of this study was to present a case of correction Tessier 0 type of craniofacial cleft with hypertelorism with a modified box osteotomy surgery where the dura is very adherent to the base of the skull below the cribriform plate of ethmoid

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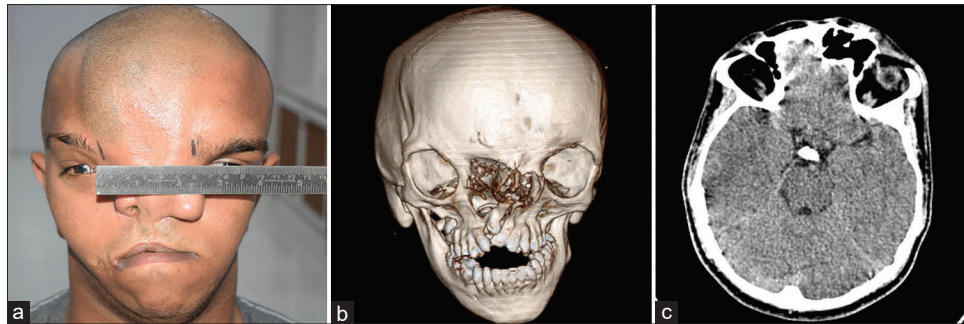


Figure 1: (a) Preoperative view showing increased intercanthal distance (68 mm), broad and flat nasal bridge, deformed nasal tip, (b and c) three-dimensional computed tomography scan revealed the absence of nasal bones with square-shaped head and temporal displacements of orbits

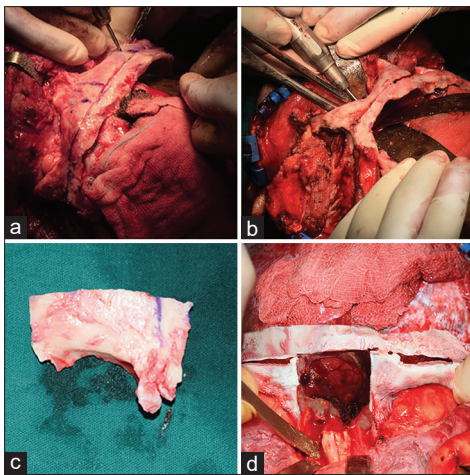


Figure 2: (a) Vertical osteotomy cuts placed perpendicular to the frontal bar, (b) circumferential osteotomy around the orbit was carried out, (c) removed median segment, (d) large asymmetrical critical-sized dural matter tear was observed at the anterior cranial fossa

where a huge dural tear with large defect was noted. This is also where the major venous channels penetrate into the inner table of the skull. The successful management of the large, critical-sized tear using fascia lata graft and fibrin glue is being presented.

CASE REPORT

A 20-year old male reported with complaints of widely placed eyes and broad nose. The patient was born with midline craniofacial cleft, cleft of lip and palate at the midline. He had already undergone unilateral cleft lip and palate correction elsewhere before 10 years. The patient's medical and family histories were noncontributory. On clinical examination, he had deformed nasal tip with broad and flat nasal bridge, retrognathic maxilla, and brachycephaly with hypertelorism. His left eye vision was normal, while his right eye had amblyopia. The intercanthal distance was 68 mm [Figure 1a]. He had a hypernasal voice. Intraoral examination shows the presence of oronasal fistula along the midline with anterior open bite and narrow maxillary arch. Imaging with three-dimensional computed tomography (CT) scan revealed the absence of nasal bones with square-shaped head, and temporal displacements of orbits [Figure 1b and c]. Based on the clinical history,

examination, and radiology, he was diagnosed as Tessier-0 cleft and cleft lip and palate with hypertelorism.

Modified box osteotomy surgery was planned. In the operation theater, in the sitting position, lumbar puncture was performed and CSF drain was placed. Later, the patient was intubated orotracheally and standard preparation was done. Transient tarsorrhaphy (temporary eyelid suturing) was performed. Through a bicoronal approach, scalp and temporalis muscle reflected. Bur holes were made 10-cm caudal to the frontocoronal suture and bifrontal craniotomy was done till 2 cm above the superciliary arch. Frontal bone flap was reflected and the frontal lobe was exposed. About 60 ml CSF fluid was drained and a small amount of Mannitol was injected to relax the brain and facilitate retraction of the frontal lobe. Below the lobe, 1 cm away, parallel to craniotomy cut, an osteotomy cut was made to create a frontal bar. Two vertical osteotomy cuts perpendicular to the frontal bar were performed till the pyriform aperture and the nasal bridge were exenterated. Following this guide, circumferential osteotomy around the orbit was carried with, 1 cm behind the central axis of the globe. During this procedure, the globe was protected using a malleable retractor. The standard osteotomy cuts were made on the roof of orbit, descended via lateral wall, and extended until the floor of orbit. Orbital floor osteotomy continued through the midline and extended medially protecting the nasolacrimal duct descending downward till the floor of orbit. The same procedure repeated on the opposite side. Through intraoral approach, osteotomy cuts made bilaterally on the anterior maxilla, the osteotomy cut does not pass through the pterygoids with no disturbance in occlusion, the right and left orbitomaxillary segments were mobilized medially as a single median segment and stabilized in the midline using transosseous wiring. During the removal of the bones along the cribriform fossa, the dura was adherent to the base of the skull in the cribriform plate region. During this manipulation, a large, asymmetrical, critical-sized dural matter tear was observed at the anterior cranial fossa, near the cribriform fossa-frontal bar-nasal area causing a nasal encephalocele. If left untreated, the nasal encephalocele could stabilize and CSF leak would commence. To correct this, fat and fascia lata were immediately harvested from lateral aspect of right thigh. The harvested grafts were placed on the defective dura

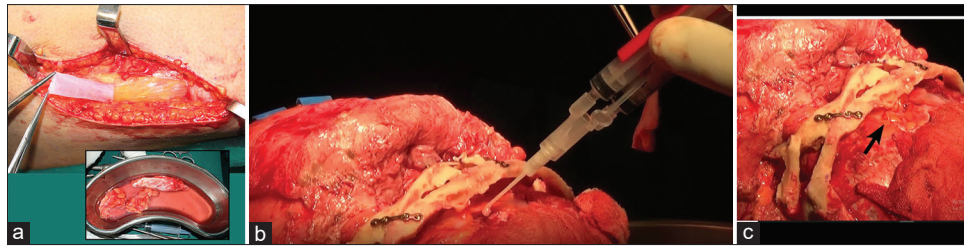


Figure 3: (a) Fat and fascia lata were harvested from the lateral aspect of the right thigh, (b and c) fibrin sealants were sandwiched in between the fascial graft. Surgicel® was used to achieve haemostasis



Figure 4: (a and b) Fixations of the other segments were done using titanium plates and screws, (c) scalp were re-draped and sutured with 2.0 vicryl, surgical drain was placed and staples were placed, (d) postoperative view reduced interocular distance

of anterior cranial fossa. Fibrin sealants were sandwiched in between the fascial graft. Surgicel® was used to achieve haemostasis. Dural hitch sutures were placed. Frontal bone flap was refixed using three four holes with gap titanium plates and screws. After adequate checks, the fixations of the other segments were done using titanium plates and screws. Exenterated nasal bridge was used as a graft in defective temporal sites. Later, the scalp was re-draped and sutured with 2.0 vicryl, surgical drain was placed, and staples were placed. All donor sites were appropriately closed. The patient was closely observed and provided with appropriate nonsteroidal anti-inflammatory drugs as required. The patient recovered uneventfully and there was no clinical evidence of CSF leak or nasal encephalocele [Figures 2-4]. The surgery was deemed successful as even after a year of surgery, the interocular distance remained static and in its new position.

DISCUSSION

We report a successful management of a Tessier 0 cleft with hypertelorism including a correction of large, critical-sized dural tear during the procedure. Algorithm for the management of large dural tears has been postulated in the literature for successful management.^[9] In the present case too, as it was deduced during the procedure itself, institution of remedial

procedure was feasible. An ideal dural “patch material” for a critical-sized defect would need to ensure that it maintains its integrity as a tissue layer; one which does not strongly adhere to pia mater and has a low incidence of infection.^[9] Furthermore, the reason for correction is to restore the air-watertight barrier between the brain and the sinonasal cavity as well as to provide strong mechanical support to the intracranial structures such that the nasal encephalocele does not form.^[10]

Human allograft has a risk of infections such as viruses and prions. Synthetic materials are associated with the risk of bacterial infection and adhesion. Autografts such as fascia lata are immunocompatible but might increase the operative time as well as carry inherent risk of donor site morbidity. The procedure, when combined with fibrin glue, increases the cost, but the benefits are large as compared to managing CSF leaks and potential encephaloceles. The fibrin glue functions as a haemostatic agent, as a bioadhesive as well as a fixative for injured tissue. They contain human plasma protein and thus are immunocompatible and provide the best results.^[5-8]

The repair material when in function, with time, is exposed to variable amounts of hydrostatic-hydrodynamic forces of the CSF, which by centripetal force at the edge of the dural defect tends to deflect the material from the site of repair. In our case, the site also is stabilized by glue as well as sutures. It is known that with higher elastic property, the graft would bear more quantity of hydrodynamic and hydrostatic load, thus lowering the centripetal force at the edge of the dural defect, thereby helping to avoid dehiscence.^[10] The fascia lata is the preferred autologous material for the reconstruction of a dural defect in the anterior cranial fossa.^[9] However, the fascia lata is stiffer, could bear more force when stabilized with sutures, and biomechanically completely different material as compared to temporalis fascia. Currently, temporalis fascia is shown to have sufficient elastic capability to cater to medium and large defects too.^[10]

With the fascia lata secured by sutures and glued with fibrin, the chance of CSF leaks becomes reduced, even with varying degrees of hydrostatic-hydrodynamic forces in any form. Hence, the chance of postoperative CSF leak and the possibility of nasal encephalocele were averted.

CONCLUSION

A large, critical-sized dural tear was observed during correction

of Tessier 0 cleft associated hypertelorism correction in the anterior cranial fossa. This tear was successfully managed and the patient recovered uneventfully as well as the intercanthal distance was greatly reduced postoperatively. The patient had no signs and symptoms of CSF leak or nasal encephalocele or intercanthal distance increase.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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