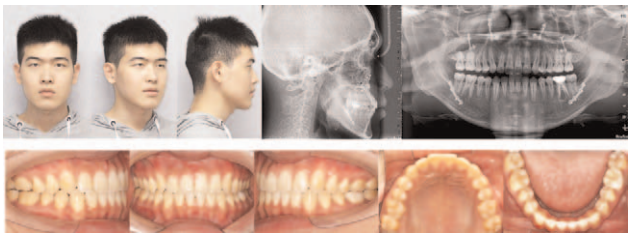

FIGURE 2. X-rays, Intraoral, and extraoral images after completion of treatment.

well-developed chin. During surgery, an interim splint was used for maxillary position localization, while the final splint was fixed in the mouth for 1 month postoperatively.[3] Intermaxillary elastics were used to maintain the intercuspal occlusion position of the jaws. At two months postoperatively, the degree of mouth opening for this patient had recovered to approximately two and a half fingers. A new series of Invisalign aligners were then designed via the rescanning of the postoperative dentition and occlusal relationship to finalize treatment (Fig. 2).

DISCUSSION

There are several advantages to apply the Invisalign system in combination with orthognathic surgical approaches in patients being treated for severe craniofacial deformities. First, this approach can better meet the aesthetic demands of adult patients while better allowing them to adapt their speech and articulation during treatment. This system also decreases the soft tissue discomfort relative to that associated with labial or lingual fixed orthodontic appliances.[4] Second, this system is not associated with any dietary restrictions, making it far easier to maintain normal patient oral hygiene and periodontal health. Third, mini-screws are used for intermaxillary fixation and intermaxillary elastics during and after the operation, thus avoiding the need for the use of the traditional labial arch, enabling patients to conduct intermaxillary elastics on their own. Postoperatively, patients also require far fewer intraoral orthodontic devices, improving the healing of surgical incisions and reducing the odds of traumatic ulcer development. While this approach is promising, the Invisalign therapeutic approach is subject to certain limitations. The requirements that Invisalign aligners be worn for 20 to 22 hours per day and those chewies be used for $>$ 10 min per day necessitate excellent patient compliance. Presurgical screw implantation also has the potential to damage tooth roots.[5] In addition, appropriate 3D control of tooth movement using the Invisalign aligners can be challenging, making this approach difficult for certain premolar extraction cases. The use of the Invisalign system also substantially increases treatment-related costs for the patient.

CONCLUSIONS

In patients with jaw deformities who do not require premolar extraction for pre- or post-operative orthodontic treatment, the Invisalign system can be effectively utilized as a better replacement for traditional orthodontic appliances.

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OPEN

Immediate Resection and Reconstruction of Encephalocele in the Craniofacial Region

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Introduction: Congenital meningoencephalocele is a herniation of brain and meninges through a skull base defect. It may result not only in neural defects, sensorimotor deficits, neurological morbidities, visual impairment, impaired nasal function, and a potential risk of intracranial infection. Goals of surgery include removal or repositioning of nonfunctional cerebral tissue, closure of the dura, and reconstruction of skeletal and cutaneous structures.

Materials and Methods: The authors present the case of a 4-months-old infant who was found to have a frontoethmoidal encephalomeningocele that was only discovered after birth, the

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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.

The study was approved by the Ethical Review Board of Third People's Hospital of Xinjiang Uygur Autonomous Region. Written informed consent was obtained from enrolled patients.

The authors report no conflict of interest.

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volume increased gradually. After multiple department discussions, the procedures were planned in 2-staged surgical protocol comprising of the first stage urgently performed by neurosurgeon and craniomaxillofacial surgeon, which aimed at removal or repositioning of nonfunctional cerebral tissue, closure of the dura, and reconstruction of skeletal; then second stage was performed by plastic surgeon to correct craniofacial hard and soft tissue deformities.

Results and Conclusions: The surgical procedures for frontoethmoidal encephalomeningocele are complicated, particularly for the infant. In order to achieve the final surgical purpose, it needs multiple department cooperation to make the surgical plans.

Key Words: Encephalocele, frontoethmoidal encephalomeningocele, meningocele, meningoencephalocele

Congenital meningoencephalocele is a herniation of brain and meninges through a skull defect. Meningoencephaloceles can be categorized as occipital, parietal, basal, and sincipital lesions.[1,2] Suwanwela and Suwanwela[3] have subdivided sincipital encephaloceles into frontoethmoidal, interfrontal, and those associated with craniofacial clefts. The frontoethmoidal group is further subdivided into nasofrontal, nasoethmoidal, and naso-orbital types. Frontoethmoidal encephalomeningocele manifests as a clinically visible facial mass along the nose and its location and size varies depending on the variety.[4]

SURGERY PROCESS

A 4-months-old male infant presented with swelling between the forehead and nose, which had been present since birth, had progressively increased in size and easily been noticeable over the past 1 month, with an increased intercanthal due to the mass between the eyes. This mass looked/showed irregular in shape with little bumps and indistinct with surrounding tissue, with high local tension, almost to ruptured (Fig. 1A).

Computed tomography scan (with three-dimensional reconstruction) and magnetic resonance imaging revealed a frontoethmoidal encephalocele. The ethmoidal plate of the anterior cranial fossa was absent, the brain parenchyma herniated forward and downward, and protruded into the bilateral orbit. The nasal bone was slightly everted, the bilateral eyeballs were compressed to the lateral deviation. The posterior horn of bilateral ventricles was enlarged, and the midline structure was centered (Fig. 1B-F).

After multidisciplinary discussions, the surgical procedures were planned in 2 stages, the first stage was performed by a neurosurgeon, which aimed at removal or repositioning of nonfunctional cerebral tissue, closure of the dura, and reconstruction of skeletal; then second stage was performed by plastic surgeon to correct craniofacial soft tissue deformities.

The first surgical procedure was performed when the patient was 4 months old. The cranial approach was employed using the standard bicoronal incision. This incision should be as anterior as possible while staying behind the hairline (Fig. 2A). The incision does not always need to reach the tragus, but it at least should reach the level of the superior edge of the pinna. The scalp incision should leave the pericranium, temporalis muscle, and fascia intact (Fig. 2B). Elevate a vascularized pericranial graft as a separate layer. Monopolar electrocautery disconnects the posterior and lateral attachments of the pericranium (to the superior temporal line). This vascularized graft would be reflected and based anteriorly along the orbital rims. A single burr hole was placed over the anterior superior sagittal sinus, a bilateral coronal craniotomy was performed, the dura was then carefully dissected from the calvarium, burr holes in the region of the forehead were avoided for cosmetic reasons. After detaching all adherent dura from its undersurface, exposing the underlying frontal lobes of the brain (Fig. 2C).

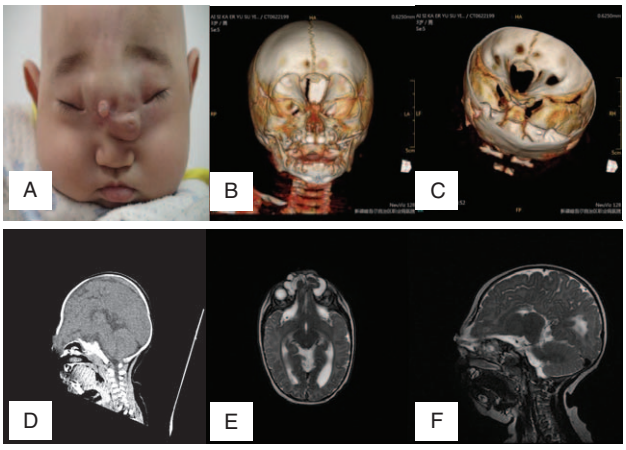

FIGURE 1. (A) A 4-months-old male infant swelling between the forehead and nose, had progressively increased in size and to be easily noticeable over the past 1 month, with an increased intercanthal because of the mass between the eyes. This mass irregular in shape with little bumps on it indistinct with surrounding tissue, with high local tension, almost break up. (B-F) CT scan (with 3D reconstruction) and MRI demonstrate a frontoethmoidal encephalocele. The ethmoidal plate of the anterior cranial fossa was absent, the brain parenchyma herniated forward and downward, and protruded into the bilateral orbit. The nasal bone was slightly everted, the bilateral eyeballs were compressed to the lateral deviation. The posterior horn of bilateral ventricles was enlarged, and the midline structure is centered. 3D, three-dimensional; CT, computed tomography; MRI, magnetic resonance imaging.

The frontal lobes were carefully retracted epidurally, the large skull defect was found at the junction of frontal bone and ethmoid bone. After identifying the bone defect, the herniated portion of abnormality was opened and noted to contain brain tissues. Removing the herniated portion of brain tissue, separating the dura mater at the skull base, taking part of the periosteum to repair the dura mater

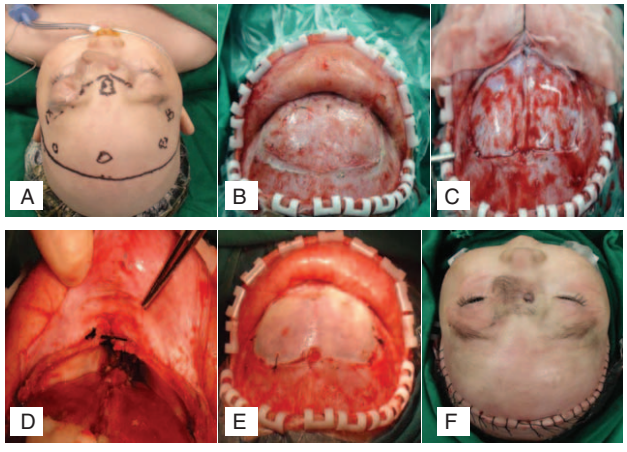

FIGURE 2. (A) A bicoronal incision is designed (dark solid line). (B) The scalp incision should leave the pericranium, temporalis muscle, and fascia intact. (C) A bilateral coronal craniotomy was performed. (D) Craniomaxillofacial surgeon reconstructed the craniofacial deformity and correction of hypertelorism covered the surface of the reconstructed orbital rims using by the rest of the periosteum. (E) The bone flap was put back in place, fixed. (F) After the operation, the mass of the nose root was obviously reduced, and the local tension significantly reducted, we can see the correction of the hypertelorism.

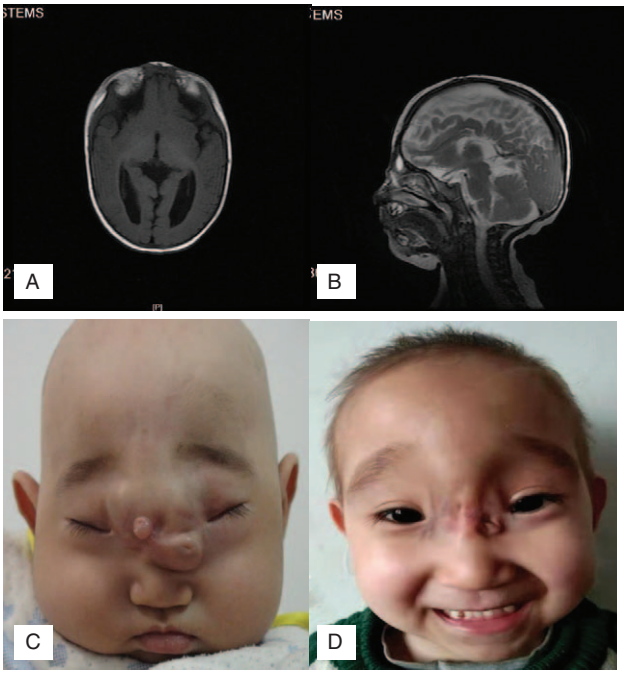

FIGURE 3. (A-B) Postoperative MRI demonstrates the total removal of the encephalocele. (C) Preoperative photographs of representative the patient. (D) 1 year postoperative appearance of the patient showing the mass of the nose root was disappeared unless there is some craniofacial soft tissue deformities on the skin and it will correct by plastic surgeon. MRI, magnetic resonance imaging.

and watertight closure of the dura (see Supplemental Digital Content, Video 1, http://links.lww.com/SCS/C999). Then craniomaxillofacial surgeon reconstructed the craniofacial deformity and corrected the hypertelorism by removal of central sections of bone and bringing the medial walls of both orbits closer together with suture, covered the surface of the reconstructed orbital rims using by the rest of the periosteum (Fig. 2D). The bone flap was put back in place and fixed with suture (Fig. 2E). After surgery, the mass of the nose root was obviously reduced, and the local tension significantly reduced. The correction of the hypertelorism was visible (Fig. 2F).

Antiepileptic medication and broad-spectrum antibiotics were used prophylactically. Postoperative magnetic resonance imaging demonstrates the total removal of the encephalocele (Fig. 3A-B). Postoperative courses were uneventful and complication free (Fig. 3B-D).

DISCUSSION

The debate whether frontoethmoidal encephalomeningocele is a neural tube defect continuing as the pathogenesis itself is hardly understood. Many have defined it as a combination of genetic and environmental factors resulting in the pathogenesis.[5] Defects have been associated with folate deficiency and supplementation has been responsible for the decreased prevalence by up to 70%.[6]

Most are managed conservatively and repaired in a delayed manner, within months to years later, aiming to minimize surgical morbidity and mortality. However, in this case, the swelling between the forehead and nose had progressively increased in size the past 1 month, with an increased intercanthal because of the mass between the eyes, this mass looked irregular in shape with little bumps, with high local tension, almost to be ruptured anytime, if ruptured, it would result in wound infection, low intracranial pressure, local skin necrosis and cerebrospinal fluid (CSF) leakage, meningitis, etc. These were indication of urgent repair, therefore, emergency surgery was required.

Operative management could include many approaches. Treatment of frontoethmoidal is not a unique standardized procedure. In the literature, we found several different techniques, such as the classic approach of Tessier,[7,8] the Chula technique,[9] modified Chula techniques,[10] the HULA procedure and others.[5,11,12]

Because the volume of the tumor increased gradually, and the instant increase in the surface tension, possibly leading to rupture with unimaginable consequence, therefore, the operation must be carried out in emergency. (After multiple department discussions, the surgical treatment was planned in 2 stages, the first stage urgently performed by a neurosurgeon and craniomaxillofacial surgeon, which aims removal or repositioning of nonfunctional cerebral tissue, closure of the dura, and reconstruction of skeletal, second stage will be performed by plastic surgeon to correct craniofacial hard and soft tissue deformities.)

We used a modified intracranial–transcranial approach with no anterior facial surgical exposure. The advantage of this protocol was that performing the procedure with both the neurosurgeon and craniomaxillofacial surgeon present, assured an adequate elimination of the anomaly, complete dural closure, as well as correction of the craniofacial deformity.

For this procedure, a watertight and durable closure of the dural defect was particularly important, which gained by using the autologous pericranial graft harvested, whereas reflecting the scalp flap. In this way, many complications could be avoided after surgery, such as CSF leak, meningitis, epidural abscess, and brain herniation. Due to the great healing potential of the young child and the fusion of the cranial bones as a part of normal development, skull defects often heal very well,[13] therefore, no need to reconstruct the defect in the anterior cranial fossa base. The infant made an uneventful recovery and was discharged home to the care of his parents. We successfully followed up for 1 year, no CSF leakage, hydrocephalus, epidural abscess, and brain herniation was found, we planned to perform by plastic surgeon to correct craniofacial hard and soft tissue deformities.

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A Novel Septoplasty Technique for Patients With Nasal Fractures

Feifei Chen, MS, Yongyi Yan, MS, and Huicheng Gong, MS

Abstract: Nasal structures have both functional and cosmetic significance. These structures maintain the shape of the nose and regulate the nasal airflow. During trauma, fractures of the nasal bone are frequently associated with nasal septum deviations. This can lead to the nasal bone collapsing and nasal obstruction. The septoplasty technique is a major surgical intervention to improve nasal obstructions, with the submucosal resection of the deviated septum. In the past, septoplasty was deferred until the nasal bone fracture was healed to reduce the postoperative risk of saddle-nose and flat nose deformities. Advances in technology have enabled surgeons to attempt septoplasty together with a closed reduction of the nasal bone fraction. It is most important to preserve the septal support structure during surgery. Hence, we advocate that the nasal septum be reset in the midline rather than removed, by modified endoscopic septoplasty.

Key Words: Endoscopic septoplasty, nasal fracture, nasal obstruction, septal deviation

Deviated nasal septum correction is a major and frequent surgical intervention to improve nasal obstruction. In the early twentieth century, submucosal resection was first described for nasal septal deviation by Killian.[1] Although it was the foundation of modern septoplasty techniques, more aggressive resections of the cartilaginous and bony septum resulted in nasal collapse. Subsequently, Freer[2] revived this technique, which involved leaving 6 to 10 mm dorsal and caudal cartilaginous struts. He emphasized that an L-shaped cartilaginous strut was important for maintaining nasal support and minimizing the risk of nasal collapse; however, it was less effective in correcting the caudal septal deviation. To address this, there are several techniques mentioned in the current literature.[3,4] At present, there is no clinical consensus statement for septoplasty; however, these techniques are becoming more refined.

When a nasal septal deviation occurs with a nasal fracture, there are 2 key surgical points to consider: the keystone region (Fig. 1A) and the L-shaped cartilaginous strut. Septoplasty techniques should be performed without damaging these 2 areas. However, deviated cartilage resections result in narrow dorsal and caudal struts, and limited resections that preserve adequate struts along the caudal and dorsal margins often causing recurrence of the deviation. Minimal deviations in the anterior septal cartilage can significantly affect airflow resistance and result in nasal congestion. To address deviations of the septal bone, the posterior bony-cartilaginous junction is often disarticulated, and the deviated septal bone is resected. Subsequently, the stability of the keystone region is likely to be weakened. Therefore, we advocate that the nasal septum should be reset in the midline rather than removed. This study aimed to describe this surgical technique and present the results of 12 patients.

CLINICAL PRESENTATION

A total of 12 eligible patients (10 males and 2 females), with a mean age of 28.17 ± 8.63 years (range, 21–57 years) were included in this study. All patients were preoperatively diagnosed with nasal fractures and septum deviations. They were diagnosed with collapsing nasal bone and nasal obstruction. Cases that included deviation of the nasal columella and any other sinonasal disorder were excluded. The surgeries were performed by the same team of surgeons under general anesthesia. Closed reduction of the nasal bone fraction and conchoplasty of the hypertrophic turbinates were performed simultaneously.[5]

Septoplasty was performed using a 30° nasal endoscope. Operative access was performed on the convex side of the nasal cavity. An incision was made at the caudal margin of the quadrangular cartilage and the anterior edge of the deviated area. Subsequently, a broad-based septal mucosal flap was developed using suction elevators under endoscopic visualization. Subperichondrial and subperiosteal dissection could be extended to the posterior superior perpendicular plate of the ethmoid, the posterior inferior vomer, and the inferior maxillary crest. During this procedure, an important caveat was to preserve the integrity of the mucoperichondrium and mucoperiosteum. If the mucosa is lacerated, the extent of the laceration must be minimized. Cartilaginous deviations frequently occurred in a perpendicular or parallel plane, and sometimes in both planes simultaneously. To reduce the tension lines, 2 strips of the quadrangular cartilage were resected, measuring 2 to 3 mm in width. One strip was vertical, and the other was horizontal (Figs. 1B and 2A). Subsequently, to reduce the tension between the

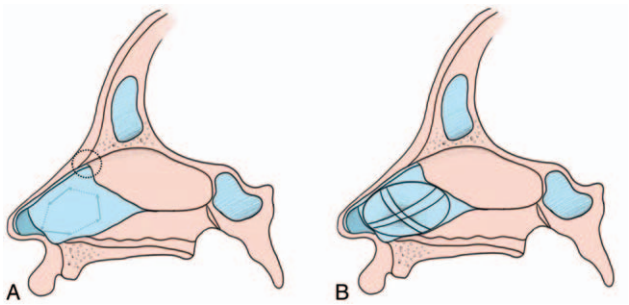

FIGURE 1. Schematic drawing. (A) The keystone region (○) and the transseptal suturing techniques (→ the ipsilateral side, → the contralateral side). (B) Resection of 2 strips of the cartilage and a ring-shaped incision.

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