Treatment of Condylar Hypoplasia in Alagille Syndrome - A Case Report

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Abstract

Rationale: Alagille syndrome is a rare genetic disorder with dental and facial abnormalities in the head-and-neck area. It is autosomal dominant and occurs in approximately 1 in 100,000 people. No cases of Alagille Syndrome (ALGS) with mandibular hypoplasia and temporomandibular joint ankyloses (TMJa) have been reported to date. **Patient Concerns and Diagnosis:** A 3-year-old female patient suffering from ALGS came to our hospital affected by unilateral mandibular hypoplasia and TMJa with severe limitation of mouth opening (maximal interincisal distance [MID] of 2 mm). **Treatment:** A two-phase surgical management approach was undertaken based on computed tomography scans and the patient's age. The first phase involved mandibular distraction, followed by arthroplasty with amniotic human membrane placement. **Outcomes:** After immediate post-surgery rehabilitation, the patient showed good mandibular function with no complications after 15 months. MID was 20 mm. **Take-away Lessons:** This is a rare and interesting case with no previous literature reports. The use of amniotic membranes in surgical management adds further significance.

Keywords: Alagille syndrome, condylar hypoplasia, human amniotic membrane, mandibular distractions, temporomandibular joint ankyloses

Introduction

Alagille syndrome (AS) is a disorder caused by defects in the Notch signalling pathway. Its features include chronic cholestasis, pulmonary artery stenosis, vertebral anomalies, characteristic facies, posterior embryotoxon and dysplastic kidneys. It is inherited in an autosomal-dominant pattern with variable expressivity. Temporomandibular joint ankylosis (TMJa) is a joint disorder that results in loss of function. Mandibular hypoplasia is a craniofacial anomaly that can impact the patient's quality of life, affecting mastication, speech and appearance. It ranges from mild flattening to complete agenesis of the condyle, ascending ramus and glenoid fossa.[1]

There are up to 60 syndromes that feature mandibular hypoplasia as a main manifestation in the literature.[2] This paper presents the case of a child with AS, TMJa and unilateral mandibular hypoplasia who underwent two-stage surgery to restore mandibular function.

Case Report

A 3-year-old female patient with AS and TMJa had severe limitation of mouth opening. The diagnosis was made at Meyer's Hospital in Florence based on clinical presentation and hepatic biopsy. DNA sequencing confirmed the diagnosis, revealing a mutation in the JAG1 gene. During the initial examination, the patient was found to have mandibular retrognathism, which made it difficult for her to open her mouth (the maximum interincisal distance was only 2 mm). The triangular shape of her face was the most noticeable sign of this condition. As a result, her quality of life was severely impacted, as she faced difficulties in eating comfortably and maintaining proper oral hygiene. In addition, she was suffering from chronic cholestasis, which was being orally treated with 180 mg of ursodeoxycholic acid (divided into 2 doses/day). The parents did not report any signs or symptoms

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Figure 1: (a) Clinical aspect with severe reduction of mouth opening. (b) Stereolithographic model of the computed tomography in frontal view (c) Hypoplasia of the left condyle resulting in mandibular asymmetry (d) Right mandibular condyle

of obstructive sleep apnoea. A 3-dimensional computed tomography (3D CT) scan was done to evaluate the mandible's condition. Left mandibular hypoplasia, reduced sigmoid notch depth, mandibular body height and ankyloses of the left temporomandibular joint (TMJ) were found [Figure 1]. The mandibular deficiency was analysed using 3D CT images. The surgical procedure was divided into two stages: mandibular distraction osteogenesis (MDO) and removal of TMJa. MDO was performed using distraction devices (Zürich Paediatric Ramus Distractor, Cloverleaf design, KLS Martin, Tuttlingen, Germany) applied to the posterior region of the body of the mandible, on the left side [Figure 2]. Mandibular osteotomy with piezosurgery was made between the portions of the device. Left/ipsilateral coronoidectomy was also carried out. An intraoral approach was used to perform a horizontal osteotomy of the coronoid process. A distraction device was activated for 15 days with a rate of 1.0 mm/day. The device was maintained for four months to allow the newly formed bone tissue to consolidate. The distraction device was removed, and a left TMJ arthroplasty was performed. An osteotomy was performed between the glenoid fossa and condyle to remove the bony fusion. To promote wound healing and prevent scarring, the human amniotic membrane (HAM) was applied to the TMJ area. The jaw range of motion was assessed by opening the mouth, and the tissue was then stitched. Finally, a skin scar revision was performed [Figure 3]. Histological examination was performed on the TMJ tissue, and no pathological alterations were reported. The patient's recovery after surgery was smooth. TheraBite Jaw Motion Rehabilitation System® for passive physiotherapy was used at home. Although the mouth opening distance regressed to 18 mm after four months and 20 mm after nine months, a CT scan showed no ankylosis. After 2½ years, the patient maintained a good maximal interincisal distance of 23 mm and had normal functionality [Figure 4].

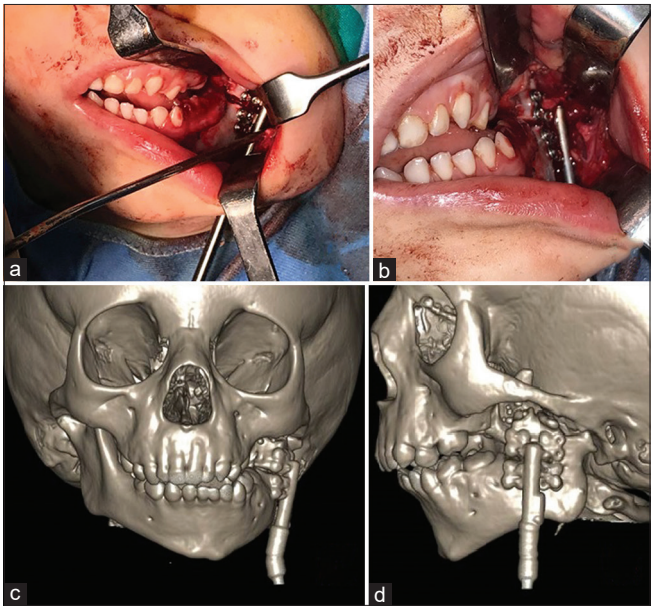

Figure 2: (a and b) Intraoperative views of the mandibular osteotomy and distractor placement. (c and d) Post-operative view of 3-dimensional computed tomography

Discussion

TMJa is a debilitating condition that affects chewing, digestion, speech, oral hygiene and overall physical and mental well-being.[3] It can be classified based on the location of the fusion (intra-articular or extra-articular), the type of tissue involved (bony, fibrous or fibro-osseous) and the degree of fusion (complete or incomplete).[4]

There is no agreed-upon surgical technique for the treatment of TMJa, highlighting the complexity of the issue.[3] The treatment course of TMJa in children with craniofacial anomalies is complex, often leading to recurrence and multiple reoperations, despite initial improvement in post-operative maximal incisal opening.[3,5] Various surgical modalities, including gap arthroplasty, have been proposed for managing TMJa,[3] a variety of interpositional arthroplasty approaches and joint reconstruction using transport distraction osteogenesis,[6] autologous grafts, free flaps or alloplastic[7] material, the choice depends on the age of the patient and the stage of the ankylosis. The management principles for interventions during craniofacial

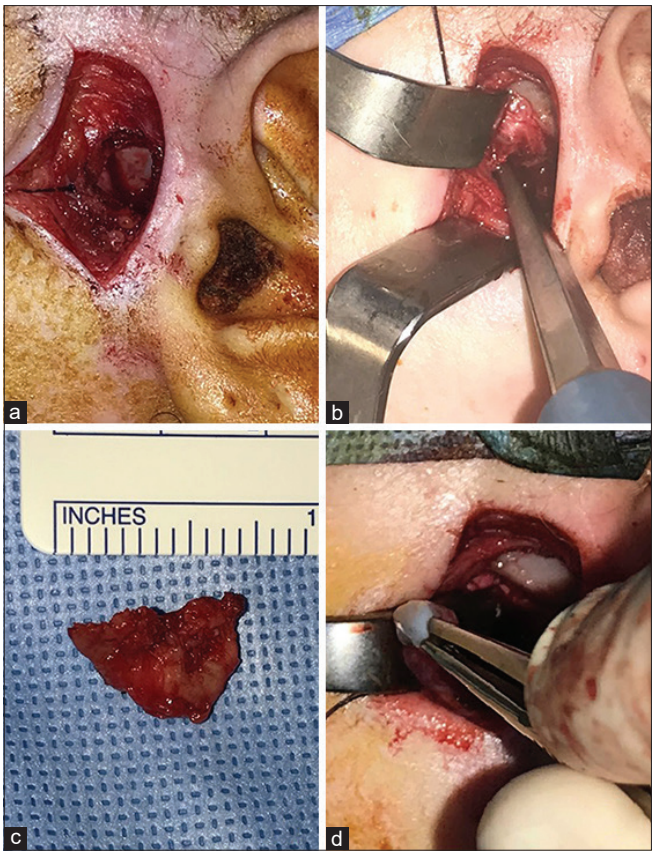

Figure 3: Second surgery to remove the ankylotic block of the right temporomandibular joint. (a and b) Surgical access and identification of the ankylotic block, (c) Removed bone block (d) Positioning of the amniotic membrane

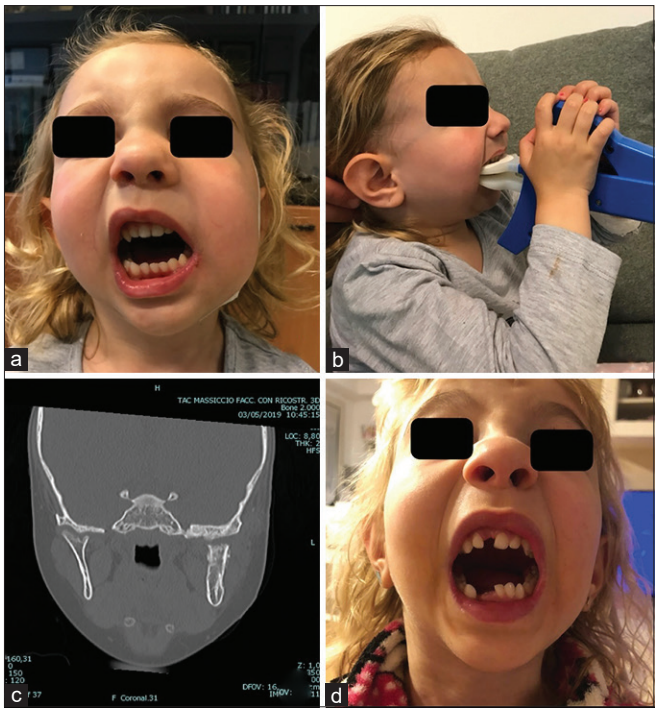

Figure 4: (a) Opening of the oral cavity 1 month after surgery, (b) Immediate post-operative stretching (c) Computed tomography scans in coronal view after the second surgical stage. (d) Good maintenance of the opening of the oral cavity 2½ years after surgery

growth remain a topic of debate, including the ideal timing and sequence of interventions. A two-step surgery was planned for severe TMJa (Stage IV). The first phase involves MDO to elongate the hypoplastic ramus. MDO allows immediate jaw mobilisation and eliminates donor-site morbidity.[6] We need to consider that the paediatric condyle is more prone to intracapsular microfractures due to its broad head with thin cortical bone and a relatively thick neck, which can be caused by trauma or surgical manipulation. In addition, its superior regenerative and remodelling capabilities may contribute to the development and recurrence of ankylosis after surgery.[8] It is important to note that using a mandibular distractor at a rate of more than 1 mm/day can lead to degenerative damage of the TMJ. Moreover, a longer activation period increases the risk of TMJ degeneration. Several clinical studies have reported the occurrence of TMJ damage as a result of MDO.[8] TMJa following MDO is a rare occurrence but has been observed in syndromic patients.[6] During the first-stage surgery, our patient underwent also a left coronoidectomy, which is an important procedure for increasing mouth opening. TMJa causes mechanical restriction of mouth opening due to hyperplastic coronoid processes, leading to discomfort and limited jaw mobility.[3] Costochondral graft was not considered due to its invasiveness and potential negative side effects. Furthermore, parents declined it to avoid a second surgical field. During the second stage of surgery, a left TMJ arthroplasty was performed and HAM was placed at the TMJ level. HAM can reduce inflammation and scarring and improve the patient's quality of life during the post-operative period.[3] Patient trained with TheraBite® to mobilise jaw passively postoperatively. Aggressive physiotherapy prevents adhesions and soft-tissue contraction and restores muscle function. A child's cognitive and emotional development, along with parental involvement, impacts treatment outcomes. Active parental participation in management is essential. Few studies on TMJ disorders exist in children, but they have already influenced medical practices in the field.[8] Long-term outcomes of ankylosis are not well-described due to limited post-operative follow-up. A longer follow-up period is essential since ankylosis develops gradually. In Ramly *et al*.,[8] younger patients who have their first mandibular operation are at a higher risk of needing reoperations, including for recurrent TMJa. The report describes a patient with AS who had TMJa and mandibular hypoplasia. The patient underwent mandibular elongation before TMJa treatment with HAM insertion. Post-operative physiotherapy helped prevent re-ankylosis.

Conclusion

Dealing with TMJa is an incredibly complex and demanding task. The treatment process is often plagued by a plethora of technical difficulties, and the likelihood of recurrence is significantly high. This condition has a profound impact on oral function and severely limits mouth opening in both children

and adults alike. As a result, it poses a significant challenge to healthcare providers who must navigate its complexities to provide the best possible outcomes for their patients.

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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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