Challenges in Evaluation, Management and Outcome of the Patients with Treacher Collins Syndrome

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Background*: The challenges for management of Treacher Collins Syndrome (TCS) are the analysis of deformities and staged soft tissue and bony reconstruction.*
Objective*: To present clinical and radiologic findings, the evaluation methods and the concept of staged reconstruction for patients with TCS.*
Material and Method*: The authors reviewed the clinical and radiologic findings, the evaluation methods, the staged reconstruction and early surgical outcome of three patients with TCS treated at Srinagarind Hospital, between 1994 and 2011.*
Results*: One patient underwent evaluation by CT scan for planning, reconstruction of the zygoma and orbit, correction of the lower eyelid coloboma, bilateral staged ear reconstruction with costal cartilage. At the age of 8 years, he had acceptable initial outcome with planned middle ear management and staged facial reconstruction. Palatoplasties of a cleft palate were performed in two patients,*
Conclusion: *TCS is a rare craniofacial deformity but poses challenges in evaluation, management and reconstructive surgery. The development of Craniofacial Center and interdisciplinary management is important for provision proper evaluation, initial management and longitudinal care, including appropriate timing for staged reconstruction of bone, ear and soft tissue reconstruction in patients with TCS. This treatment should be tailored and balanced with the functional and psychological needs of patient and his/her family. In developing countries, funding from other resources, including the not-for-profit foundations, is needed in order to increase patients' accessibility, and improve the quality of the entire treatment program.*

Keywords*: Treacher Collins Syndrome, Challenges for evaluation, Interdisciplinary management and staged reconstruction, Developing country*

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Treacher Collins syndrome (TSC) (also known as manibulafacial dyspotosis) is a rare craniofacial deformity that arises as the result of mutations in the TCOF1 gene[1]. It was first described by Thompson in 1846[2] and later by Berry in 1889[3]; however, it was given its eponym after E. Treacher Collins, who described the essential components of the condition in 1900[4]. Franceschetti and Klein- who described the facial profile of patients with TCS as fish-like or bird like and identified its hereditary nature- were the first to use the term "mandibulofacial dysostosis"[5].

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The prevalence of TCS is estimated to be between 1:10,000 and 1:50,000[6,7]. TCS is caused by a mutation in the TCOFI gene[1], inherited in an autosomal dominant fashion with variable penetrance and phenotypic expression. Sixty percent of cases arise as new mutations[8].

The diagnosis of TCS relies upon clinical and radiographic findings. Its features are caused by abnormal development of the first and second branchial archs with the key bilateral and symmetrical distinguishing feature[9]. It is characterized by (a) hypoplasia or absence of the zygomatic bones and mandible, (b) external ear abnormalities, (c) colobomas of the lower eyelid (pathognomonic for TCS), (d) a scarceness of the lid lashes medial to the defect, (e) downward slanting of the palpebral fissures, and (f) "tongue-shaped", pre-auricular hair displacement[10].

About 40-50% of patients with TCS have conductive hearing loss. Auricular anomalies include (a) absent external auditory canal (EAC), (b) middle ear malformations, and (c) pinna deformities with 85% of TCS being associated with microtia. Fully expressed TCS has a convex facial profile with a prominent nasal dorsum and micrognathic mandible. Cleft palate with or without cleft lip is presented in 38% of cases[11].

The challenges for the management of TCS, especially in the developing countries, are classification and analysis of deformities, and staging of soft tissue and bony reconstruction. The objectives of this study were to present (a) clinical and radiologic findings, (b) the evaluation methods, and (c) the concept of staged reconstruction in patients with TCS treated at Srinagarind Hospital, Khon Kaen University, Northeast Thailand. The analysis results of these data might be instructive for making recommendations for appropriate guidelines in the diagnosis and treatment of patients with this syndrome.

Material and Method

Study design

The medical records of three patients with TCS were reviewed by the authors who treated them at Srinagarind Hospital between 1994-2011, a university hospital and the tertiary referral center of the Northeast of Thailand. The diagnosis of TCS was performed through clinical and radiologic assessment. The details of staged reconstructive surgeries and early surgical outcomes of a single patient are reported here.

The protocol of the present study was reviewed and approved by the Ethics Committee of Khon Kaen University (based on the guidelines in the Helsinki Declaration). As well, written, informed consent was obtained for each patient.

Results

Patient report

Patient No. 1

A male patient born in 2004 in Maha Sarakham province, presented with coloboma, bilateral microtia, hypoplasia of zygoma, maxilla and mandible, cleft palate, hair growth extending in front of the ear to the lateral cheekbones (also known as "tongue-shaped" preauricular hair displacement) and bilateral conductive hearing loss. Closure of the cleft palate and speech management was performed.

Patient No. 2

A female patient born in 1994 in Roi Et province, presented with coloboma, microtia, micrognathia and cleft palate. She was treated by closure of the cleft palate and given speech management but was lost to follow-up after palatal repair.

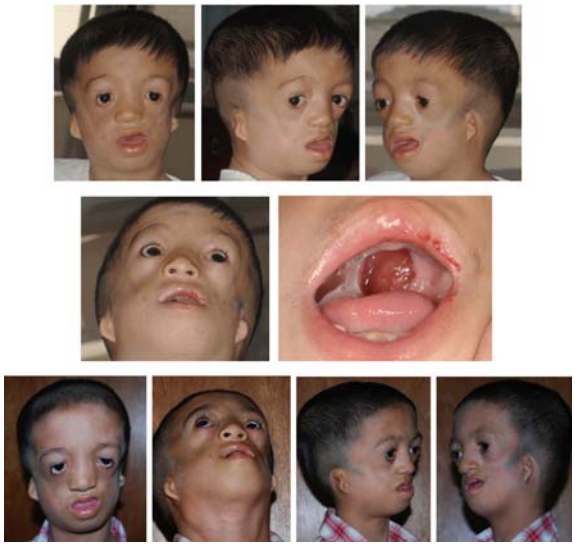

Fig. 1 Patient No. 1, presented with coloboma, bilateral microtia, hypoplasia of zygoma, maxilla and mandible, cleft palate, "tongue-shaped" preauricular hair displacement and bilateral conductive hearing loss. He was treated by closure of the cleft palate and given speech management. Follow-up photos were taken at the age of 7 years

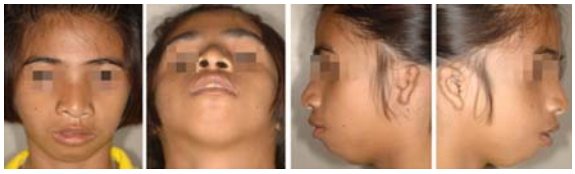

Fig. 2 Patient No. 2, presented with coloboma, bird-like face with microtia and micrognathia, and cleft palate. She was treated by closure of the cleft palate given speech management

Patient No. 3

A child born in Sakon Nakhon Province in 2003 presented with hypoplasia of the zygoma and mandible, external ear abnormalities, colobomas of the lower eyelid, downward slanting of the palpebral fissures, notching of the lower eyelids, conductive hearing loss and bilateral microtia. He was registered at a surgical volunteer mission in Sakon Nakhon Province in 2004 and an initial correction of the eyelid coloboma was performed. He was subsequently referred to

Srinagarind Hospital. A craniofacial computed tomography (CT scan) was performed for analysis of the deformities and planning of surgical reconstruction. Orbit and zygoma reconstruction were performed at the age of 4 years and bilateral staged ear reconstruction, using costal cartilage transplantation, was performed at the age of 6 years. An acceptable initial outcome was achieved with the planned middle ear management and other staged facial reconstruction.

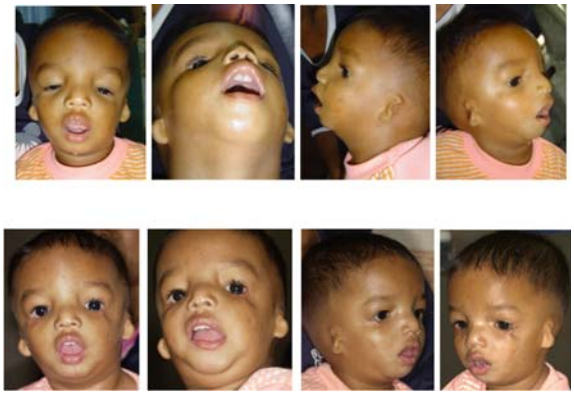

Fig. 3 Patient No. 3, presented with hypoplasia of the zygoma and mandible, external ear abnormalities, colobomas of the lower eyelid, downward slanting of the palpebral fissures, notching of the lower eyelids, conductive hearing loss and bilateral microtia. Post-operative photos show the patient after the first eyelid surgery

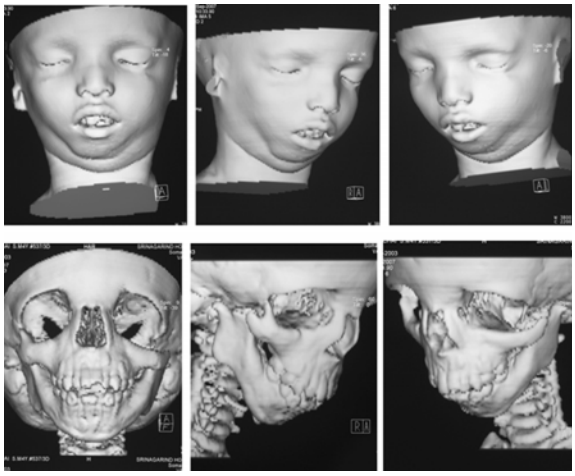

Fig. 4 Three-dimensional CT (3-D CT) reconstruction (lower row) with Shaded Surface Display (SSD) (upper row) of patient No. 3 showing bilateral hypoplasia of the zygomatic bones and mandible, and downward slanting of the lateral orbital wall

Discussion

Treacher Collins syndrome (TCS) is inherited in an autosomal dominant manner and 40% of patients have a parent who is similarly affected. The full clinical presentations include hypoplasia or aplasia of the zygoma, lower eyelid deformities, increase in facial convexity, mandibular hypoplasia and external and middle ear deformities[9]. The differential diagnosis includes Goldenhar syndrome, Nager syndrome, Miller syndrome, Pierre Robin sequence, and non-syndromic mandibular hypoplasia[12]. A prenatal diagnosis with ultrasound examination in mothers with a risk for TCS may be helpful for detecting anomalies such as polyhydramnios, microcephaly, abnormal fetal facial features, and abnormal fetal swallowing[13,14].

The clinical and radiologic assessment is essential to confirm diagnosis, characterize deformities and plan for staged reconstruction. A useful modality is a craniofacial computed tomography (CT scan) in axial plane with coronal, sagittal and three- dimensional reconstruction and lateral cephalography[11].

An effective interdisciplinary craniofacial team should comprise of a medical geneticist, plastic surgeon, speech and swallow team, audiologist and otolaryngologist, oral and maxillofacial surgeon, orthodontist, psychologist, social worker and family support group

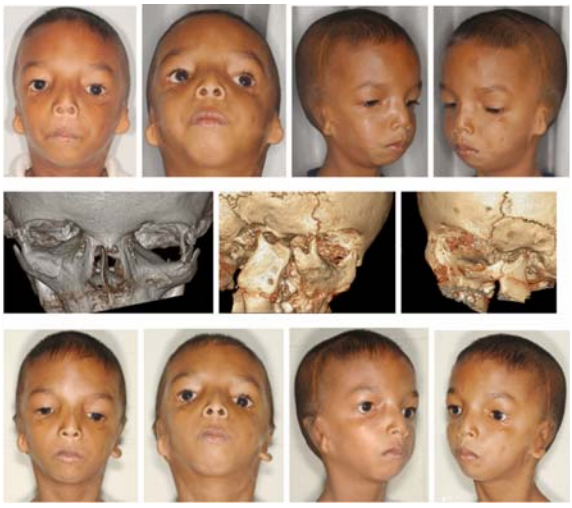

Fig. 5 Patient No. 3 after surgical reconstruction with a calvarial bone graft to the orbit and maxilla (upper row). The post-reconstruction 3-D CT scan of the facial and temporal bone demonstrates improved skeletal structures of the orbit and zygoma and bilateral aural atresia (middle row). Follow-up photos were taken at the age of 8 during bilateral, staged ear reconstruction (lower row)

and a nurse coordinator. The initial evaluation should include assessment of the airway, cleft palate and the functions of nutrition, swallowing, hearing and vision. The cranial base in patients with TSC is generally shorter in all dimensions[15]. Challenges in the radiologic analysis of deformities include (a) the use of CT scan for analysis of hypoplasia or aplasia of the zygomatic arch, and (b) cephalometric measurements for mandibular hypoplasia or mandibular retrognathia due to facial convexity[16]. Additionally, a craniofacial CT scan is also indicated for evaluation of the anatomy of the external auditory canal, middle ear, and inner ear. Posnick et al studied the CT measurement and found that it agreed with the clinically observed morphology[17,18].

The primary concern in the initial management of infants with TCS is airway management: indeed, non-surgical and surgical procedures may be needed to improve respiratory function[19], including: positioning of the infant, tracheostomy or early distraction osteogenesis of the mandible in severely affected patients[20].

Through, there is still no clear consensus when to begin the reconstruction, a treatment protocol and staged reconstruction timetable should be provided by a multidisciplinary craniofacial team, after an analysis of the defects, functional demands and specific needs of each patient. Cleft palate, if present, should be repaired at one to two years of age. Bone conduction amplification and speech management are indicated for treatment of hearing loss. Craniofacial reconstruction, including correction of both the lower eyelid deficiency and the zygomatic deficiency[9], is indicated to prevent the progression of facial asymmetry[21]. Zygomatic and orbital reconstructions with bone grafts may be performed when the cranio-orbitozygomatic bony development is complete at about 5 to 7 years of age. Tessier, however, has advocated delaying major reconstruction until the age of 6-10 years to reduce resorption of bone grafts, which is more severe in TSC. The correction of coloboma of the lower eyelid may be performed with or subsequent to, bony reconstruction of the zygoma: using Z-plasty, and the reconstruction of the orbicularis muscle, orbital septum, and tarsoconjunctiva[22]. The recommended technique for microtia reconstruction is staged reconstruction with autogeneous costal cartilage which should be performed after the age of 6 years for adequate development of costal cartilage. External auditory canal and middle ear reconstruction may be performed for a patient with TCS with bilateral microtia and/or narrow ear canals.

Orthognathic surgeries and orthodontic treatment may be performed at the age of early skeletal maturity. Nasal reconstruction and soft tissue contouring procedures, if needed, should be performed after the orthognathic surgeries. The timing for surgical reconstruction should be balanced with the psychological and functional needs of both the patient and his/her family.

The available sources of bone grafts for zygoma, orbit and mandibular reconstruction bone reconstruction are either rib, or calvarial bone. Most surgeons use non-vascularized bone grafts with rigid fixation, though it is believed that vascularized bone grafts have better long-term survival with good thickness and contouring.

The setting of a Craniofacial Center and interdisciplinary management is important to provision of proper longitudinal care in patients with TCS. The limitation of healthcare resources in Thailand and other developing countries has, however, led to a limitation in accessibility to proper management and, as indicated in this report by the relatively low number of patients receiving the treatment. Funding from other resources, -including the Tawanchai Foundation for Cleft Lip, Cleft Palate and Craniofacial Deformities- play an important role in increasing accessibility, and improving the quality of treatment and programing.

Conclusion

TCS is a rare craniofacial deformity but poses challenges in evaluation, management and reconstructive surgery. Proper initial management and appropriate timing for staged bone, ear and soft tissue reconstruction needs to be planned by a multidisciplinary team at a craniofacial center for optimum outcomes. This treatment should be tailored and balanced with the functional and psychological needs of the patient and his/her family. In developing countries, external funding is needed to leverage overall accessibility, and quality of treatment.

Acknowledgement

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Potential conflicts of interest

None.

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ความท้าทายของการประเมิน การรักษา และผลลัพธ์ในผู้ป่วยกลุ่มอาการเทรเชอร์คอลลินส์

บวรศิลป์ เชาวน์ชื่น, กมลวรรณ เจนวิถีสุข, ปรารถนา เชาวน์ชื่น, พลากร สุรกุลประภา

ภูมิหลัง: *ความท้าทายของการดูแลผู้ป่วยกลุ่มอาการคราโอซินออสโตสิส คือ การประเมินความพิการ และการเสริมสร้างแบบของเนื้อเยื่ออ่อนและกระดูกเป็นขั้นตอน*

วัตถุประสงค์: *เพื่อนำเสนอลักษณะการตรวจพบทางคลินิกและรังสีวิทยา วิธีการประเมิน และแนวความคิดของการเสริมสร้างแบบเป็นขั้นตอนในผู้ป่วยกลุ่มอาการเทรเชอร์คอลลินส์*

วัสดุและวิธีการ: *การศึกษาเป็นการทบทวนบันทึกทางการแพทย์และรังสีวิทยา วิธีการประเมิน การเสริมสร้างแบบเป็นขั้นตอน ในผู้ป่วยกลุ่มอาการเทรเชอร์คอลลินส์ จำนวน 3 ราย ที่ได้รับการรักษาโดยผู้นิพนธ์ในโรงพยาบาลศรีนครินทร์ ในระหว่างปี พ.ศ. 2537-2554*

ผลการศึกษา: *ผู้ป่วย 1 ราย มีผลการตรวจเอกซเรย์คอมพิวเตอร์เพื่อวางแผนการรักษา รักษาโดยการผ่าตัดเสริมสร้างแบบเป็นขั้นตอนของกระดูกโหนกแก้ม การแก้ไขการแหว่งของเปลือกตาล่าง การเสริมสร้างแบบเป็นขั้นตอนของใบหูสองข้างโดยใช้กระดูกซี่โครง และมีผลลัพธ์การรักษาในระยะแรกที่ดีเมื่ออายุ 8 ปี ผู้ป่วย 2 ราย ได้รับการผ่าตัดซ่อมแซมภาวะเพดานโหว่*

สรุป: *ผู้ป่วยกลุ่มอาการเทรเชอร์คอลลินส์เป็นความพิการทางศีรษะและใบหน้าที่พบได้น้อย แต่มีความท้าทายในด้านการประเมิน การรักษา และการผ่าตัดเสริมสร้าง ในประเทศไทยการมีศูนย์การดูแลผู้ป่วยทางศีรษะและใบหน้าและการดูแลแบบทีมสหวิทยาการเป็นความจำเป็น เพื่อให้การประเมินอย่างเหมาะสม การรักษาทั้งในระยะแรกและระยะยาว รวมถึงการเสริมสร้างแบบเป็นขั้นตอนของกระดูกและเนื้อเยื่ออ่อน ซึ่งต้องมีการปรับให้เข้าและสมดุลกับความต้องการด้านหน้าที่การทำงานของผู้ป่วยและภาวะจิตวิทยาสังคมของผู้ป่วยและครอบครัว ในประเทศที่กำลังพัฒนา การมีแหล่งทุนสนับสนุน เช่น จากมูลนิธิจะช่วยการเข้าถึงการรักษา และทำให้คุณภาพของการรักษาดียิ่งขึ้น*