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CT 3D Reformating Technique to Aid Microtia Reconstruction Procedure Planning

This 8-year-old girl presented to a tertiary surgical centre with a history from birth of an absent left and a malformed right pinna, and associated bilateral hearing impairment.

On clinical examination, the left pinna was absent and the right dysplastic. No penetrable external auditory meati were evident. Bilateral hearing impairment, more pronounced on the left, was confirmed with auditory testing.

Prior to surgery high resolution CT imaging of the temporal bones was performed. In addition a CT of the lower thoracic cavity was undertaken to assess the costal cartilage for surgical planning. (Figure 1)

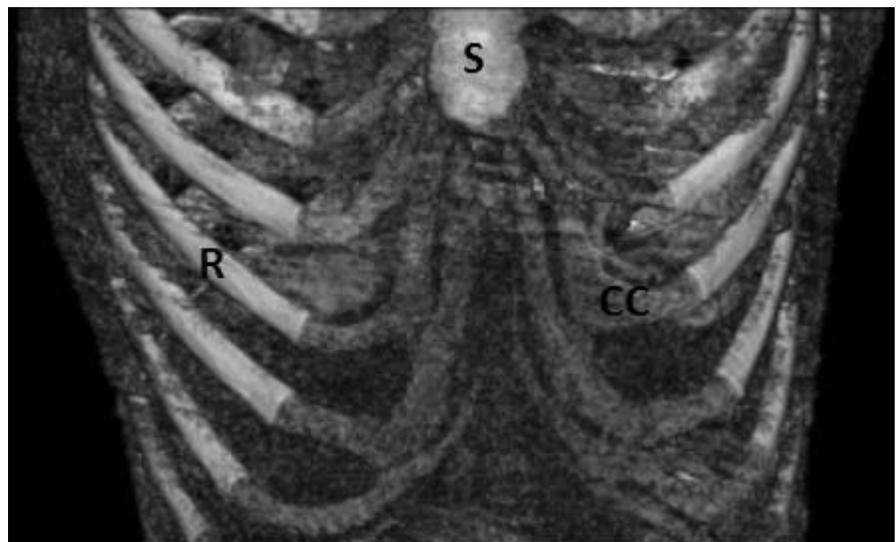


Figure 1: Coronal CT Chest (Non-Contrast) with 3D In-space (Siemens, Erlangen, Germany) Reformating. (R= bony rib, S = sternum, CC = costal cartilage)

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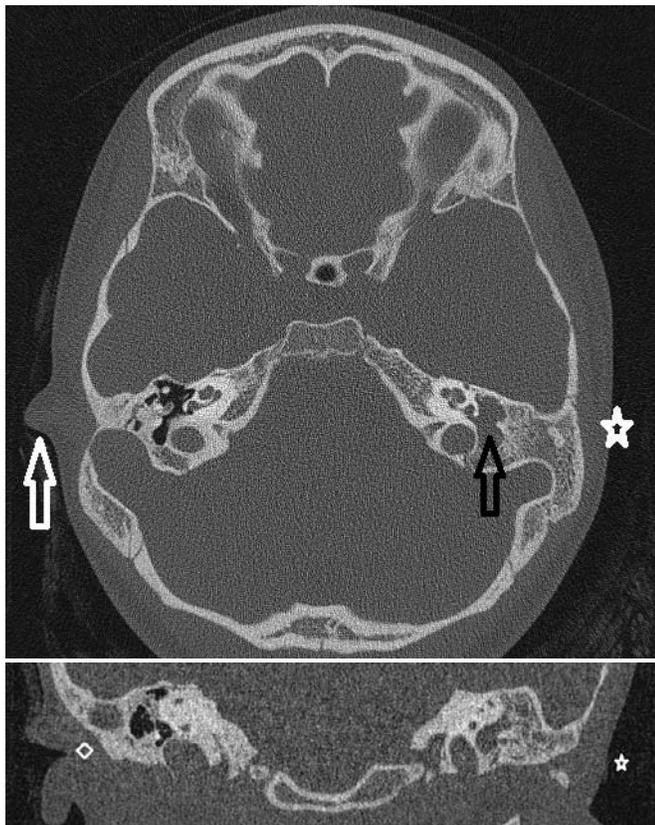


Figure 2: High resolution CT of the Temporal Bones: a: Axial images illustrating bilateral microtia, with an absent left pinna (*) and dysplastic right pinna (white arrow). In addition the left ossicular chain is absent with soft tissue filling the middle ear (black arrow). B: Coronal images showing the absent left pinna (*) and absence of the external auditory canals (diamond).

DISCUSSION

Microtia is a congenital deformity of the pinna, with a wide spectrum of abnormalities ranging from complete absence (anotia) to a relatively, well formed but dysplastic pinna (Figure 2). It occurs in one in every 6,000 births, with a higher preponderance in select racial groups such as the Japanese.¹

For decades surgical procedures have been performed and evolved for the treatment of microtia. In contemporary practice these may either be autogenous, using costal cartilage or alloplastic, using the likes of porous high density polyethylene (Medpor).² The key autogenous surgical techniques in common practice are those described by the Brent and Nagata.^{3,4}

Autogenous costal cartilage is utilised in one of the key stages in reconstructing the pinna to fabricate the auricular framework. The age at which the procedure is performed is typically in childhood (8 – 10 years of age), when costal cartilage is believed to be well formed and fusion may have occurred at the mid-lower ribs levels (7th – 9th). Traditionally no pre-operative imaging has been undertaken given the difficulties with visualising cartilage at this age. On standard CT chest with traditional viewing methods the costal cartilage is poorly if at all seen in children. However, utilising some of the more advanced 3D software algorithms on contemporary CT scanners, accurate

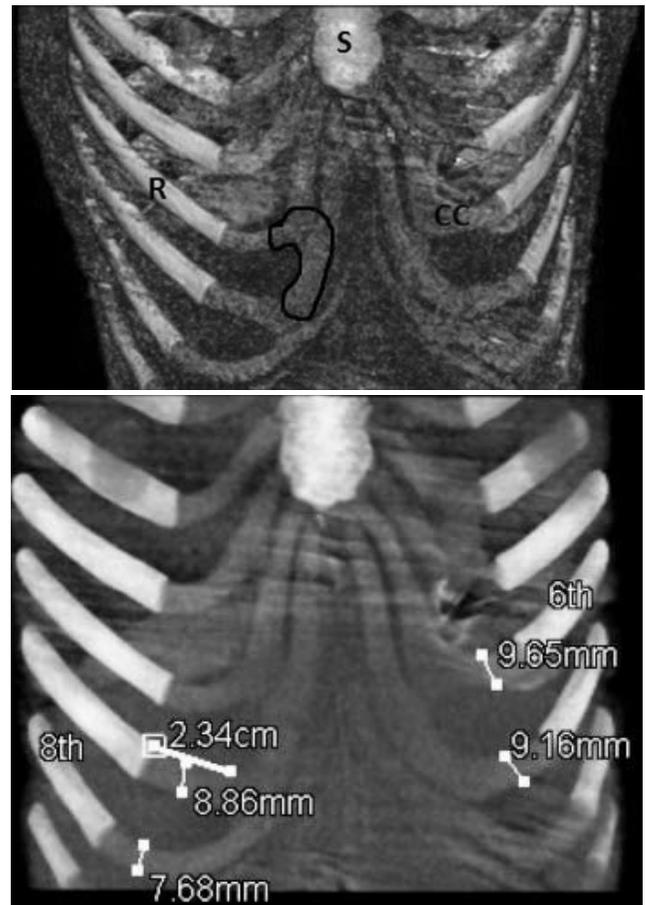


Figure 3: Coronal CT Chest (Non-contrast) with 3D In-space Reformatting. A: Using the arterial algorithm illustrating with line annotation a suitable costal cartilage segment for surgical harvest for auricular reconstruction. B: Using a soft tissue algorithm with width and distance annotations applied.

assessment to aid the surgeon prior to scheduling a procedure can be performed (Figure 1). The configuration of costal cartilage may be reviewed and if adequate fusion has occurred. A potential framework can then be outlined (Figure 3a). In addition selective dimensions can be recorded to the nearest millimeter (Figure 3b). This post-processing work is undertaken with the reporting radiologist and surgical lead for the procedures.

*Images in our institutions were acquired on a Siemens Somatom 64 slice scanner with radiographic parameters of kV 120, Mas 46, slice thickness 0.6mm and DLP of 68 without the use of intravenous contrast. Coronal 3D reformatting was performed using the InSpace software, using an arterial algorithm (Figures 1 and 3a). Alternatives employed include the use of soft tissue algorithm (Figure 3b).

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