

Peer Review File

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Reviewer A:

Comment 1

In a recent survey of paediatric otolaryngologists 100% reported using CT to diagnose choanal atresia. The same group reported using MRI only for selected cases.

Moreddu E, Rizzi M, Adil E, Balakrishnan K, Chan K, Cheng A, Daniel SJ, de Alarcon A, Hart C, Hartnick C, Inglis A. International Pediatric Otolaryngology Group (IPOG) consensus recommendations: Diagnosis, pre-operative, operative and post-operative pediatric choanal atresia care. International journal of pediatric otorhinolaryngology. 2019 Aug 1;123:151-5.

CT offers fast acquisition of images with excellent bony definition. The concern for ionising radiation exposure raised the question from the authors as to whether MRI could offer the same diagnostic information and enough information to the surgeon with regards to surgical management. This small retrospective study confirmed high diagnostic sensitivity but poor correlation to quantitative measurements with regards to the atresia and bony aperture. As no patients had defects in the skull base the sensitivity for this is unknown. Given the association with craniofacial syndromes and potential neurological abnormalities the addition of MRI during the diagnostic work up for this patient group would seem attractive. Whether MRI alone is adequate requires further investigation and this paper appears the first of its type to raise this question.

- Reply 1: Thank you for your comments. The mentioned reference is certainly worth including in the text.
- Changes in the text: (Page 3, Line 56-59) A recent consensus recommendation from the International Paediatric Otolaryngology Group, all 28 members surveyed agreed pre-operative CT should be performed in all patients with choanal atresia and magnetic resonance imaging (MRI) should be performed in selected cases (Moreddu 2019).

Comment 2

Abstract:

Line 44 - Given that MRI correctly picked the atresia in 100% I think that is worthy of comment in the abstract. All patients had intact skull bases which was identified on both CT and MRI. The MRI appears to be less sensitive at diagnosing mid face bony abnormalities and better for intracranial pathology. Bony measurements show poor correlation when comparing Ct and MRI the importance of this to surgical planning is unknown.

- Reply 2: Thank you for the comments. We have made the following changes below.
- Changes in the text: (Page 2, Lines 39-48) Results: Seven patients were included. MRI was able to identify choanal atresia as unilateral or bilateral in all cases. An intact skull

base as identified on CT was confirmed on MRI in all cases. MRI appears to be less sensitive in identifying bony intranasal and mid face abnormalities. Choanal height, width and skull base slope were able to be assessed in most MRI scans, however, quantitative correlation between CT and MRI could not be established. It is unknown what impact the variability of these measurements has on surgical planning.

Methods:

Comment 3

Line 71 - how was the search performed? Would be useful to know how many total patients with CA over this time frame and then how many were included as had both MRI and CT.

- Reply 3: This comment is addressed with the changes below.
- Changes in the text:
 - (Page 3, Line 71-72) Potential cases were identified by search of radiology reports for mention of “choanal atresia”.
 - (Page 4, Line 90-91) Over the search period, there were 26 patients identified with choanal atresia, of which seven patients (four male, three female) were included in the study.

Comment 4

Line 76 - the quantitative features in table 1 sound like features that are routinely reported for choanal atresia ie radiological features rather than ent important features. Are these standard measurements and if so is there a reference?

- Reply 4: There is no consensus on which features on imaging are surgically important. This is stated in the methods section. We have added some references to comment on the previous work in this area to assess surgically important features on CT
- Changes in text: (Page 5-6, Line 121-133) There is no consensus on which features on pre-operative imaging are surgically important. Messineo et al described several parameters on CT in patients with choanal atresia compared with a control group to identify helpful parameters for surgical planning. In children aged ≤ 1 year, choanal height, rostrum height, anterior interorbital distance, bone septum thickness, maximum septum length, posterior right bone width, posterior left bone width, bone width of choana and vertical distance of nasopharynx dimensions were all found to be significantly less in the study group compared with controls. Skull base slope was not assessed. There was no assessment of the utility of these parameters in a surgical setting. Fitzpatrick et al reported the choanal width, choanal height, mid-nasal skull base height and skull base slope in patients with isolated bilateral CA compared with CHARGE associated bilateral CA from CT, emphasising the importance of identifying steeply angulated bony trajectory which informs the surgeon of a lower skull base level posteriorly. In our study, we attempted to evaluate the minimum acceptable parameters to safely perform surgery in accordance with the discussion amongst our otolaryngology consultants.

Comment 5

Given this is also being published in an Australian journal and the study is from an Australian

hospital the use of the term attending is out of context. Guessing the attending are the consultant otolaryngologists?

- Reply 5: Yes, this is correct
- Changes in the text: (Page 3, Line 74) ...we surveyed our department's consultant paediatric otolaryngologists

Comment 6

Line 78 - how were the radiologists blinded? They presumably knew they were looking at scans of choanal atresia. How many radiologists? Some bias introduced as no normal scans reviewed.

- Reply 6: Comments have been addressed below.
- Changes in the text:
 - (Page 4, Line 76-83) Using this checklist (Table 1), two radiologists separately evaluated either the CT or MRI scans. Scans were loaded onto the RCH picture archiving and communication system using anonymize test overlays prior to reporting to deidentify the patient and blind the radiologist. The scans were be loaded by an independent party employed by the RCH medical imaging department. Physical blocking measures were used to ensure deidentification and blinding was also used where the anonymize option was not adequate.

Comment 7

No mention of any specifics regarding CT and MRI scanner or protocols used.

- Reply 7: This has been added to the results section.
- Changes in text:
 - (Page 4-5, Line 96-99) Siemens Somatom definition flash 2 x 128 slice CT scanner was used for CT image acquisition. Non contrast CT scans were performed to include a field of view from mid orbits to below the nasopharynx. 0.75 mm slice thickness used with multi planar bone and soft tissue reconstructions. Siemens Magnetom Prisma 3T MRI scanner used for MRI image acquisition.

Comment 8

Results:

Discussion:

Line 114: 2 patients had CS and in table 2 it states 1 correlated between CT and MRI CHARGE features- so that MRI did have IAM protocol? Not clear

- Reply: This has been added in the results section.
- Changes in the text:
 - (Page 5, Line 100-101) Dedicated IAM sequences performed only in one study. Studies were MRI brain studies with no dedicated imaging performed for the region of the nose and nasopharynx.

Given that MRI takes longer and that particularly children with bilateral CA have airway obstruction the requirement for intubation should also be taken into consideration. If

intubated there is reduction in movement artefact. CTs can be performed quickly which may be desirable in neonates with unstable airways.

The importance of the quantitative numbers to the surgeon is also debatable.

In children with associated craniofacial abnormalities the CT is likely to offer better assessment of the bony skeletal but additional of MRI may prove useful for neurological associations.

The limitations include small numbers, possible bias with blinding method, and the lack of consensus from surgeons regarding how important the physical features of the stenosis actually are to surgical approach.

Comment 9

It would be nice for the paper to include an MRI and CT side by side to demonstrate the appreciated anatomy - perhaps with the quantitative distances marked for comparison. Useful to demonstrate limitations and advantages of each scan.

- Reply: This has been added to the text.
- Changes in the text:
 - (Page 5, Line 104-105) Figures 1 and 2 shows measurements of quantitative assessment points on axial and sagittal planes in MRI and CT for the same patient.
 - (Page 9-10, Line 211-233) **Figure 1: Measurement of Choanal width using CT axial bony window and T2 axial MRI images in the same patient.** (V – Vomer; MPP – Medial Pterygoid Plate). The different image acquisition angles in two studies and the less clear definition of the bony margin in MRI results result in different measurements. However, the difference between the two sides and the presence of choanal atresia in the right side is evident in both CT and MRI.

Figure 2: Landmarks and measurements in the Sagittal plane in CT bony window and T2 weighted MRI image in the same patient. (ACP – Anterior Cribriform Plate; ESS – Ethmoid spine of Sphenoid; BS – Base of Sphenoid; HPP – Horizontal process of Palatine bone; ANS – Anterior nasal spine). Nasal floor line is drawn between the ANS and HPP. Skull base line is drawn between the ACP and ESS. The slope of the skull base was calculated bilaterally by measuring the angle between the line of the nasal floor and the line of the skull base. The choanal height was measured at the narrowest distance between the horizontal plate of the palatine bone and the body of the sphenoid on sagittal view.

Reviewer B:

A succinct paper on the use of MRI to diagnose and assess CA.

The small study reveals that MRI is not as useful as CT in the anatomical assesement of CA (but if it could, would reduce radiation exposure to the infant brain). Therefore is an

interesting study. However the outcome suggests that further work is required and MRI is not an adequate tool for use in this context.