MR Sialography: Evaluation of ductal appearance with ductal occlusion and sialogogue

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Introduction:

Traditional sialography involves cannulating the duct and injecting contrast medium along the duct whilst imaging. The procedure is invasive and uncomfortable and success is dependent on the operator's technical skills. Complications are occasionally reported [1]. The evaluation of masses within the salivary glands is well established with MR[2]. MR Sialography was originally described as a technique in the 1990s[3] but only recently has MR Sialography become recognized as technique comparable to conventional sialography for evaluating the salivary ducts[4]. However, visualization of the third order ducts and subtle ductal abnormalities with MR is limited when compared to X-ray digital subtraction sialography[5]. This would be necessary to diagnose subtle intra-glandular ductal pathology, such as in sialadenitis. 'Adaptive averaging' is a method of re-registering multiple images in the same location to improve SNR, and has been shown to significantly improve the visualisation of the peripheral ducts in the liver at MRCP[6]. Traditional sialography involves giving the patient a sialogogue to stimulate salivary secretion and occluding the duct (by the cannulation). This work aims to evaluate these factors in MR sialography and in addition any benefit of adaptive averaging to correct any motion-related problems after using a sialogogue.

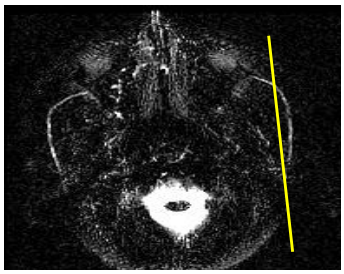

Fig 1 Axial navigation section prescribing sagittal oblique.

Methods:

Eight volunteers (5F: 3M; age range 23-56 years) were recruited for the study. Prior to the study, a 'bung' was placed between the parotid duct orifice and the dentition to try and passively occlude the duct. The 'bung' was made by wrapping a dressing gauze in clingfilm. Patients were examined with a 1.5T whole body scanner (Excite, GEHT, Milwaukee) with an 8-channel high-resolution brain coil. Two location-matched sequences were obtained prior to applying the sialogogue and then repeated afterwards. Firstly, an FRFSE sequence (fast-recovery fast spin echo: TR/TE = 8000/840ms, matrix 256 x 256, NEX = 4, ETL = 128, bandwidth 41.67 kHz, 1 sagittal oblique slice, section thickness 20 mm, acquisition time 2 mins 10 s) was performed. This was followed by a series of real-time single-shot fast spin echo (parameters as above except 138 echo train, 20 images acquired, acquisition time 2 mins 40 s). An interactive real time interface (iDrive Pro, GEHT, Milwaukee) with a modified single shot-half-Fourier FRFSE sequence was used to identify the parotid gland in the axial plane using a 50mm section thickness (figure 1) and a sagittal oblique slice was selected so as to be in line with the posterior portion of the duct. XX real-time images (TR=8000ms) were acquired with parameters matching the initial sequence. The real time images were subsequently 'adaptively averaged' (RTAA) by means of a cross-correlation method implemented in IDL (RSI, Boulder, Co).

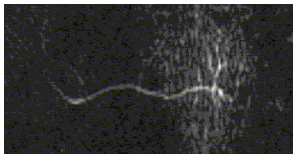

Fig 2a Pre-lemon FRFSE

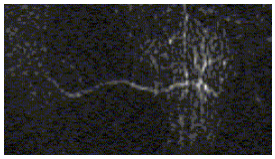

Fig 2b Pre lemon RT

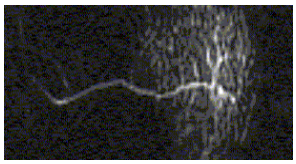

Fig 2c Post-lemon FRFSE

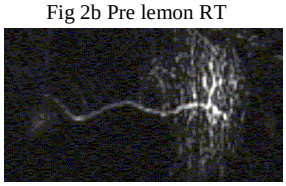

Fig 2d Post lemon RT

Once these sequences had been acquired, the patient was given a sialogogue (in the form of 2ml lemon juice via a syringe) and the above protocol was repeated. Qualitative visual analysis, using a 5-point scale, was then performed by two experienced observers, blinded to the acquisition details and the following pairs were compared:

1.Pre-lemon FRFSE vs post lemon FRFSE; 2. Pre-lemon RTAA vs post-lemon RTAA; 3. Pre-lemon RTAA vs pre-lemon FRFSE; 4. Post-lemon RTAA vs post-lemon FRFSE.

The criteria used to qualitatively compare each pair were:

a) the visibility of the main duct,
b) the visibility of the intra-glandular and branch ducts and
c) the presence of motion artefact.

Once this had been performed, the four images from each subject (fig 2)were then evaluated alongside each other and ranked in order of image quality (1-4) according to the same criteria listed above (a-c).

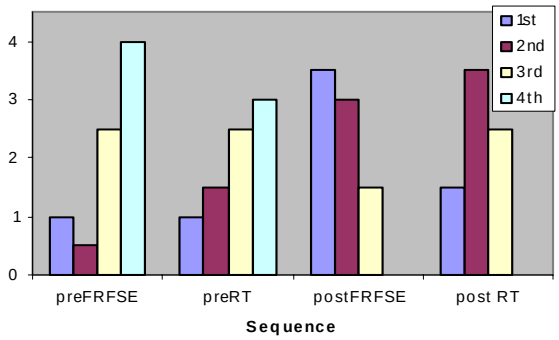

Figure 3: Ranking of image quality between sequences for individual volunteers. Y axis represents no of times ranked from 1st to 4th

Results:

Pairwise comparison between the two different sequences demonstrates no statistically significant difference. The pre and post lemon data suggests that the use of a sialogogue is beneficial in visualising the intra-glandular ducts.

When all four images from each subject were evaluated alongside each other (fig 2) for image quality no benefit is shown in evaluating the main duct. However the use of a sialogogue once again does appear to produce better visualisation of the intraglandular ducts (fig 3). The post-lemon FRFSE and RTAA sequences were ranked 1st and 2nd more often than the pre-lemon sequences. There was no difference at all between any of the sequences for motion artefact.

Conclusions:

This study shows that use of a sialogogue does improve the visibility of the branch parotid gland ducts. No significant difference was demonstrated between the two techniques using static and adaptively averaged methods. The use of a sialogogue results in excess salivation which requires repeated swallowing to prevent 'gagging'. Our volunteers, who all had experience of MRI, showed no evidence of motion artefact at all. They knew to swallow between scans whereas patients may not be aware of this and would have greater movement. This is where the adaptive averaging may be of most benefit. The use of a bung from the start may have caused ductal occlusion and improved the quality of the pre-lemon scans. A further study evaluating the effect of ductal occlusion on image quality would clarify this although clearly the use of a sialogogue is beneficial in evaluating the intra-glandular ducts and should be considered when evaluating for subtle branch ductal pathology such as sialadenitis.

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References:

1 Cockrell DJ *et al.*, *Dentomaxillofac. Radiol.* **22**, 41 (1993)
2 Tabor *et al.*, *Radiol. Clin. North Am.*, **27**, 379 (1989)
3. Lomas et al. *Radiology* . **200** (1):129-33 (1996)
4 Becker et al., *Radiology*, **217**, 347 (2000)
5 Kalinowski et al., *Am. J. Neuroradiology*, **23**, 1485 (2002)
6 Sala et al. *Proc. ISMRM* **11** (2004); p 430