The Role of Magnetic Resonance Imaging and Magnetic Resonance Sialography in the Diagnosis of Various Salivary Gland Disorders: An Interobserver Agreement

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ABSTRACT

Objectives: This study was conducted to evaluate the interobserver agreement on the diagnostic ability and quality of magnetic resonance imaging (MRI) together with magnetic resonance (MR) sialography in the assessment of various salivary gland disorders.

Materials and Methods: Six patients (four men and two women, age range = 24–45 years old) with salivary gland disorders were included, and seven glands were examined. All patients underwent MRI (T1 and T2 sequences) and MR sialography (single-section single-shot turbo spin-echo sequence) using a surface coil. A scoring system was performed by three observers on 12 criteria for MRI and MR sialographic image interpretation. Interobserver agreement was performed using the Cohen kappa test, and the $k$ values were computed.

Results: The overall $k$ values of the interobserver agreement between the three observers revealed an almost perfect agreement ($k = 0.97$) on two-level decisions and a substantial agreement ($k = 0.77$, $k = 0.74$, and $k = 0.77$) on four-level, image quality, and total decisions, respectively.

Conclusions: The overall almost perfect to substantial interobserver agreement through the diagnostic criteria used denoted the effectiveness of MRI and MR sialography using single-section single-shot turbo spin-echo sequence with a relatively low acquisition time and a surface coil in the diagnosis of various salivary gland disorders; however, efforts should be made in improving the radiologist training to reduce variability in interpretation that will increase the effectiveness of these imaging modalities.

Keywords: Magnetic resonance imaging; magnetic resonance sialography; salivary gland diseases; benign lymphoepithelial lesion; observer training and experience

Introduction

Salivary glands are subject to a variety of diseases including inflammatory, infectious, obstructive, degenerative, and neoplastic processes. Many of these diseases culminate in salivary dysfunction [1].
Imaging techniques of the salivary glands include plain radiography, sialography, ultrasonography, computed tomography, magnetic resonance imaging (MRI), and salivary gland scintigraphy [2–4]. MRI has several advantages over other diagnostic imaging procedures because it offers excellent soft tissue contrast resolution, no ionizing radiation is involved, and direct multiplanar imaging is possible without reorienting the patient [5]. MRI is the method of choice in patients with palpable salivary gland masses to assess the exact extent of tumors, invasion of neighboring structures, perineural spread, and lymph node staging [2, 6]. However, MRI cannot be used to evaluate the duct system of the salivary glands [7].

The introduction of the magnetic resonance (MR) sialography protocol by Lomas et al [8] in 1996 was the first step toward nonionizing noninvasive imaging of the duct system. MR sialography is a hydrographic technique in which static or slowly flowing fluids in the body are imaged as high signal intensity structures against a dark background with very low signal intensity. This hydrographic image contrast is derived from heavy T2 weighting, which accentuates the visibility of structures containing fluids with long T2 relaxation times; hence, MR sialography does not require ductal cannulation or contrast medium injection [9]. MR sialography can also be performed during acute gland infection and in patients with known reactions to iodinated contrast material [10]. Moreover, upstream ductal systems can be visualized in cases of complete ductal obstruction [7].

Only a few published studies in the literature assessed the value of both MRI and MR sialography in the diagnosis of salivary gland disorders. However, in these studies, the image findings were scored with special emphasis on the staging of Sjögren’s syndrome [11–13], hyperlipidemia, and inflammation [11]; yet, other disorders were not addressed. Therefore, the objective of the present study was to evaluate the interobserver agreement on the diagnostic ability and quality of MRI together with MR sialography in the assessment of various salivary gland disorders.

Methods and Materials

After the approval of the Regional Research Ethics Committee, six patients (four men and two women, age range = 24–45 years old, mean age = 35 years) with salivary gland disorders (six parotid glands and one submandibular gland) were included in the study, and written informed consent was obtained from all patients after the whole procedure for patient examination was explained.

Inclusion Criteria

Patients suffering from symptoms of pain and/or swelling of the parotid or submandibular salivary glands and patients suffering from dry mouth were included in the present study.

Exclusion Criteria

Patients contraindicated for MRI examination were excluded from the study; this included patients having electrically or magnetically activated implants such as cardiac pacemakers, infusion pumps, and ferromagnetic implants.

MRI Examination

A detailed history was taken for all patients focusing on a history of salivary gland swelling and/or pain, history of dry mouth, and/or dry eye symptoms. The clinical examination included examination of the affected salivary gland area for the presence of swelling or pus oozing from the salivary duct orifice.

MRI Analysis

MRI was performed by using a 1.5-T superconducting magnet (Gyroscan Intera; Philips, Best, The Netherlands). A surface coil (Philips) of 17-cm external diameter and 14-cm internal diameter was placed over the gland area. For each patient, axial T1- and T2-weighted images were performed with the following parameters: T1WI (T1-weighted image): TR (repetition time) = 488, TE (echo time) = 15, NSA (number of signal averages) = 8, FOV (field of view) = 7 cm, image matrix = 256 × 256, slice thickness = 4 mm, interslice gap = no gap, and imaging time = 3 minutes 46 seconds and T2WI (T2-weighted image): TR = 3,612, TE = 100, NSA = 8, FOV = 7 cm, image matrix = 256 × 256, slice thickness = 4 mm, interslice gap = no gap, and imaging time = 5 minutes.

In cases suggestive of Sjögren’s syndrome, short tau inversion recovery (STIR) images were performed with the following parameters: TR = 2,650, TE = 90, NSA = 8, TI (inversion time) = 130, FOV = 7 cm, image matrix = 256 × 256, slice thickness = 4 mm, interslice gap = no gap, and imaging time = 5 minutes.

For MR sialographic examination, a few drops of concentrated lemon juice were given to all patients to stimulate salivation. The single-section single-shot turbo spin-echo (SSTSE) sequence was used to perform sagittal MR sialographic images with the following parameters: TR = 8,000, TE = 900, NSA/NEX (number of excitations) = 8, FOV = 7 cm, image matrix = 256 × 256, slice thickness = 3 cm, and imaging time = 18 seconds. A rectangular imaging area including the whole gland thickness was determined on the axial T2-weighted or STIR images for proper visualization of the main salivary gland duct, and the long axis of the rectangular imaging area was placed parallel to the course of the main duct (Figure 1).

Further investigations were performed when indicated including fine-needle aspiration cytology (FNAC) in case of mass lesions to promote the diagnosis of the type of pathology present, autoantibody tests, and eye examinations in cases suggestive of Sjögren’s syndrome.