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Lithotripsy for salivary stones with prospective US assessment on our first 25 consecutive patients

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ABSTRACT

Objectives: To evaluate the predictive value of sonographic fragmentation in the successful treatment of sialolithiasis.

The main objective was to streamline the management by treating the patients with three sessions of ultrasonic lithotripsy, and to compare the success rate and complications with data from the literature. A second objective was to analyse the predictive value of data from the post procedure and follow-up sonography related to therapeutic success with regard to size, site and location of stones.

Material and methods: Prospective follow-up of 25 patients (mean age of 43 ± 17.2 years old 11–68; 13 women, 10 men) over a period of 31 months (October 2009–April 2012) with one or more salivary calculi (19 parotid, submandibular 6) treated with extracorporeal lithotripsy (electromagnetic MINILITH SL 1, Storz Medical, Switzerland). No anaesthesia or analgesia was used. Each session of lithotripsy lasted on average 30 min. Minor complications were collected on an anonymised sheet.

Results: Complete success (absence of clinical symptoms 3 months after the end of treatment (or the last session) and residual stones <2 mm) was observed in 36% of patients, partial success (persistence of symptoms least 3 months (lower intensity and lower frequency) or size of residual stones>2 mm) in 48% and failure (persistence of same or increased symptoms at 3 months or no change in size of the calculi) in 17% of patients.

Sonographic fragmentation of the stone ($p = 0.004$), total energy delivered ($p = 0.008$) and the total number of shock waves ($n = 0.045$) are predictive factors of complete success. Size, salivary topography, ductal topography, mobilization of the stones, occurrence of minor side effects and total duration of treatment had no predictive value of complete success ($p > 0.05$). There was no significant difference between the first 5 and the last 20 patients ($p = 0.367$).

In agreement with the literature data, the efficacy of treatment was greater for parotid than submandibular calculi.

Conclusion: Extracorporeal lithotripsy is an alternative to conventional surgery with no major complications. Sonographic fragmentation of calculi, total energy and total number of shock waves are predictive factors of successful treatment.

1. Introduction

Stones represent half of the causes of pathology of the salivary glands (Epker, 1972).

They affect submandibular glands in 78%–92% of cases, parotid glands in 6–20% and sublingual or accessory salivary glands in 2% of cases (Epker, 1972; El Deeb et al., 1981). Sialolithiasis affects 0.1%–1% of the population with a higher incidence in men in the third and sixth decade (Koudelka, 1991). The first line of treatment is medical and combines anti-inflammatory and antibiotic therapy with massage of the salivary gland. Typically after failure of medical treatment, the standard treatment for symptomatic salivary calculi is surgical sialadenectomy or intraoral removal of the stone from the duct. However, these techniques carry a risk of significant postoperative complications.

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Parotid surgery carries the risk of facial nerve paralysis and Frey's syndrome (gustatory sweating by aberrant regeneration of parasympathetic fibres to the sweat glands) (Koch et al., 2010). Surgery of the submandibular gland may be complicated by nerve damage to a branch of the facial, lingual or hypoglossal nerves.

Many techniques using a conservative approach have reduced the morbidity: minimally invasive endoscopic techniques, fluoroscopically guided basket stone retrieval, transoral surgical removal under local anaesthesia, intracorporeal salivary gland lithotripsy and extracorporeal lithotripsy (Karavidas et al., 2006; Combes et al., 2006; Bisase et al., 2008). The main limits of the endoscopic approach are difficulty catheterising the salivary ducts, especially Wharton's duct (Chossegros et al., 2006), and failure to remove the stone with the miniaturized basket if the stone is larger than the diameter of the salivary duct.

The first patient successfully treated with lithotripsy was reported in 1989 by Iro et al. using a kidney piezoelectric lithotriptor (Iro et al., 1989). Over the last 20 years, sialolith lithotriptors have appeared, using various techniques to generate shock waves: electrohydraulic (Iro et al., 1992a), piezoelectric (Hessling et al., 1993) and electromagnetic (Iro et al., 2009). The complete success rate (clinical cure or complete stone fragmentation) has not changed over this time (50% in 1992 (Iro et al., 1992b) to 51% in 2009 (Königsberger et al., 1993)). Several studies (Ottaviani et al., 1996, 1997; McGurk et al., 2005; Schmitz et al., 2008; Zenk et al., 2009; Iro et al., 2009) have reported on the use of extracorporeal lithotripsy in the management of salivary calculi.

The goal of lithotripsy is to fragment stones into multiple fragments smaller than 2 mm to restore salivary flow and allows them to pass to the ostium where they can be removed by sphincterotomy or by sialendoscopy with a Dormia miniaturized basket for calculi stuck in the proximal third part of Wharton's or Stensens's duct.

Indications for lithotripsy in the literature vary depending on the function of the gland affected, the size of the stones and the affected portion of the canal. For Capaccio et al. (Capaccio et al., 2007) the effectiveness of the LEC is best for parotid stones larger than 3 mm, submandibular stones of between 3 mm and 7 mm for proximal or hilar locations and intraparenchymal submandibular calculi of any size.

The main objective of this study was to streamline the management by treating the patients with three sessions of ultrasonic lithotripsy, and to compare the success rate and complications with data from the literature.

A second objective was to analyse the predictive value of data from the post procedure and follow-up sonography related to therapeutic success with regard to size, site and location of stones.

2. Materials and methods

2.1. Patients

Between October 2009 and April 2012, 42 patients were seen following failure of medical treatment of symptomatic salivary stones, confirmed by imaging. All patients in whom stones were not easily accessible to minimally invasive surgery or transoral sialendoscopy were included in the study. Pregnant women, patients with stones that could not be demonstrated by sonography, those with glandular atrophy or with pacemakers were excluded. As a result of these exclusions 25 patients were included (13 women and 10 men) with a mean age of 43 ± 17.2 years old (11–68).

Patients with signs of acute sialadenitis only received extracorporeal lithotripsy after complete resolution of the inflammatory episode following treatment with antibiotic and anti-inflammatory medication.

2.2. Ultrasound

Each session consisted of a pre procedure ultrasound tracking, a per procedure ultrasound centering and post procedure sonographic evaluation. Ultrasound tracking and evaluation were performed using a last generation sonography (Aixplorer® SuperSonic Imagine, Aix-en-Provence, France) with a 10 MHz probe surface. The ultrasound centering was made with more rustic probe (7.5 MHz, Sigma 1AC, Kontron Instruments, St. Quentin en Yvelines, France) in an adjacent coaxial lithotriptor. This allowed targeting of the previously marked stones. Ultrasound gel was applied between the latex membrane of the lithotriptor and the skin of the patient. Checking the correct position was performed by sonography during the procedure (Fig. 1).

2.3. Extracorporeal lithotripsy

Treatment consisted of three lithotripsy sessions (spaced about a month apart) or less if full success occurred with one or two treatment episodes. Complete success was defined as complete resolution of symptoms and disappearance of stones on ultrasound, often associated with expulsion. In case of multiple stones, only the larger stones were treated because they were easier to target. Antibiotic, anti-inflammatory and antispasmodic treatments were prescribed after each session.

The installation included the lithotriptor (MINILITH SL 1, Storz Medical, Switzerland) and a dentist's chair (Fig. 2). The patient was comfortably seated with a headrest. Sessions of lithotripsy used progressively increasing intensities according to the tolerance of the test with 5000 target shock waves per session. The number of shock waves, total energy delivered and side effects were collected on an anonymised sheet. The total energy delivered was calculated as the sum of the number of shock waves multiplied by the mean frequency of each session (http://www.youtube.com/watch?v=FFYXDneXPFw).

2.4. Assessment of therapeutic efficacy

The efficacy of treatment was evaluated both clinically and sonographically. It was classified into three groups: complete success, partial success and failure. Complete success is defined as the absence of clinical symptoms 3 months after the end of treatment (or the last session) and residual stones <2 mm. Partial success is

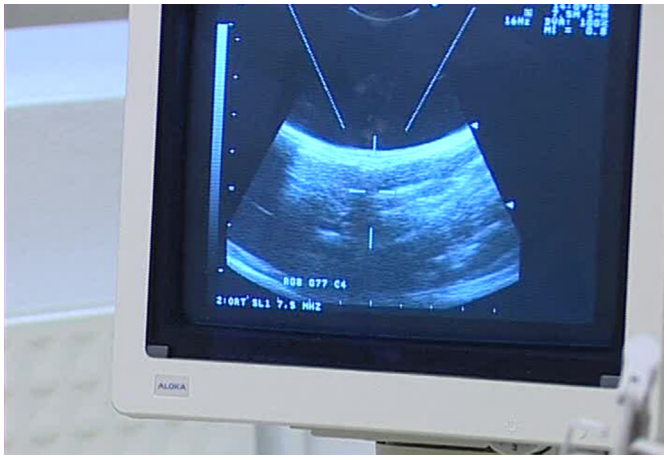

Fig. 1. (Storz Medical, Switzerland) Specific ultrasound probe of electromagnetic lithotriptor MINILITH SL 1 (7.5 MHz, Sigma 1AC, Kontron Instruments, St Quentin en Yvelines, France) allowing continuous US per procedure visualisation of the lithiasis.