**ABSTRACT**

Background: Ultrasound examination is a highly sensitive imaging modality for various forms of obstructive disease of the salivary glands. It can accurately localize and diagnose diverse causes of obstruction, making it an important tool in the assessment of the submandibular gland after sialolithotomy. The objective of this study is to determine whether ultrasound examination performed in the immediate post-operative period can accurately identify patients at risk of recurrent symptomatic sialolithiasis.

Methods: Thirty-three adult patients with symptomatic submandibular sialolithiasis undergoing either transoral sialolithotomy with or without sialendoscopic retrieval of stones were enrolled in the study. Ultrasound examination was performed pre-operatively and post-operatively to evaluate for the presence of retained calculi.

Results: There were no instances of infection, ductal stenosis, loss of salivary function, or permanent lingual nerve paralysis in this study population. A total of 33 patients underwent open sialolithotomy for the management of submandibular gland sialolithiasis. Five patients died during the study period and were excluded from further evaluation. The results of our study indicate that ultrasound is reliably able to predict which patients are at risk of having recurrent sialolithiasis secondary to residual stones immediately following sialolithotomy. Intra-operative localization of foreign bodies is important in the neck following trauma. Lastly, the presence of hyperechogenic foci without posterior shadowing is an indicator of retained stones (p<0.0001).

Conclusions: Ultrasound examination following transoral sialolithotomy can reliably be used to guide the need for further surgical intervention in patients undergoing sialolithotomy of the submandibular gland.

**INTRODUCTION**

Ultrasound examination is a highly sensitive imaging modality for various forms of obstructive disease of the salivary glands. It can accurately localize and diagnose diverse causes of obstruction, making it an important tool in the assessment of the submandibular gland after sialolithotomy. The objective of this study is to determine whether ultrasound examination performed in the immediate post-operative period can accurately identify patients at risk of recurrent symptomatic sialolithiasis.

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Conclusions: Ultrasound examination following transoral sialolithotomy can reliably be used to guide the need for further surgical intervention in patients undergoing sialolithotomy of the submandibular gland.

**METHODS AND MATERIALS**

Thirty-three adult patients with symptomatic submandibular sialolithiasis underwent purely open sialolithotomy at the George Washington University Hospital from August 2000 to January 2002. All patients had a history of recurrent and painful swelling of one or both submandibular glands, a known submandibular sialolithiasis diagnosed by CT or ultrasound, and had failed treatment with sialendoscopic retrieval of stones. The presence of hyperechogenic foci without posterior shadowing is an indicator of retained stones (p<0.0001).

All patients underwent a pre-operative high-resolution ultrasound examination of the affected submandibular gland for the identification and localization of calciolated. Immediately following sialolithotomy, each patient underwent a second ultrasound examination to identify retained stones or evidence of persistent obstruction. Those patients with ultrasound findings in the transverse and oblique planes returned for follow up ultrasound examination 2 weeks postoperatively.

All ultrasound examinations were performed using an ultrasound scanner with a high-resolution 7.5-10 MHz linear array linear-array transducer, and were conducted by the lead investigator. Initial images were obtained in the paramandibular plane via a submandibular approach with the head turned to the contralateral side. Immediately following the procedure, images were again obtained in the paramandibular plane via a submandibular approach. Additional scans were collected as performed in the transverse and oblique planes to identify any retained stones. All ultrasound images were interpreted by the lead investigator and were evaluated for the following: residual stones and/or stone fragments causing persistent obstruction, and persistent proximal ductal dilation.

**RESULTS**

A total of 33 patients underwent open sialolithotomy for the management of submandibular gland sialolithiasis. The subjects were males (n=16) and females (n=17) ranging in age from 13 to 84 years (mean age 47.8 years). Twenty patients had sialoliths of the left submandibular gland and 13 patients had sialoliths of the right submandibular gland.

Immediate post-procedure ultrasound demonstrated retained stones (hyperechogenic foci with posterior shadowing) in 7 out of 33 patients (21.2%). In 2 of these 7 patients the procedure was terminated prior to stone retrieval due to hemorrhage, and in 1 patient it was terminated prior to stone removal due to bleeding. Ultrasound examination performed after procedure termination demonstrated hyperechogenic foci with posterior shadowing in all 3 patients with known residual calculi. Another 3 of the 7 patients underwent bilateral surgical procedures (sialolithotomy followed by sialodochoplasty and/or sialendoscopy) and demonstrated residual stones during the follow up procedure. The last patient underwent re-exploration and was not found to have a retained stone. The appearance of hyperechogenic foci with posterior shadowing accurately predicted stone presence in 6/6 patients and was falsely positive in 1 patient (p<0.0001).

Another fifteen patients were found to have hyperechogenic foci without posterior shadowing and no evidence of stones on further exploration. Seven of the thirty-three patients (21.2%) were also noted to have persistent proximal ductal dilation on ultrasound exam without stones present. Further exploration in these seven patients failed to locate any residual stones. Neither the presence of hyperechogenic foci without posterior shadowing nor the presence of proximal ductal dilation was an indicator of retained calculi (p=0.10 and p=0.295 respectively).

Two weeks post-operatively, complete symptom resolution was achieved in thirty-one out of thirty-three patients (94%). There were no instances of infection, ductal stenosis, loss of salivary function, or permanent lingual nerve paralysis with follow-up ranging from 6 months to 1 year.

**CONCLUSIONS**

There is no widely used method to assess for residual stones following endoscopic-assisted or open submandibular sialolithotomy. Our findings demonstrate that ultrasound accurately identifies the presence of residual calculi in the immediate post-operative period and should be used in the assessment of patients undergoing sialolithotomy. Second, they demonstrate the ultrasound is effectively able to guide the need for immediate re-exploration and predict chances of surgical success in patients at risk of recurrence.

**REFERENCES**