Endoscopic Cauterization of Fourth Branchial Cleft Sinus Tracts

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Objective: To evaluate the effectiveness of endoscopic cauterization as definitive treatment for fourth branchial cleft sinuses.

Design: Retrospective chart review with follow-up questionnaire.

Setting: Tertiary care children’s hospital.

Patients: Ten children (age range, 10 months to 10 years) with fourth branchial cleft sinuses treated with endoscopic cauterization between 1995 and 2002.

Main Outcome Measure: Recurrence of neck infections after endoscopic cauterization of fourth branchial cleft sinus tracts.

Results: Seven of the 10 patients treated with endoscopic cauterization of the fourth branchial cleft sinuses showed no recurrence with an average follow-up of 3 years. Three of the patients were unavailable for follow-up, but medical records of the hospital showed no additional admissions for those patients for neck masses. No morbidity of the procedure was identified. All patients were discharged the day of surgery.

Conclusions: Endoscopic cauterization of fourth branchial cleft sinuses appears to be an effective alternative to open excision.

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SINCE THEIR FIRST DESCRIPTION by Sandborn and Shafer in 1972, fourth branchial cleft sinuses have remained a rare and somewhat controversial entity. They have a left-sided predominance, are usually diagnosed in childhood, and should be considered in the differential diagnosis of asymptomatic neck masses (Figure 1 and Figure 2), recurrent neck abscesses, and suppurative thyroiditis.

Fourth branchial cleft sinuses represent approximately 2% of all branchial anomalies, with approximately 100 described in the world literature to date. They are derived from the fourth branchial pouch, and their course is different depending on which side of the neck they are found. Both left- and right-sided sinuses start as an opening in the piriform fossa, exit the larynx near the cricothyroid joint, and pass between the superior and recurrent laryngeal nerves behind the body of the thyroid gland. Fourth branchial fistulae would continue their course. Left-sided fistulae descend along the trachea and esophagus and loop around the aorta in a posteroanterior direction. Right-sided sinuses descend lateral to the trachea and esophagus and loop posteroanteriorly around the subclavian artery. The tracts then pass superior to the hypoglossal nerve, dip down, and exit anterior to the sternocleidomastoid muscle. The course of fourth branchial cleft fistulae is theoretical, based on embryological development, since no fourth branchial fistula has been described. Left-sided anomalies are likely more frequent because of the asymmetry of the vascular supply of the developing arch or possibly an asymmetry in the development of the ultimobranchial body.

The ability to differentiate fourth from third branchial arch anomalies is difficult because both sinuses are expected to open into the piriform sinus. The ability to differentiate between the two lies in determining the relationship of the sinus to the superior laryngeal nerve, which can only be done with surgical exploration. If the sinus passes below the superior laryngeal nerve, a fourth branchial pouch sinus is suggested, whereas if the sinus passes above the superior laryngeal nerve, a third branchial pouch sinus is suggested. Endoscopic clues to the origin of

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a sinus can be gained from the location in the piriform sinus. Openings in the apex of the piriform sinus suggest fourth branchial cleft anomalies.

The findings of pathologic examination of the excised specimen to determine the pouch of origin can be confusing. The presence of parathyroid tissue and thymus in a specimen suggests that the sinus is of third pouch origin, as both the inferior parathyroid glands and the thymus are of third pouch origin. The presence of parathyroid and thymus tissue can be misleading, however, because parathyroid tissue may be part of the superior parathyroid gland (a fourth pouch structure) and an accessory thymus can develop from the fourth pouch, making these findings less specific for a third branchial cleft sinus.

Regardless of the pouch of origin, histologic examination of excised tracts often reveals inflammatory changes to nonkeratinized stratified squamous or stratified columnar epithelium. Transitional epithelium and subepithelial lymphoid infiltrates have also been reported.

While controversy remains regarding identification of third and fourth branchial sinuses, the current treatment of choice involves complete excision of the sinus tract. While we agree that the fistula tract must be closed, in 1998 we described a novel approach to the treatment of fourth branchial cleft sinuses. Herein, we present the long-term follow-up of our previous experience with endoscopic cauterization as the primary treatment for correction of fourth branchial cleft sinuses.

**METHODS**

**STUDY DESIGN**

A retrospective chart review was conducted at the Children’s Medical Center of Dallas, Dallas, Tex, a tertiary academic referral children’s hospital, for all patients undergoing endoscopic cauterization of fourth branchial cleft sinuses. Ten patients were identified who had been treated between 1995 and 2002. The patients' families were contacted by phone using the information provided in the medical records. Verbal phone consent was obtained, and a phone questionnaire regarding patient follow-up was conducted. The study was conducted with approval from the institutional review board of The University of Texas Southwestern Medical Center at Dallas.

**PATIENTS**

Ten patients (age range, 10 months to 10 years) were identified who presented to the Children’s Medical Center of Dallas with neck masses diagnosed as fourth branchial cleft sinuses and treated with endoscopic cauterization. The patients' charts were evaluated to determine the age at treatment, initial presentation, initial treatment, and time between treatment of presenting complaint and endoscopic cauterization. The patients' families were then contacted for a phone interview for long-term follow-up, and verbal consent was obtained for study participation. A family member was then asked the following questions: (1) Has your child had any recurrent neck infections? (2) Did your child require another surgery for his or her neck problem?

**DESCRIPTION OF PROCEDURE**

The patient was taken to the operating room, and a general endotracheal anesthetic was administered. The head of the bed was rotated 90° to give the surgeon access to the oral cavity. Microsuspension was then performed with a Lindholm laryngoscope. The opening into the piriform sinus was identified (Figure 3). An appropriately sized intravenous balloon catheter (Angiocath) was then passed into the sinus tract, and the balloon was inflated to dilate the opening of the sinus (Figure 4). An electrocautery generator (Force 2 Generator; Valleylab, Boulder, Colo) at a coagulation setting of 5 was then
used. An electrocautery ball coagulator (Bovie Medical Corp, St Petersburg, Fla) was placed into the sinus tract to its base through the piriform sinus opening and stimulated until the surrounding tissue began to blanch. The cautery was partially removed to just cover the opening of the sinus and then stimulated until the sinus opening was cauterized. The sinus opening was manipulated to ensure that closure had occurred. The patient was then awakened, extubated, and taken to the recovery room.

**RESULTS**

The presenting complaints of the 10 patients included recurrent neck abscess (n = 2), abscess of the left side of the neck (n = 6), suppurative thyroiditis (n = 1), and neck abscess after open excision of a branchial cleft sinus (n = 1). No right-sided neck masses or complete fistulae were identified. Except for the 3 patients who presented with recurrent neck abscesses, the average time between the initial neck complaint and endoscopic cauterization was 6 weeks. The average follow-up was 3 years. Three patients were unavailable for follow-up. Of the patients contacted, none had a recurrence of a neck mass. The 3 patients who were unavailable for follow-up have no other record of hospitalization or emergency department visit at the Children’s Medical Center of Dallas for a neck mass or other complaint related to a branchial cleft anomaly. The diagnosis of a branchial cleft anomaly should be considered whenever a child presents with a neck mass, recurrent neck abscesses, or suppurative thyroiditis. The usual workup for a branchial cleft anomaly includes either magnetic resonance imaging or computed tomography to determine if a tract exists. As part of our routine evaluation of neck masses that appear suspicious on imaging of the neck for branchial cleft sinuses, direct laryngoscopy is performed to look for a piriform sinus opening. In 2 of our patients who presented with a neck abscess that required surgical incision and drainage, direct laryngoscopy was performed before open incision. When a piriform sinus opening was identified, the abscess was also endoscopically drained. This procedure resulted in complete resolution of the abscess in one patient, while the other one required a delayed open incision and drainage.

In a patient who presents with a neck abscess and in whom a piriform sinus opening is identified, the abscess is treated appropriately. The patient then returns 6 to 8 weeks later for endoscopic cauterization of the sinus tract. Cauterizations are performed as outpatient procedures. The patients are observed in the recovery room for signs of airway compromise for 2 to 4 hours and are then discharged home if there are no problems. They re-
turn for office-based follow-up 2 to 4 weeks later. All of our patients who were available for long-term follow-up had no recurrence of their original disease process.

Endoscopy offers several advantages over the open procedure. The risk of surgical dissection in the neck is eliminated. The surgical treatment of a fourth branchial cleft sinus is complete excision of the tract. Its path lies in proximity to the superior and recurrent laryngeal nerves, esophagus, trachea, and, at times, aorta. Because of previous infection and scar tissue, such dissections can be difficult. Endoscopic cauterization minimizes risk of injury to these structures, as no open excision is required. Also, the cost and anxiety associated with hospitalization are alleviated, because endoscopic cauterization can be performed on an outpatient basis.

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REFERENCES