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Minitrephination of the frontal sinus: Indications and uses in today’s era of sinus surgery

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ABSTRACT

Background: This study reviews the role of frontal sinus minitrephination in today’s era of endoscopic sinus surgery. Retrospective chart review was performed of 165 patients undergoing a total of 149 bilateral and 39 unilateral frontal sinus minitrephinations.

Methods: Charts were reviewed for patient demographics and outcomes. Details obtained from the chart included type of surgery performed, reason for minitrephine placement, pathology, Lund score, complications, and endoscopic patency.

Results: One hundred eighty-eight minitrephines were placed during 80 modified Lothrop and 108 frontal sinusotomies. Trephines were placed when there was difficulty finding the frontal recess, severe edema/polyps, obstructing frontal cells (type 3/type 4 frontethmoidal cells and intersinus septum cell), and to aid the dissection and postoperative irrigation during the modified Lothrop. Twelve complications occurred with infection at the trephine site being the most common. Follow-up ranged from 2 to 122 months (average, 25.5 months) with 92% showing endoscopic patency at last visit.

Conclusion: Frontal sinus trephination is a safe useful procedure that can be extremely helpful in identifying the pathway to the frontal sinus. Fluorescein flushes through the trephine help guide the dissection in a modified Lothrop. Lasty, it may be used in the postoperative period to flush the sinus with saline and steroids to promote patency of the frontal sinus.


Key words: Chronic sinusitis, endoscopic sinus surgery, frontal sinus, frontal sinusotomy, minitrephination, modified Lothrop, paranasal sinus

Today, endoscopic surgery of the frontal sinus still presents a challenge to many surgeons. The anatomy of the frontal sinus is complex and may vary from case to case, potentially confusing the surgeon. The close proximity of the thin cribiform plate medially, the orbit laterally, and the anterior ethmoidal artery posteriorly often leads to anxiety when dissecting in this region. Furthermore, a narrow anterior–posterior diameter of the frontal recess and/or the presence of frontethmoid cells (supraorbital ethmoidal cells, suprabular cells, frontal bulla cells, frontethmoidal cells types 1–4) often lead to difficulty in identifying the frontal recess. Not infrequently, the outcome is an inadequate dissection of the frontal recess with incomplete removal of the frontethmoidal cells and failure of frontal sinus surgery. In addition, the presence of a large type 3 (T3) or T4 cell may be mistaken for the frontal sinus itself. If the correct drainage pathway is not identified and opened at the time of surgery, the patient is at risk for postoperative scarring resulting in chronic frontal sinusitis.

In cases where the frontal sinus is difficult to find, the surgeon may opt to use image guidance or, alternatively, place a frontal sinus trephine.2,3 Frontal sinus trephines allow fluorescein mixed with saline to be flushed through the frontal sinus and visualized within the nose creating a direct pathway to the frontal sinus and easy identification. Frontal sinus trephines have other useful functions as well. They may be used intraoperatively to flush out the sinus when there is concern for pus, mucus, or fungal mucin located out of reach of surgical instruments.4 In addition, postoperative flushes through the cannula with saline and steroid drops may decrease muco-mucal inflammation and lessen scarring of an inflamed frontal ostium. If necessary, the opening of the trephine site may be widened to 5 mm to accommodate instruments and scopes and allow for an “above and below” approach to frontal sinus pathology.5 Larger openings up to 10 mm may be made if placed in the floor of the frontal sinus.6 At last, the trephines may be used in the modified Lothrop procedure to delineate the posterior extent of the dissection, which lies immediately posterior to the fluorescein flushes. This article details our experience with frontal sinus minitrephination. Operative technique, indications, complications, and outcomes will be presented.

MATERIALS AND METHODS

After Institutional Review Board approval, a retrospective chart review was performed on all patients who had a frontal sinus minitrephine placed as a part of endoscopic sinus surgery between the years of 2000 and 2008. Information obtained from the charts included patient demographics, presenting symptoms, previous sinus surgeries, nasal endoscopy findings, type of surgery, and indication for minitrephination, postoperative complications, and outcomes. CT scans were reviewed for the presence of frontethmoidal cells and staged according to the Lund-Mackay scale. Pathology was reviewed and patients were classified into four disease classes: allergic fungal sinusitis, nonallergic fungal eosinophilic sinusitis, nonallergic nonfungal eosinophilic sinusitis, and chronic rhinosinusitis (no eosinophilia present).
Operative Technique

In all cases, minitrephination of the frontal sinus was performed using the Medtronic Mini-Trehphination Set (Medtronic ENT, Jacksonville, FL). The optimal location for trephine placement is at a point 1 cm from the midline at the level of the medial aspect of the eyebrow (Fig. 1). This point lies on the superior orbital rim in most people. The skin is infiltrated with local anesthetic and a stab incision is made with a 15 blade scalpel and widened with Iris scissors. The drill guide is placed in the incision and firmly anchored onto the bone. While using gentle irrigation, the drill bit is placed through the guide with contact to bone limited to only several seconds. This prevents the drill from heating up and causing a burn of the bone and skin. When penetration of the anterior table is felt the drill is removed and a guidewire is placed through the drill guide. The frontal cannula is placed over the wire and rotated into the bone as the guidewire is removed. Correct placement of the trephine is checked with a 10-mL syringe filled with saline. Aspiration should either produce air bubbles, blood, mucus, or pus. Clear fluid may indicate intracranial penetration and the trephine should be removed. Next, a syringe filled with half-strength fluorescein (500 mL of saline and 0.5 mL of 5% fluorescein) is placed on the cannula and irrigated into the sinus. The endoscope is placed in the nose to allow for visualization of the fluorescein. In patients in whom it is thought that there is an increased risk of possible frontal ostium stenosis (edematous, inflamed ostium, circumferential ostial trauma, and very narrow ostium), the cannulas are left in for a period of 2–5 days. After surgery the patients are instructed to flush each cannula with saline every 2 hours while awake and the nonmodified Lothrop patients are instructed to use steroid drops every 4 hours while awake for a period of 5 days. In the modified Lothrop patients 5 mL of steroid cream is injected into each port immediately before removal of the cannula. This is done to help prevent excessive crusting in the neofrontal ostium.

RESULTS

One hundred sixty-three patients, 110 men and 53 women, underwent a total of 188 minitrephines. The average age was 49.5 years (range, 19–88 years). Twenty-six patients had Samter’s triad and 79 patients had asthma alone. Nasal polyps were found in 132 of the patients. The average Lund score was 17.5. The majority of patients was classified as having nonallergic nonfungal eosinophilic sinusitis followed by chronic rhinosinusitis allergic fungal sinusitis, and nonallergic fungal eosinophilic sinusitis (Table 1).

One hundred forty-nine bilateral trephines and 39 unilateral trephines were placed. Trephines were used in 80 drill outs (modified Lothrop) and as a part of 108 routine sinus surgeries. One hundred forty-eight of the cases were revisions. Reasons for trephine placement included severe edema, narrow frontot recess, and the presence of obstructing frontal cells (Table 2). Complications occurred in 12 (6.4%) patients (Table 3), with the most common being that of infection at the trephine site. Follow-up ranged from 2 to 122 months (average, 25.5 months) with 151 (92%) patients showing endoscopic patency of the frontal sinus at last visit.

DISCUSSION

Although several studies have been published regarding minitrephination of the frontal sinus, all have been limited by small numbers. To our knowledge, this is the largest published series looking at the outcomes of frontal sinus minitrephination. We present our results of frontal sinus trephines.
placed over the past 8 years, specifically looking at those patients with difficult frontal recess anatomy and those undergoing modified Lothrop procedure. We have shown it to be an extremely useful adjunctive procedure to frontal sinus surgery with minimal morbidity. Although not widely publicized or practiced today, frontal sinus trephination should not be regarded as a procedure of the past. Since its initial description in 1939 by Hutchinson who described a puncture technique into the frontal sinus, it has undergone considerable advancement. In 1991 Hoffman and May described an “above and below” approach to the frontal sinus using the trephine porthole. Subsequent studies have been published reviewing patients who underwent a combined trephination with frontal sinusotomy for complex frontal sinus pathology. Each study concluded that the “above and below” approach is an important adjunct for the management of complex frontal sinus disease and could potentially reduce the need for more advanced procedures such as the modified Lothrop and osteoplastic flap. Recently, Zacharek et al. published a series of 13 patients with advanced frontal disease who underwent computer-aided frontal sinus trephination. Computer-aided guidance was used to place the trephine site based on surface localization of the frontal pathology. Although traditionally frontal trephines are placed into the inferomedial aspect of the frontal sinus, using computer-aided guidance the trephine may be paced anywhere along the surface of the frontal sinus. In our series the majority of patients had a history of previous sinus surgeries and presented with severe nasal polyposis. The average Lund score was 17.5 showing a high degree of pansinusitis in most patients. Minitrephines were placed early in the case when identification and exposure of the frontal recess was anticipated to be difficult from reviewing the preoperative films or in the case of a scheduled modified Lothrop. Fluorescein flushed through the trephine was used to help guide the instruments in the correct direction. A small malleable frontal sinus probe (Medtronic ENT) can be directed up the fluorescein stained pathway. This focuses the dissection in the direction of the frontal sinus and can potentially prevent damage to surrounding critical structures. Occasionally, despite the surgeon’s best efforts to create a wide frontal drainage pathway, it is often not possible because of the bony anatomy. Efforts to enlarge the ostium may only create circumferential damage increasing the patient’s risk factor for postoperative stenosis of the frontal ostium. In these cases we recommend leaving the trephine in place to allow for saline rinses after surgery to maintain patency and prevent occlusion by blood clots. If the mucosa surrounding the trephine is found to be edematous and inflamed, postoperative steroid flushes are alternated with the saline flushes. Theoretically, this reduces inflammation of the surrounding mucosa and helps prevent scar tissue formation although this is still to be proven scientifically. In our patients who underwent a frontal sinusotomy, an overall endoscopic patency was seen in 92.6%. Complications from minitrephination range from minor skin infection to orbital injury and intracranial penetration with cerebral spinal fluid leak. We showed an extremely low complication rate of 6.4% using the landmarks described previously for placement of the trephine. The most common complication encountered was infection at the trephine site (n = 4). Intracranial penetration with cerebral spinal fluid leak occurred in one of our patients with an underpneumatized frontal sinus that was not identified preoperatively. This was recognized immediately after the bone was drilled by clear fluid leaking from the wound. Two complications occurred when a trephine was placed into a frontal mucocle with erosion of the orbital rim/lamina papyracea. In one patient, flushing through the trephine generated increased intracranial pressure and temporary proptosis. In the other patient, flushes caused an ocular carotid reflex with a brief episode of asystole. Care must be taken flushing fluorescein through the trephine when there is erosion of the floor or the posterior wall of the frontal sinus. No pressure should be used in these cases. If there is any resistance to flushing or there is an absence of fluorescein visualized in the nasal cavity, flushes should be halted immediately and the situation should be reassessed.

CONCLUSION
Minitrephination has many applications in frontal sinus surgery today and should be a part of the surgeon’s armamentarium. When using the appropriate landmarks for placement there is a low risk of complications.

REFERENCES