

Canine fossa trephine is a beneficial procedure in patients with Samter's triad*

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Summary

Background: Canine fossa trephine (CFT) is an adjunctive technique to sinus surgery in patients with recalcitrant maxillary sinusitis. CFT allows for disease clearance in areas of the maxillary sinus that are hard to reach with standard endoscopic techniques. The objective of this study was to compare the surgical outcome of CFT to standard middle meatal antrostomy (MMA) in matched patients with the severely diseased maxillary sinus.

Study design: Prospective clinical study

Methods: Patients undergoing sinus surgery were enrolled in either the CFT or MMA group. All patients had nasal polyps, Lund Mackay score of 2 in the maxillary sinus, and nasal endoscopy showing the maxillary sinus full of polyps. The patients were followed and the maxillary sinus was graded endoscopically at 3, 6 and 12 months after the surgery. Length of surgery, disease recurrence and need for revision surgery was documented.

Results: Forty-two CFTs and MMA were performed in each group. At 6 and 12 months the CFT group demonstrated statistically significant improvement in nasal endoscopy scores. Six patients recurred by the one year mark in the MMA group, 4 of which underwent revision surgery. In the CFT group 2 patients recurred, one who underwent a unilateral revision CFT. Furthermore the CFT did not prolong the surgical time and was often faster than performing a MMA.

Conclusion: CFT allows for clearance of all gross disease in the maxillary sinus and appears to improve postoperative outcome at 6 and 12 months and decrease the need for revision surgery.

Key words: canine fossa trephine, maxillary sinusitis, caldwell luc, endoscopic sinus surgery, maxillary antrostomy, nasal polyps

Introduction

Canine fossa trephine (CFT) is used as an adjunctive technique to endoscopic sinus surgery in patients with recalcitrant maxillary sinusitis. It aids clearance of disease in patients whose maxillary sinus is partially or completely opacified with polyps, eosinophilic mucin, fungal debris or edematous polypoid mucosa. Complete clearance of the maxillary sinus through a conventional middle meatal maxillary antrostomy is often difficult. Despite using various curved shaver blades the anterior

and inferior walls of the maxillary sinus are hard to reach and often not cleared of disease. Thus, when the maxillary sinus is completely opacified disease may be left behind when only the natural ostium of the maxillary sinus is penetrated. Therefore, adjunctive surgical techniques for clearance of the severely diseased maxillary sinus have been described such as the Caldwell Luc procedure, CFT, inferior meatal antrostomy, endoscopic maxillary mega-antrostomy (EMMA), and endoscopic medial maxillectomy (EMM). EMMA involves extending the antrostomy

down through the posterior half of the inferior turbinate to the floor of the nose⁽¹⁾. EMM involves removal of the medial wall of the maxillary sinus and inferior turbinate.

CFT has evolved from the traditional Caldwell Luc approach which was first described in the late 19th century⁽²⁾. As a result of the large anterior antrostomy created with the Caldwell Luc approach significant complications and morbidity such as facial numbness, paresthesia and oroantral fistulas were common⁽³⁾. The CFT approach provides a much smaller localized opening into the anterior wall of the maxillary sinus through which a microdebrider blade can be inserted. A 70 degree scope is used within the nose to allow visualization of the maxillary sinus and to guide clearance of the disease using the microdebrider placed through the trephine. Landmarks for placement of the trephine are well established which minimizes the risk of injury of the infraorbital and the anterior superior alveolar nerves^(4,5). Injury to the nerves and surrounding tissue may result in facial pain, paresthesias and numbness which may be transient or permanent⁶. Although most complications are transient in nature there is the potential for long term side effects. Thus, the question remains, is it crucial to clear all disease of the maxillary sinus or is ventilation of the sinus and near partial clearance of the sinus adequate surgery? Is the addition of a CFT with its potential adverse effects worth the change in outcome? Does complete clearance of the maxillary sinus with a CFT improve postoperative outcomes and delay or prevent postoperative recurrence?

In this study we attempt to answer the above questions by prospectively comparing the surgical outcomes of those patients who underwent a CFT compared to matched controls who underwent a standard middle meatal antrostomy (MMA).

Methods

Patients

After approval from the Institutional Review Board at Loma Linda University Medical Center and the Research Ethics Committee at the Queen Elizabeth Hospital in Adelaide Australia a prospective study was initiated in patients who underwent a CFT or maxillary antrostomy for extensive maxillary sinus disease between February 2008 and September 2010. Patients recruited ranged between the ages of 18 and 80 years. All patients presented with signs and symptoms of chronic sinusitis as defined by the new research criteria established in 2004 by 5 national American societies⁽⁷⁾. Only those patients who failed conventional medical treatment (nasal and/or oral steroids and long term antibiotics) and were enlisted for surgery were included in the study. All patients recruited had severely diseased maxillary sinus defined by a nasal endoscopy score of 3 (Table 1) and a maxillary Lund Mackay score of 2. The presence of nasal polyps were diagnosed by nasal endoscopy and CT scan. Pa-

tients were included if they had at least one maxillary sinus that fit the above criteria. Patients were excluded if they had a history of a prior Caldwell Luc or CFT, fungal ball, mucocele, mucous retention cyst, antrochoanal polyp, benign or malignant tumor, sinus opacified with pus which was easily suctioned out, cystic fibrosis or ciliary dysfunction. Patients who dropped out before the 12 month follow-up visit were also excluded.

Patients were divided into those who had MMA (control group) and those who had a CFT. Both groups had similar disease severity as confirmed by nasal endoscopy of the maxillary sinus (grade 3) at the time of surgery. Intraoperatively the duration of disease clearance of the maxillary sinus was recorded in both groups. Patients charts were searched and the following data obtained: history of asthma or aspirin sensitivity and number of prior surgeries.

Surgery

Patients recruited from Adelaide Australia all underwent either a unilateral or bilateral CFT as a part of endoscopic sinus surgery by the same senior author (PJW). A CFT was performed identically in each patient using the well established landmarks as described in previous papers⁽⁵⁾. Patients recruited from Loma Linda University all underwent a standard middle meatal antrostomy by senior authors (CC and KS) and served as the control group. Clearance of the sinus was performed using various curved shaver blades (40 and 90 degree) and suction. Duration of clearance was recorded from the time the uncinate was removed to the end of disease removal in the maxillary sinus in the MMA group. In the CFT group the duration of the procedure was recorded from the time of mucosal incision along the upper lip and included the time spent taking down the uncinate and opening up the natural ostium of the maxillary sinus.

Patients were seen in follow-up at 3 months, 6 months and 12 months postoperatively. At the time of each office visit nasal endoscopy was performed and the status of the maxillary sinus noted. The sinus was graded using the original grading scale 1-3 (Table 1). Postoperative complications were noted and recorded. All patients were given the same postoperative care which included the use of intranasal steroid sprays and oral steroids and antibiotics as needed.

Statistics

Data was analyzed using students chi square analysis and unpaired t-test. Statistical analysis was performed using Prism software (GraphPad, La Jolla, CA, USA). P-values < 0.05 were considered statistically significant.

Results

Twenty-eight patients from Australia (CFT group) and 26 patients from Loma Linda (control group) fulfilled the inclusion

Table 1. Grading of the diseased maxillary sinus. Table 1. Grading of the diseased maxillary sinus.

Grade	Endoscopic findings
1	Normal or slightly edematous mucosa
2	Edematous mucosa with small polyps without significant eosinophilic mucus
3	Extensive polyps and tenacious mucus, nonreversible disease

criteria of the study. Of those 24 patients from the CFT group and 22 patients from the control group completed the 12 month follow-up period and were included in the study. In the CFT group there were 14 males and 10 females with a mean age of 53 years (range 18-74). In the control group there were 10 males and 12 females with a mean age of 52 years (range 18- 79). In the CFT group 6 unilateral and 18 bilateral CFT were performed for a total of 42 CFT. This was compared to 2 unilateral and 20 bilateral maxillary antrostomies in the control group (42 total antrostomies). All patients in both groups had nasal polyps, maxillary sinus grade 3 disease (table one) and a predominance of eosinophils noted on pathology. The number of patients undergoing revision surgery as well as the pre-operative Lund Mackay score was comparable in both groups (Table 2). In addition each group had comparable numbers of patients with asthma, AFS and Samter's triad (Table 2).

Anesthesia was administered in a similar manner at both institutions using inhalation gases. The average time spent cleaning the maxillary sinus in the CFT group was 7.5 minutes (range 2-10 minutes) compared to 15 minutes (range 7-30 minutes) for the control group. Both groups used similar instruments to clean the sinus including: straight and curved microdebrider blades and suctions along with angled scopes. Surgeon estimation of disease clearance was recorded at the end of the case. Complete clearance of disease was achieved in all patients who underwent a CFT and was documented by placing an angled scope within the trephine hole. In the in the control group disease clearance ranged between 80 and 100%, however, this is a rough estimate based on the visibility of the anterolateral walls using a 70 degree angled scope. No intraoperative or postoperative complications including no post-operative numbness, parasthesia or unusual pain occurred in either group.

Overall, we found no statistical significance between control and treatment side at 3 months. However, at 6 and 12 months

Table 2. Patient characteristics.

	CFT group	Control group
Revision surgery (n)	20 (93.3%)	17 (77.8%)
Primary surgery (n)	4 (16.7%)	5 (22.2%)
Average # prior surgeries	2.1 (range 1-11)	1.68 (range 1-4)
Lund Mackay score	19.5 (range 12-24)	19.7 (range 12-24)
Number w/ Asthma	9	7
Number w/ Samter's triad	6	6
Number w/ AFS	4	4

those in the canine fossa group tended to have less edema and disease recurrence as noted by a lower grade on endoscopy (Table 3). In the control group, 6 patients had bilateral recurrence of disease by 12 months (11 sides with a grade 3) and 4 of those patients underwent revision surgery within the year the study was completed. Two of the patients with grade 3 recurrence refused revision surgery and were managed with intranasal and oral steroids but continue to have persistent disease. Of the 6 patients who recurred, 4 had Samter's triad (Table 4). In the CFT group 2 patients (one with Samter's triad) for a total of 3 sides had a grade 3 maxillary sinus at the one year mark. Of those 2 patients one underwent revision surgery (table 4). Excluding those patients with Samter's triad no difference in postoperative outcome was noted between the two groups.

Discussion

This study compared disease outcome and recurrence between two groups with extensive maxillary sinus disease. All groups had extensive polyps within the maxillary sinus requiring surgical removal. Both groups had comparable Lund MacKay scores and number undergoing primary and revision surgery. The treatment group underwent a CFT with complete clearance of disease at the time of surgery while the control group underwent a standard middle meatal antrostomy (MMA) with disease removed from 80-100% of the sinus. It is common knowledge that through the traditional maxillary antrostomy complete clearance of disease along the anterior and inferior walls of the maxillary sinus is often difficult if not impossible. If the goal of sinus surgery is to remove all diseased mucosa a standard MMA will have to be accompanied by another approach such as Caldwell luc or CFT. To date it is unclear whether complete clearance of disease within the maxillary sinus is necessary or whether a large antrostomy with appropriate postoperative care is good enough. This study demonstrates that in patients with a grade 3 maxillary sinus a CFT improve postoperative outcome at 6 and 12 months. Further-

Table 3. Maxillary sinus grade at 3, 6 and 12 months following surgery.
P value < 0.05 considered statistically significant (* statistical significance achieved).

	CFT group	Control group	p-value
Average grade at 3 months	1.49 ± 0.0857	1.38 ± 0.0899	0.4075
Average grade at 6 months	1.34 ± 0.099	1.76 ± 0.122	0.0115*
Average grade at 12 months	1.26 ± 0.10	1.77 ± 0.12	0.0042*
# sides with grade 3 recurrence	3 (2 patients)	11 (6 patients)	0.047*
# requiring revision surgery	1	4	

more, a CFT appears to decrease the need for revision surgery in patients with Samter's triad. Although surgeon dependent, performing a CFT with disease clearance may take less time than a standard MMA.

Other studies have looked at the results of canine fossa puncture and have come up with both comparable and differing conclusions. Sathananthar et al assessed the impact of CFT on subjective outcomes using visual analogue and chronic sinusitis survey and on objective outcomes as measured by nasal endoscopy and MRI findings⁽⁸⁾. In this study the group of patients who underwent a CFT had statistically less symptoms and less mucosal thickening on postoperative MRI. However in this study there is criticism that the controls and CFT group were not matched appropriately. The control group consisted of 12 patients all who had basic CRS except one diagnosed with nonallergic eosinophilic fungal sinusitis (NEFS). In the CFT group 19 of 25 had fungal sinusitis (11 with AFS, 8 with NEFS). In this study we attempted to match our control and treatment groups more rigorously (matched for presence of Samter's triad, AFS and asthma) to further evaluate for any differences between the two groups. In another study by this group, the surgical outcomes of 97 patients undergoing CFT were evaluated⁽⁸⁾. In this study, 82.5% were disease free at last follow-up. In this study those patients who had recurrence of disease tended to have a greater Lund Mackay score, higher number of previous surgeries and AFS. In our study all of our patients who recurred had a history of previous surgeries and a Lund Mackay score of at least 18.

Lee et al., compared the results of 11 CFP to 13 MMA in a prospective randomized study⁽¹⁰⁾. They found no difference between the two groups as measured by symptom scores and computed tomography findings. This group excluded those patients with a history of prior surgery, asthma, Samter's triad and fungal

sinusitis which composed a large percentage of those enlisted in this study. The cohort excluded in study by Lee et al., by nature have severe disease and it is in those patients who we believe benefit the most from a CFT. In our CFT and control groups, 83.4 % and 77.8%, respectively, had a history of prior surgery. In the 12 month follow-up period, 2 patients in the CFT group needed revision surgery compared to 6 in the control group. Of those patients who needed revision surgery, 4 in the control group and 1 in the CFT group had Samter's triad. In addition, Lee et al., excluded those patients who required a unilateral CFT in the presence of bilateral sinusitis because symptoms scores could not be calculated accurately. In this study we looked at postoperative endoscopy as the only outcome measured so that patients who underwent a unilateral or bilateral CFT could be included. This increased the power of our study by looking at each side individually. Comparing the outcomes of both groups we found better postoperative appearance of the maxillary sinus at 6 and 12 months in the CFT group compared to controls. From our results, it may be suggested that those patients with severe disease as noted by a history of previous sinus surgeries and the presence of Samter's triad undergo CFT to help ensure the best outcome.

Conclusion

CFT appears to help control recurrence of disease in the maxillary sinus at 6 and 12 months in those patients with Samter's triad. In addition it may reduce surgical time and in our patients had no increase in morbidity.

Conflict of interest

PJ Wormald receives royalties for design of instruments used for CFT from Medtronic ENT.
Financial disclosures- none.

Table 4. Characteristics of those patients who had disease recurrence as noted by a grade 3 maxillary sinus on endoscopy. c- control group. t- CFT group. * patient 1t had positive fungal cultures to *Aspergillus* but negative to fungal allergens on allergy testing.

Patient	# previous surgeries	Samter's triad	AFS	Lund Mackay
1c	2	Y	N	24
2c	2	Y	N	17
3c	4	Y	N	18
4c	1	N	N	21
5c	3	Y	N	24
6c	1	N	N	21
1t	1	N	N*	24
2t	4	Y	N	18

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