A STUDY OF CALDWELL-LUC APPROACH IN VARIOUS ETIOLOGIES

Minutha R¹, Sriram Nathan²

HOW TO CITE THIS ARTICLE:

Minutha R, Sriram Nathan. "A study of Caldwell-luc approach in various etiologies". Journal of Evolution of Medical and Dental Sciences 2013; Vol2, Issue 36, September 9; Page: 7015-7023.

ABSTRACT: BACKGROUND: Caldwell Luc procedure was designed to remove irreversibly damaged mucosa of the maxillary sinus and to facilitate gravitational drainage and aeration via an inferior meatal antrostomy. Though the frequency of Caldwell Luc procedure has reduced with the advent of the more conservative functional endoscopic sinus surgery, it is still indicated in cases of irreversible scarring, polypoidal mucosal inflammation and chronic inflammation associated with mucociliary dysfunction. Although initially confined to the treatment of maxillary sinusitis, nowadays, it is also indicated in case of removal of foreign bodies from maxillary sinus, as an access to pterygomaxillary fissure and pterygo-palatine fossa, evaluation and stabilization of orbital floor fracture or removal of orbital floor in decompression. In spite of its effectiveness and variety of indication, it can be associated with complications, such as numbness, pain, paresthesia, damage to teeth and oro antral fistula. **OBJECTIVES:** This study aims to know the possible indications of Caldwell Luc procedure and to understand the effectiveness and the complication that can be associated with the procedure. **KEY WORDS:** Caldwell-luc, FESS, Maxillary Sinus, AC Polyp.

INTRODUCTION: The Caldwell-Luc operation was first described in the late 19th century as a technique to remove infection and diseased mucosa from the maxillary sinus via the canine fossa, while creating intranasal counter drainage through the inferior meatus. This operation has been performed countless times over the past century, but it has come under increased scrutiny within the past 20 years. This criticism is multifactorial. Medical management of allergic and infectious sinus disease has continued to improve, and endoscopic sinus surgery techniques have proven to be safe and effective in the vast majority of patients requiring surgical management. Additionally, several retrospective studies have shown high complication rates with the operation. Recent studies have illustrated both the histologic benefit of complete removal of diseased mucosa, as well as better patient outcomes with minimal morbidity when a safer operative technique is used. Overall, the Caldwell-Luc procedure is safe and effective as described, and should remain in the repertoire of surgeons managing the maxillary sinus.¹

MATERIALS AND METHODS: This was a prospective study of fifty patients on whom Caldwell-luc procedure was performed for various indications from November 2005 to may 2007.

OPERATIVE TECHNIQUE: The initial steps and approach to the maxillary sinus through the canine fossa is similar regardless of the indication (Figures 1 to 5). Incision is usually placed 5 mm above the gingivolabial sulcus. The site is elevated preserving the mucosa which aids in proper healing. The elevation is proceeded towards the periosteum and the same is elevated from the maxilla using the elevators. A standard and adequate exposure extends from the pyriform aperture medially to the maxillary tuberosity laterally, alveolar ridge inferiorly to infraorbital nerve superiorly. These structures also form the boundaries of the canine fossa. Entry into the maxillary sinus is initiated

routinely through an osteotome although drill can also be used. The further procedure is tailored to the indications as mentioned below. The procedure can be performed in both general and local anaesthesia with advocates of both. We used local anaesthesia in around thirty cases and general anaesthesia in around twenty cases.

The following Inclusion Criteria was thus used for the selection of cases:

Inclusion criteria:

1. Patients who have undergone Caldwell Luc procedure and have been followed up for atleast 3 months.
2. Patients undergone Caldwell Luc procedure after failure of endoscopic sinus surgery.

The Exclusion Criteria used were:

1. Patient who have undergone diagnostic Caldwell Luc procedure,
2. Patients age <14yr and 3. Patients who failed to report for regular follow up.

RESULTS AND OBSERVATIONS:

Indications: Caldwell luc approach as used in our patients is represented in figure 6

Maxillary sinus pathology: This was the most common indication with over thirty six patients having antrochoanal polyp related conditions such as chronic sinusitis which was seen in three other patients. Other cases affecting maxillary sinus which were treated by this approach included three cases of dentigerous cyst, three cases of mucocoele and two cases of osteomyelitis secondary to diabetes.

Oroantral fistula: This entity is rarely encountered in recent clinical practice. The one case operated and treated by the Caldwell luc approach was in fact caused by a similar procedure performed for the removal of an antrochoanal poly in another center some years before. Thus oroantral fistula is a complication as well as is treated by Caldwell luc method.

Maxillary sinus as an approach using Caldwell luc technique: The first was a case of impacted foreign body, a piece of bullet which was stuck in the maxillary sinus and removed via the Caldwell luc approach. The second case in our study was the reduction and repair of a blow out fracture of the orbit. Other conditions and procedures which utilise the maxillary sinus and Caldwell luc as a conduit include, maxillary artery ligation, Vidian neurectomy, pterygopalatine fossa surgeries and sphenopalatine artery libation to name a few.

We did not encounter any of the above indications.

Complications: The most common complication was swelling over the cheek which was seen in around thirty five or seventy five percentage of cases. While other complications included bleeding in around twenty five cases (50%), numbness in an around the cheek area in around twenty two cases (44%) and recurrence of the disease, in this case the polyp in one case (2%). The same was treated with revision surgery and the patient on follow up has been recovering well. The numbness mentioned above was a temporary symptom which was relived in some time in all the cases.

DISCUSSION: The relevance of Caldwell luc in the present era of ENT practice especially with the excellent results obtained by functional endoscopic sinus surgery is confined to limited indications. However certain age old indications certainly do exist as this procedure provides access to the antrum easier and the exposure is large.

Matheny KE, Duncavage JA. Et al have analysed this very assessment stating that recent studies have illustrated both the histologic benefit of complete removal of diseased mucosa, as well as better patient outcomes with minimal morbidity when a safer operative technique is used. Overall, the Caldwell-Luc procedure is safe and effective as described, and should remain in the repertoire of surgeons managing the maxillary sinus.[1]

As with the above we have also utilized the Caldwell luc approach in maxillary sinusitis with good outcome.

Eski E et al aimed to evaluate the long-term results of endoscopic sinus surgery and combined approach with Caldwell Luc procedure for the treatment of antrochoanal polyps. In the study 41 patients (24 males, 17 females; mean age 34.7 years; range 14 to 78 years) were retrospectively analyzed. Patients were divided into two groups according to treatment modality: group 1 included 26 patients who underwent endoscopic sinus surgery alone and group 2 included 15 patients who underwent endoscopic sinus surgery in combination with Caldwell Luc procedure. There was no statistically significant difference between the groups in terms of recurrence and complication rate ($p > 0.05$). Mean follow-up was 50.5 months (range 15 to 94 months). It was concluded that current approach for the treatment of antrochoanal polyps is endoscopic sinus surgery. However, combined approaches should be performed to avoid recurrences, unless removal of antral part of the antrochoanal polyp completely by endoscopic resection is possible. Selection of the combined techniques depends on the surgeon familiarity with the procedure and whether the patient is pediatric case. Combined approach with Caldwell Luc is a safe procedure in adults. [2].

Similarly, we have used the Caldwell luc approach for the removal of AC polyp and found it to be effective.

Ozer F et al performed a comparative analysis on the surgical approaches for antrochoanal polyp. The aim of this study was to evaluate the clinical and histopathological characteristics of antrochoanal polyps (ACPs) and to perform a comparative analysis of surgical techniques in terms of recurrence. The clinical, radiological and histopathological features of 42 patients with a diagnosis of ACP who underwent surgery in a period of 6 years (January 2000 - January 2006) were investigated retrospectively. Histopathological examinations were present for all patients and were re-examined for histological analysis. Endoscopic sinus surgery (ESS) was performed in all patients. Transcanine sinusoscopy (TS) and the Caldwell-Luc approach (CL) were used in addition to ESS in 14 and 13 patients respectively. The attachment site was detected in 21 patients (50%) and the most frequent site was found to be the lateral wall in 15 patients (71.4%). There was no relationship between the choice of surgery, the attachment site or accessory ostium, or any sinusitis with ACP. Histological examination showed prominent eosinophilia in 29 patients (69%). Three recurrences were seen after ESS. However, there was no recurrence after ESS+TS and ESS+CL. They concluded stating that the most important factors affecting the choice of surgical approaches are the preference of the surgeon, the age of the patient and the presence of recurrent disease. They also stated that combined approaches with either TS or CL should be considered, particularly when the attachment site of the antral part of ACP is undetected, in order to prevent incomplete excision and recurrences.[3]

Huang YC and Chen WH. Described Caldwell-Luc Operation without Inferior Meatal Antrostomy in a retrospective Study of 50 Cases. They stated that in the standard Caldwell-Luc operation, an inferior meatal antrostomy is performed to promote sinus drainage. However, inferior meatal antrostomy has been criticized for its additional operation time and wound, early loss of the opening, and risk of injury to the nasolacrimal duct. The records of 50 patients who had an odontogenic sinus disease and underwent the Caldwell-Luc operation without inferior meatal antrostomy were reviewed. The surgical indications included intrasinus odontogenic cysts (44%), oroantral fistulae with chronic sinusitis (44%), odontoma (4%), odontogenic sinusitis (4%), and foreign bodies in the maxillary sinus (4%). The patients were successfully treated with minimal complications. It was concluded that the modified Caldwell-Luc operation provides easier postoperative care and involves fewer complications. [4]

Becker SS et al compared the maxillary sinus specimens removed during Caldwell-Luc procedures and traditional maxillary sinus antrostomies. The cases of 80 patients who underwent Caldwell-Luc surgery for the treatment of chronic rhinosinusitis between 2002 and 2007 at Vanderbilt University Medical Center's Department of Otolaryngology were reviewed. Statistically significant differences were found in terms of mean patient age, sex, mean number of sinuses surgically addressed, number of prior surgeries, and tissue eosinophil counts. Microscopic examination revealed the presence of "necrotic bone" in 2 Caldwell-Luc specimens, and "necrotic debris" in 2 other Caldwell-Luc specimens. No similar finding was seen in the control group. Caldwell-Luc is a surgery of last resort for patients who fail aggressive interventions for maxillary sinus disease. The mucosal lining of this small group of patients appears to be different from that of patients who respond favorably to functional endoscopic sinus surgery. [5]

As early as 2005, Barzilai G et al analysed the Indications for the Caldwell-Luc approach in the endoscopic era. They stated that Caldwell and Luc described the Caldwell-Luc operation more than 100 years ago as the surgical treatment for maxillary sinus disease. During the last decades less radical interventions using endoscopic approach have mainly replaced the classical procedures done for chronic and recurrent maxillary sinusitis. In their analysis, between 1991 and 2002, 62 patients had the Caldwell-Luc approach for different indications. Twenty (32%) patients had chronic sinusitis, 16 (26%) patients had inverted papilloma, 9 (15%) patients had suffered from nasal polyposis, 4 patients (6%) had dentigerous cyst, 4 (6%) patients had fungal ball, and 9 (15%) patients were operated for other indications. The conclusions drawn were that the use of this surgical approach is rational in cases of fungal disease and in endoscopic medial maxillectomy for treating inverted papilloma. In all other cases, the preferred approach should now be endoscopic. [6] Ray B et al also described a rare cause of nasolacrimal duct obstruction: dentigerous cyst in the maxillary sinus. The clinical documentations of mechanical nasolacrimal duct obstructions due to a dentigerous cyst in the maxillary sinus are very rare in literature. In this case report, they described a dentigerous cyst with a supernumerary tooth in the maxillary sinus in an 11-year-old male child causing an obstruction to the nasolacrimal duct. The case was successfully managed surgically by Caldwell Luc approach. [7]

Caldwell luc approach is recognized as a treatment for blow out fracture of orbit. Recently however studies have demonstrated minimally invasive techniques to manage blowout fracture. Yoshida T et al mentioned one such study. They stated that blowout fracture repositioning is done, surgically, infraorbitally, transnasally following endoscopic sinus surgery, and transantrally.

Repositioning using fenestration is minimally invasive compared to the conventional Caldwell Luc procedure. Subjects involved 21 cases, and were under the medical treatment. The researchers estimated the treatment results as the improvement degree of subjective symptoms at the improvement degree of the visible symptom views that used a Hess chart. As a result, the fenestration method showed good improvement degree, and it was not the thing which had the big vice-damage. Fenestration was thus concluded to be useful in blowout fracture repositioning. [8]

Foreign body in the maxillary sinus and removal by the Caldwell-Luc approach has been described and is a common technique in cases where exposure is important. [9]

The complications of the Caldwell-Luc operation were retrospectively studied in 1990 by Low WK. The case records were analysed and updated information from telephone interviews and posted questionnaires were available for most patients. One hundred and eighty-five patients with 216 procedures with a mean postoperative follow-up period of 33.5 months were studied. There were three common complications found: facial swelling (61.9%), pain and/or numbness of the face (46.0%) and pain and/or numbness of the teeth/gums (30.9%). Rare complications are postoperative epistaxis (0.4%), oroantral fistulae (0.4%), epiphora (0.4%) and dental discoloration (0.4%). [10]

CONCLUSION: Although the use of the Caldwell-Luc operation has declined in recent years with the development of endoscopic sinus surgery, it still has occasional indications and a set of practical guidelines on how to prevent complications would be useful. Caldwell-Luc procedure seems to be highly effective in the management of medically refractory chronic sinusitis after failed endoscopic middle meatus antrostomy. Caldwell-Luc procedure should remain in the otolaryngologist's surgical repertoire for these selected cases.

KEY POINTS:

- Caldwell-luc is a well recognized approach to the maxillary sinus
- The indications are widespread
- In recent times, the use of this approach has declined due to the advent of Functional Endoscopic Sinus Surgery.
- The approach can still be used for certain rare indications and in cases of revision surgeries.
- The approach provides a wide and open exposure of maxillary sinus and the surrounding structures.

REFERENCES:

1. Matheny KE, Duncavage JA. Contemporary indications for the Caldwell-Luc procedure. Curr Opin Otolaryngol Head Neck Surg. 2003 Feb; 11(1):23-6.
2. Eşki E, Imre A, Çallı Ç, Pınar E, Öncel. Approaches to antrochoanal polyps in adults: long-term comparative results Kulak Burun Bogaz Ihtis Derg. 2012 Jan-Feb; 22(1):1-5. doi: 10.5606/kbbihtisas.2012.001.
3. Ozer F, Ozer C, Cagici CA, Canbolat T, Yilmazer C, Akkuzu B. Surgical approaches for antrochoanal polyp: a comparative analysis. B-ENT. 2008; 4(2):93-9.
4. Huang YC, Chen WH. Caldwell-Luc Operation without Inferior Meatal Antrostomy: A Retrospective Study of 50 Cases. J Oral Maxillofac Surg. 2011 Dec 29.

5. Becker SS, Roberts DM, Beddow PA, Russell PT, Duncavage JA. Comparison of maxillary sinus specimens removed during Caldwell-Luc procedures and traditional maxillary sinus antrostomies. *Ear Nose Throat J.* 2011 Jun; 90(6):262-6.
6. Barzilai G, Greenberg E, Uri N. Indications for the Caldwell-Luc approach in the endoscopic era. *Otolaryngol Head Neck Surg.* 2005 Feb;132(2):219-20.
7. Ray B, Bandyopadhyay SN, Das D, Adhikary B. A rare cause of nasolacrimal duct obstruction: dentigerous cyst in the maxillary sinus. *Indian J Ophthalmol.* 2009 Nov-Dec; 57(6):465-7.
8. Yoshida T, Yanagi K, Okino Y, Imai T, Moriyama H. Blowout fracture repositioning by fenestration. *Nihon Jibiinkoka Gakkai Kaiho.* 2010 May; 113(5):450-5.
9. Friedlich J, Rittenberg BN. Endoscopically assisted Caldwell-Luc procedure for removal of a foreign body from the maxillary sinus. *J Can Dent Assoc.* 2005 Mar; 71(3):200-1.
10. Low WK. Complications of the Caldwell-Luc operation and how to avoid them. *Aust N Z J Surg.* 1995 Aug; 65(8):582-4.

Figure 1 Incision

Figure 2 Landmarks

Figure 3 Incision and opening of antrum

Figure 4. Removal of disease and packing of cavity

Figure 5 Closure and immediate postoperative period

Figure 6. Indications of Caldwell- luc in our study

ORIGINAL ARTICLE

AUTHORS:

1. Minutha R.
2. Sriram Nathan

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of ENT, Madha Medical College, Chennai.
2. Senior Resident, Department of ENT, Madha Medical College, Chennai.

NAME	ADDRESS	EMAIL	ID	OF	THE
------	---------	-------	----	----	-----

CORRESPONDING AUTHOR:

Dr. Minutha R,
No. 151, "Rathna",
Minhaj Nagar, J P Nagar Post,
Bangalore – 560078.
Email- minuthar@yahoo.com

Date of Submission: 30/08/2013.
Date of Peer Review: 31/08/2013.
Date of Acceptance: 02/09/2013.
Date of Publishing: 06/09/2013