

FOREIGN BODY IN THE MAXILLARY SINUS: A CASE REPORT

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ABSTRACT

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 histological 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.

A 61 year-old lady was referred to our out patient clinic with a two-month history of right-sided symptoms of nasal obstruction and facial pain. Her past medical history was unremarkable; she was not on any medication and was a non-smoker. After orthopantomogram and CT-Scan a foreign body was detected and a Caldwell-Luc procedure was performed. The foreign body was analysed under electronic microscopy. There were no post-operative complications; the patient went on to make an uneventful recovery with no sign of recurrence one year post-operatively.

KEY WORDS

Foreign Body, Maxillary Sinus, Caldwell-Luc.

PALAVRAS-CHAVE

Corpo-Estranho, Seio Maxilar, Caldwell-Luc.

RESUMO

A cirurgia de Caldwell-Luc foi inicialmente descrita na parte final do sec. XIX como uma técnica para remover infecção e mucosa doente do seio maxilar através da fossa canina, estabelecendo drenagem intranasal através do meato inferior. Este tipo de cirurgia foi realizado inúmeras vezes no século passado, no entanto a sua utilização tem vindo a crescer nos últimos 20 anos. O tratamento médico das alergias e infecções do seio maxilar têm aumentado e as técnicas de cirurgia endoscópica para abordagem do seio maxilar têm provado ser seguras e efectivas na grande maioria dos pacientes que requerem intervenção cirúrgica.

Adicionalmente, vários estudos retrospectivos têm mostrado elevadas taxas de complicações com esta técnica. Estudos recentes têm no entanto ilustrado o benefício histológico na remoção completa da mucosa afectada, assim como uma melhor recuperação dos pacientes com mínima morbidade resultado da utilização de uma técnica mais segura. Poderá dizer-se que a técnica de Caldwell-Luc é segura e efectiva, e deverá ser mantida como opção na abordagem do seio maxilar.

Um paciente do sexo feminino com 61 anos foi

referida para a nossa clínica possuindo uma história médica de 2 meses de sintomatologia do lado direito da face com sintomas de obstrução nasal e dor facial. A sua história médica não apresenta factos relevantes de registo, não toma qualquer tipo de medicação e é não-fumadora. Após ortopantomografia e tomografia axial computadorizada um corpo-estranho foi detectado, sendo a técnica de Caldwell-Luc realizada para exérese do mesmo. O corpo-estranho foi analisado através de microscopia electrónica. Não existiram complicações pós-operatórias, a paciente realizou uma boa recuperação sem sinal de recidiva após um ano da data da intervenção cirúrgica a que foi submetida.

INTRODUCTION

In the late 19th century, many surgeons realized that severe maxillary sinus infections required aggressive removal of the sinus contents for adequate treatment. To accomplish this, several of them described techniques of trephining the sinus through the canine fossa. George Caldwell of the United States and Henri Luc of France, independently, were the first to describe a procedure to remove infection and diseased mucosa from the maxillary sinus while simultaneously providing intranasal counter drainage through the inferior meatus^{2,13,19}.

This procedure, which still bears their names, remained a mainstay of surgical management of maxillary sinus disease until the advent of endoscopic techniques for improving physiologic drainage at the natural ostia in the mid-1980s. Despite the success of endoscopic middle meatus antrostomy (EMMA) coupled with the reports of fairly high morbidity rates with the Caldwell-Luc (C-L) operation in the literature, several clear indications remain. These include approaches to the pterygomaxillary space for vessel ligation or tumour extirpation, orbital decompression in Graves ophthalmopathy, repair of certain defects resulting from facial trauma, repair of oroantral fistulae, and removal of maxillary fungus balls, foreign bodies, and neoplasms. Additionally, many surgeons still advocate the use of C-L for EMMA failures with irreversible mucosal disease^{9,11,14,19}.

OPERATIVE TECHNIQUE

The standard C-L procedure begins with a gingivolabial incision in the mucosa superior to the canine tooth. This incision is carried laterally

to approximately the level of the first molar. Care is taken to maintain enough vertical height on the inferior mucosal cuff to allow adequate closure of the wound at the end of the procedure. The soft tissue down through the periosteum is divided. The anterior maxillary periosteum is then elevated widely over the face of the maxilla to the level of the infraorbital nerve. The nerve is protected while the sinus is entered via the anterior wall^{14,19}.

This anterior antrostomy can be accomplished with a wide variety of techniques. A small puncture can be made with a trocar followed by a Kerrison punch to enlarge the hole. Cutting burrs attached to pneumatic or electrical drills can accomplish the same thing, but these burrs may be difficult to control on osteopenic bone. A commonly used method, both less precise and more dangerous, involves opening the sinus with a mallet and chisel. Once the sinus has been entered, the free contents therein are removed. Next, the sinus mucosa is roughly elevated and removed with curved Coakley curettes and grasping forceps. An inferior meatus antrostomy is also done to allow physiologic sinus drainage. This middle meatus antrostomy is naturally more precise with the use of the inferior turbinate, or the patient will be at risk for circular flow of mucus between the middle and inferior meatus. The anterior maxillary wall is left open, and the incision is closed in layers with absorbable suture^{9,14,19}.

INDICATIONS

The overall effectiveness of antibiotic therapy and EMMA, coupled with multiple publications reporting fairly high complication rates with the C-L, have led to a significant decline in the number of C-L operations performed for infectious indications. The complications most often reported include perioperative issues such as fever, facial edema, and pain, as well as more significant long-term complications such as facial asymmetry, numbness in the infraorbital nerve distribution, dacryocystitis, devitalized teeth, and oroantral fistulae¹⁴.

Although there have been several studies suggesting that the C-L carried significant risk, perhaps the most widely cited study is that by DeFreitas and Lucente in the 1988⁴.

They reviewed 670 C-L at their institution over a 10 year period. There was an overall major complication rate of 19%. The authors stated that the C-L "may not be a viable option in the treatment of purely chronic maxillary sinusitis". They advocated addressing the ostiomeatal

complex endoscopically when at all possible for treating chronic sinusitis. Other indications for the procedure were discussed such as accessing the pterygomaxillary space, decompression of the orbit in Graves ophthalmopathy, and removal of maxillary neoplasms.

Blitzer and Lawson in 1991³ further delineated alternative indications for the C-L. Patients with Graves ophthalmopathy can greatly benefit from an increase in orbital volume, and the orbital floor is easily reached via the C-L. Extension of the C-L through the posterior maxillary sinus wall allows ligation of the internal maxillary artery in severe epistaxis, resection of the sphenopalatine ganglion or the trigeminal nerve for neuralgias, and resection of the vidian nerve for vasomotor rhinitis. Maxillary foreign bodies, sometimes encountered after oral surgery, for example, require the amount of exposure provided by the C-L. Often, to adequately repair oroantral fistulae or debride osteoradionecrosis, this same degree of exposure is necessary. The final point mentioned is that C-L is necessary in cases of chronic sinusitis with irreversible mucosal changes.

This idea that the mucosa reaches a disease state so advanced that it cannot return to normal (*ie*, irreversibly-changed or condemned mucosa) has been investigated for at least 70 years. Several studies have examined the mucosal regeneration after C-L, trying to show whether radical removal of condemned mucosa would be advantageous in treatment. Gorham and Bacher *et al.*⁸ analyzed human maxillary sinus mucosa macroscopically and microscopically in 1928, concluding that virtually normal mucosa with proper ciliary orientation regenerates after C-L. Although not examining the maxillary sinus, Hilding¹⁰ contradicted Gorham's finding somewhat in 1930 by stripping the mucosal lining of canine frontal sinuses, and observing the postoperative sequelae. When this was done, the frontal sinuses usually ended up being obliterated by scar tissue and neo-osteogenesis.

Benninger *et al.*¹ in 1988 examined the mucosal regeneration of 10 rabbits after undergoing C-L operations. They found that at time of killing 6 to 8 weeks after the operation, seven of the rabbits exhibited new respiratory ciliated epithelium. In the brief postoperative interval, the authors also noted granulation, fibrosis, and both acute and chronic inflammation. They were unable to assess the function of the regenerated respiratory epithelium post-mortem, but postulated that it would not exhibit entirely

normal function because of the inflammation and fibrosis.

Forsgren *et al.*⁷ in 1993 decided to examine the entire sinus complex including the underlying bone rather than just random biopsy to try to resolve some of the contradictory findings. They also used a rabbit model and observed regeneration of fairly normal epithelium as early as 1 to 2 months postoperatively and generally by 6 to 9 months postoperatively. The same group of authors⁶ then conducted a prospective human study comparing preoperative and postoperative symptom scores and histopathologic parameters in patients with chronic maxillary sinusitis. One hundred fifty patients were randomly assigned to two groups, 75 receiving the standard C-L, and 75 undergoing EMMA. When 1 year postoperative mucosal biopsies were examined, the C-L cohort demonstrated a reduced amount of inflammatory cells and an overall normalization of the mucosa when compared with the Emma group. The data suggested that even when adequate EMMA were performed, once the mucosa had reached a certain pathophysiologic point such as that seen in asthmatics and in severe sinonasal polyposis, complete mucosal removal via the C-L with subsequent mucosal regeneration was significantly more effective long term in improving mucosal appearance histologically and functionally.

In 2001, Richtsmeier¹⁶ retrospectively looked at 85 EMMA failures requiring surgical revision. Failures were defined as patients who either had the same symptom complex as they did preoperatively, or ones who had new symptoms primarily attributable to the maxillary sinus. He identified 10 reasons why these patients failed. Obstruction of the ostium either by scarring or by inadequate identification of the true ostium at the time of operation was by the most common reason for failure. Also, adjacent sinus disease in the anterior ethmoid and frontal regions caused recurrent chronic maxillary sinusitis in many of the EMMA failures.

FOREIGN BODIES

The bone of the maxillary sinus floor can be very thin and in some individuals the roots of the posterior teeth project through this bone. In these cases the root tips are then covered only by the Schneiderian membrane of the respiratory epithelium which lines the maxillary sinus^{5,12,15,17}.

The most commonly found foreign bodies are the displaced fractured roots of teeth and in

some instances displaced whole teeth. Other foreign bodies include dental burs, dental implants, GP points and silver points. More bizarre foreign bodies include: bullets, pieces of glass, stones, wood, needles, grasses, match sticks and sand. It is generally accepted that prompt surgical intervention to remove the foreign body is desirable to prevent the possible sequelae of acute/chronic sinusitis, mucosal cyst formation, antrolith formation and persistent oro-antral communication^{2,5,12,15,17,18}.

In addition, small foreign bodies may be transported by the cilia of the epithelial lining in the maxillary sinus in the mucus-containing fluid against the influence of gravity, up the nasal wall of the sinus and out into the nose via the ostium. Small particles are transported in this way out of the sinus in less than 10 minutes. Small foreign bodies may be silently inhaled, especially during sleep or when protective reflexes are dulled by alcohol. If inhaled in this way there is a real potential for the development of pneumonia, bronchiectasis or lung abscess^{11,12,18}.

CLINICAL CASE

A 61 year-old lady was referred to our out patient clinic with a two-month history of right-sided symptoms of nasal obstruction and facial pain. Her past medical history was unremarkable, she was not on any medication and was a non-smoker. After orthopantomogram and CT-Scan a foreign body was detected and a Caldwell-Luc procedure was performed. The foreign body was analysed under electronic microscopy and Energy Dispersive Spectroscopy (EDS) analysis and results revealed that it was composed of a calcified granules enriched in Calcium (Ca) and Phosphorus (P), which were embedded in polymeric fibers. The presence of Carbon (C) is due to the coating of the sample used for analysis and therefore it is attributed of its chemical composition. The presence of several ions was also detected in particular some commonly found in the physiological environment, such as Sodium (Na) and Magnesium (Mg) at very low content.

After the removal of the foreign body, the prognosis is usually good. In our patient, there were no post-operative complications, the patient went on to make an uneventful recovery with no sign of recurrence one year post-operatively she has been free from the nasal complication.

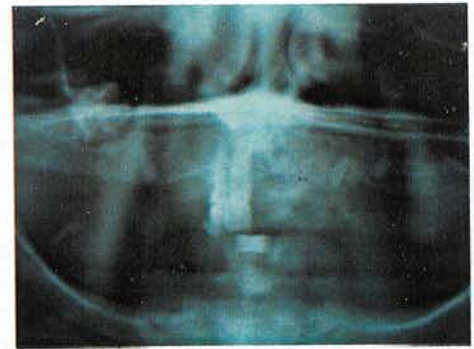


Fig. 1 - Pre-operative orthopantomogram with a foreign body in the first quadrant



Fig. 2 - Pre-operative CT-Scan in a frontal view



Fig. 3 - Clinical aspect of the area



Fig. 4 - Surgical approach with a Caldwell-Luc procedure

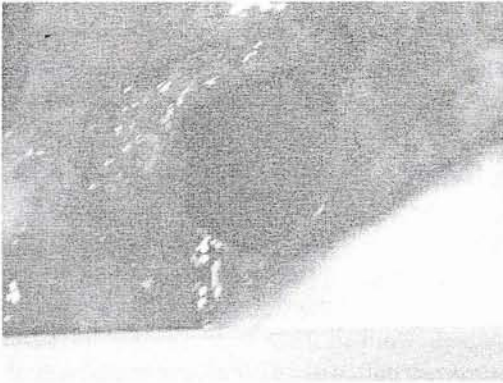


Fig. 5 - Maxillary sinus exposed after foreign body removal

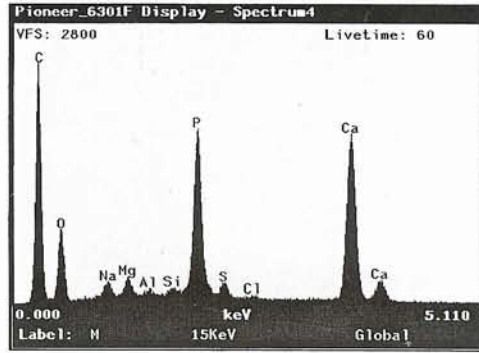


Fig. 9 - Energy Dispersive Spectroscopy (EDS) analysis

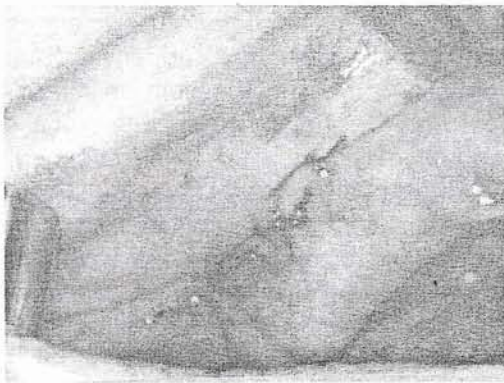


Fig. 6 - Tight wound closure through suture

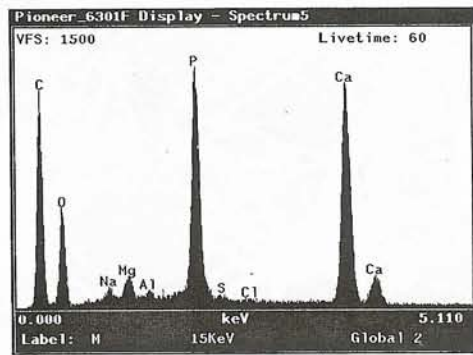


Fig. 10 - EDS analysis in a different spectrum

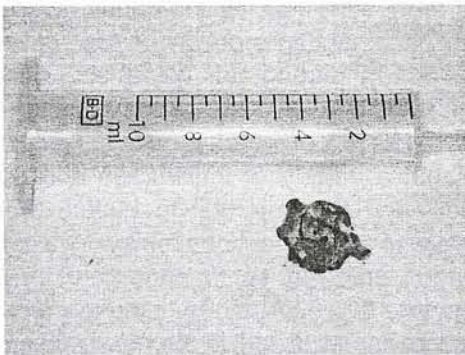


Fig. 7 - Foreign body dimensions



Fig. 11 - Surface view of the calcified granules.

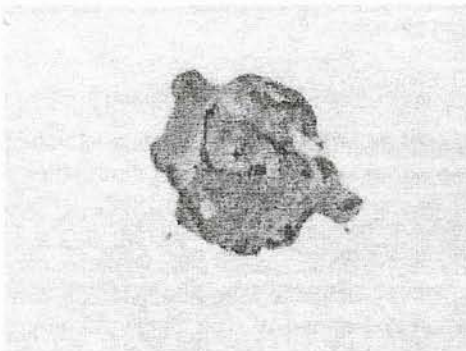


Fig. 8 - Foreign body in detail

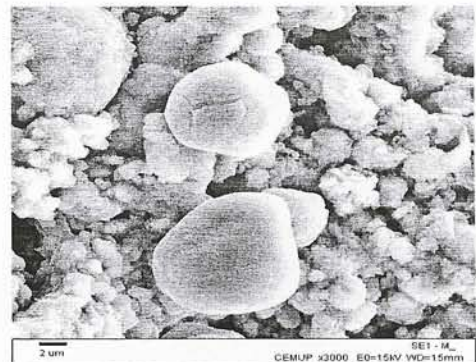


Fig. 12 - Calcified granules with spherical shape approximately

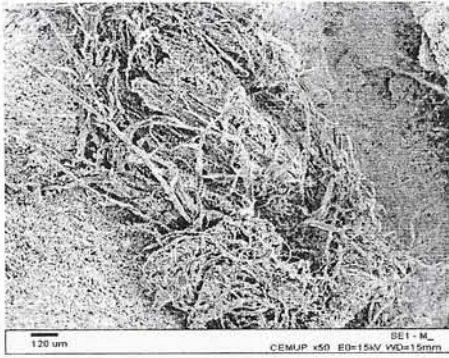


Fig. 13 - Polymeric fibers

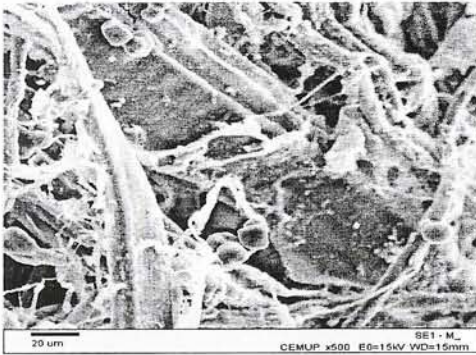


Fig. 14 - The same view of the fibers at higher magnification

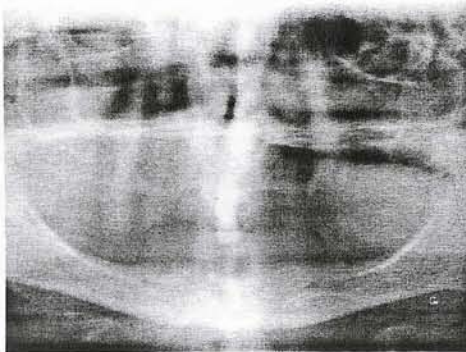


Fig. 15 - Post-operative orthopantomogram 12 months after surgical intervention

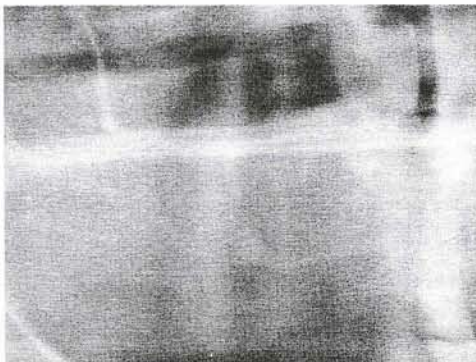


Fig. 16 - Post-operative orthopantomogram in detail

CONCLUSIONS

The C-L is an operation that has been performed myriad times by numerous surgeons during the past century. Although most otolaryngologists would agree that it is no longer a first-line operation for maxillary sinus disease as it has been historically, the literature outlines many current indications for the procedure unrelated to inflammatory or infectious sinus disease.

When management of sinus disease is considered, there is objective evidence that C-L is an option for EMMA failures, especially in cases of recurrent maxillary sinusitis where the ethmoid and frontal sinuses are free of disease, and the maxillary antrostomy is widely patent. These patients likely have underlying mucosal abnormalities that can potentially be improved by radical removal of mucosa with subsequent regeneration. EMMA failures are a subpopulation of patients that are difficult to manage. Even if the remucosalization after C-L is not perfect, getting these patients to a point that their symptoms can be controlled medically is a major clinical victory.

Although there are large series reports about unusually high complication rates with the C-L, other reports suggest that morbidity is a function of technique and surgeon experience rather than inherent danger within the procedure itself. With gentle entry into the maxillary sinus through the anterior wall, and protection of the infraorbital nerve during periosteal elevation, one can minimize the risk of a major complication^{2,14}.

With a low risk of morbidity with the techniques described, a variety of indications unrelated to sinusitis, and the potential to treat a group of patients with sinus infections refractory to medical and endoscopic surgical management, the C-L is a procedure that should remaining the repertoire of all surgeons who work in the head and neck^{2,14}.

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