

Treatment options for odontogenic maxillary sinusitis: a review

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SUMMARY

Objective. The aim of this article is to review the main treatment options for odontogenic sinusitis that are used today.

Material and methods. Search on PubMed, Cochrane Library, PMC, Science Direct data bases. For a literature review search keywords were used: odontogenic sinusitis, odontogenic maxillary sinusitis treatment OR diagnosis, maxillary sinusitis of dental source OR dental origin OR etiology.

Results. 2886 articles were found in the databases using keywords. After duplicate citations screened, inclusion/exclusion criteria applied, excluded articles after titles, summaries and full-text reading 25 articles were included in the literature review.

Conclusion. Although clinical symptomatology is not conspicuous among other types of sinusitis, the odontogenic maxillary sinusitis treatment regimen is different. It consists of eliminating dental infection and management of sinusitis. The usage of Caldwell-Luc approach is limited these days and recommended only when a better access to sinus is needed, for example, removing large foreign bodies. Endoscopic sinus surgery is widely used these days to remove the inflamed sinus mucosa, foreign bodies, displaced teeth, while preserving physiological function of the sinus. Sometimes dental infection removal alone is sufficient to resolve the odontogenic maxillary sinusitis, but sometimes concomitant endoscopic sinus surgery or Caldwell-Luc approach is necessary for full resolution.

Key words: odontogenic maxillary sinusitis treatment, Caldwell Luc, endoscopic sinus surgery, maxillary sinusitis of dental origin.

INTRODUCTION

Maxillary sinusitis is defined as a symptomatic inflammation of the maxillary sinus and is classified as chronic when it lasts longer than 12 weeks (1). The origin of sinusitis is considered to be primarily rhinogenous, but in some cases dental infection is a major predisposing factor (2). The most common causes of odontogenic maxillary sinusitis (OMS) include apical and marginal periodontitis, oroantral fistulas after tooth extraction and infection caused by intra-antral foreign bodies (3). According to literature, the incidence of odontogenic sinusitis is 10- 12% of all sinusitis cases, but recent studies suggest it may be as high as 41% (3-5). The treatment is complex and consists of removal of etiological factor and surgical management of sinusitis. There

is still no gold standart in selecting the most suitable treatment method for this disease. Literature suggests these main treatment options for OMS: Caldwell-Luc (CL) operation, Functional Endoscopic Sinus Surgery (FESS), dental extraction (treatment), and combinations of these. Therefore, the aim of this article is to review the main treatment methods that are being used today.

MATERIAL AND METHODS

Search on PubMed, Cochrane Library, PMC, Science Direct data bases. For a literature review search keywords were used: odontogenic sinusitis, odontogenic maxillary sinusitis treatment OR diagnosis, maxillary sinusitis of dental source OR dental origin OR etiology. We found 514 publications in Pubmed, Cochrane Library – 6, PMC – 1205, Science Direct – 1161.

Results were checked for duplicates, the inclusion/exclusion criteria applied, the titles, abstracts

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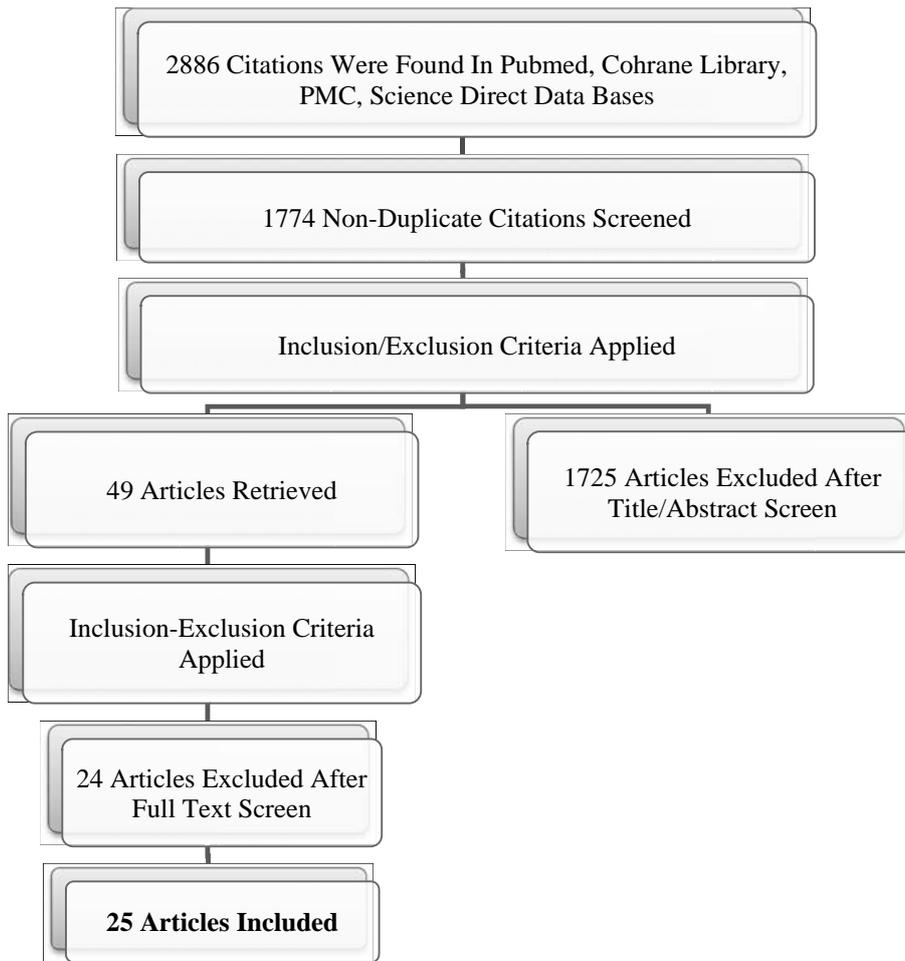


Fig. 1. Diagram of the literature search strategy

and full texts were reviewed in order to exclude all inadequate articles and finally we included 25 studies in our literature review. The process of articles' selection is presented in the diagram (Figure 1).

Studies were included despite of the type of scientific articles (case reports, original researches, review articles). The article selection criteria were determined according to the subject of study and analysis of the results:

Articles analyzing the treatment approaches of odontogenic maxillary sinusitis;

- Research on effectiveness of treatment;
- Articles published in English in 2009-2018;
- No sex or age restrictions.

Articles exclusion criteria were:

- In vitro* studies;
- Finite element analysis studies;
- Animal studies.

RESULTS

2886 articles were found in the databases using keywords. After duplicate citations screened,

inclusion/exclusion criteria applied, excluded articles after titles and summaries screen - 49 articles were retrieved. The articles which conformed the requirements were downloaded and read. After full-text reading 25 articles were involved in the literature review. 24 articles were not included because study subjects and analysis of the results were not suitable for this review.

Ten of included articles were about concomitant dental treatment or oral surgery and endoscopic sinus surgery (ESS). 5 articles suggest dental surgery alone or with following endoscopic sinus surgery. Three studies were related to Caldwell-Luc surgery. Two studies used endoscopic sinus surgery for foreign bodies removing. 2 articles were about failure in ESS because of unrecognized dental etiology. One study presented complications in endoscopic sinus surgery. 1 article was about three main

treatment options and 1 about only ESS (Table).

Seventeen of included articles were original researches, one of them about complications in ESS and one was related to cone-beam computed tomography. Five included articles were literature reviews and three case reports.

DISCUSSION

Odontogenic maxillary sinusitis has similar clinical symptomatology compared to rhinogenic sinusitis. According to the literature facial pain, postnasal discharge and congestion are three main symptoms of odontogenic maxillary sinusitis (16). These three symptoms are also related to rhinogenic sinusitis and would not raise suspicious of odontogenic source however sinusitis of dental origin treatment requires different management (4-6, 24). OMS treatment consists of removal dental infection and sinus surgery. Dental treatment or oral surgery is necessary part of treatment (6, 24). Depending on situation, it varies from endodontic treatment of infected tooth to its extraction or oroantral fistula closure. If the odontogenic etiology is overlooked,

the treatment will be unsuccessful because the source of infection is left untreated (2, 16). After the odontogenic infection removal, Caldwell-Luc or endoscopic sinus surgery is required for resolution of disease.

The Caldwell-Luc surgery has a long history in the sinus disease treatment. In the classical CL approach, the maxillary sinus is entered intraorally through the canine fossa, and the inflamed sinus mucosa is stripped and removed. A counter-opening is performed to ensure sinus drainage on the lateral wall of the inferior nasal meatus, and temporary meatal and astral packs are usually loaded. This antrostomy of inferior meatal theoretically allows drainage of reaccumulated material and facilitates suction toilet after surgery (10). Caldwell-Luc approach was defined as traditional treatment approach of various maxillary sinus pathologies until endoscopic sinus surgery was presented (8, 9).

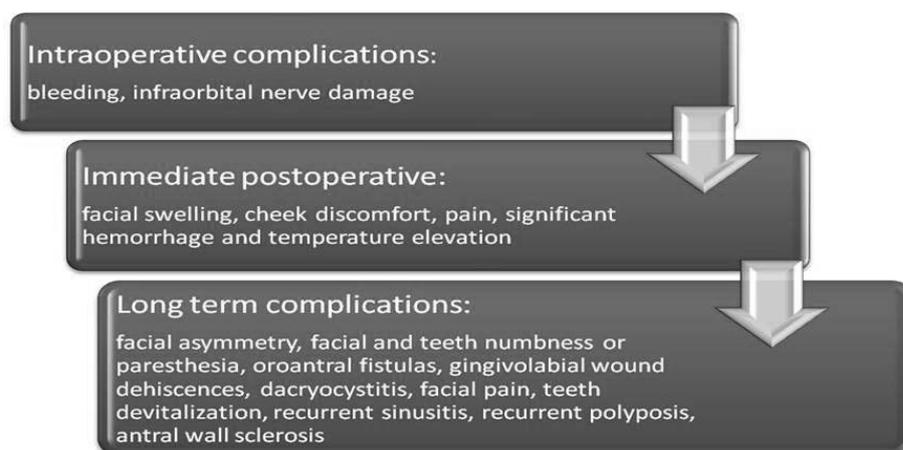


Fig. 2. Caldwell-Luc surgery complications

CL is still in use these days despite the fact of wide surgery intervention, high numbers of revision surgery and complication rates (10-12, 22) (Figure 2).

Studies were performed and concluded that patients need to be reoperated from 9 to 15 percent of the cases (8). This method requires hospitalization and general anesthesia - this leads to more eventual risks, higher costs, harm for patient and more contraindications due to general anesthesia. Moreover,

Table. Analyzed researches' results

Study group	Year	Study population	Treatment provided	Success rate of treatment protocol
Albu and Baciut (8)	2010	N=411, 104 with OMS	ESS and dental treatment	93% success
Felisati <i>et al.</i> (19)	2013	N=257	ESS and dental treatment	99% success
Wang <i>et al.</i> (3)	2014	N=55	ESS and dental surgery	38% success, 44% were lost to follow up
Fadda <i>et al.</i> (5)	2016	N=31	ESS and intraoral approach	100% success
Lonhini and Ferguson (6)	2011	N=21	Dental extractions alone or with following ESS	95% success
Longhini <i>et al.</i> (17)	2010	N=5	Dental extractions alone or with following ESS	100% success
Mattos <i>et al.</i> (24)	2015	N=43	Dental treatment alone or with following ESS	52% recovered after dental treatment alone, 48% required ESS
Albu <i>et al.</i> (23)	2011	N=110	Canine fossa puncture or ESS	91% success
Lee and Lee (2)	2010	N=27	ESS, Caldwell-Luc or dental treatment alone	100% success
Fusetti <i>et al.</i> (25)	2013	N=8	ESS and fistula closure	100% success
Andric <i>et al.</i> (9)	2010	N=14	ESS and fistula closure	100% success
Hajjioannou <i>et al.</i> (13)	2010	N=4	ESS and fistula closure	100% success
Chiapasco <i>et al.</i> (21)	2009	N=27	FESS and removal of displaced implants	96% success
Huang <i>et al.</i> (10)	2012	N=50	Caldwell-Luc	94% success
Huang <i>et al.</i> (11)	2011	N=24	Caldwell-Luc for root removal	94% success

during the Caldwell-Luc operation, the natural, physiologic mucosa is removed, which ensure sinus function, maintains its clearance and drainage (13). After the surgery the mucosa reepithelialise, but the new one is not specialized, and sinus clearance is disabled (17). On the other hand, this technique assists when clinician need better access to sinus, perisinus or pterygomaxillary fossa. Caldwell-Luc is usually performed surgery to remove foreign bodies, teeth or their roots, implants, as well for sinus cysts, tumors, maxillary osteonecrosis, epistaxis control, sinusitis with irreversible mucosal change, mycotic fungal balls, and facial trauma (10, 22). To remove displaced teeth or their roots from the maxillary sinus the CL operation is similar to the operation used for inflammatory disease except there is no need to remove sinus mucosa (11).

The inflamed sinus mucosa can be removed using Endoscopic sinus surgery (ESS). This procedure is performed under general anesthesia for treatment of chronic, acute, fungal, bacterial sinusitis as well for others various sinus pathologies. An endoscope is passed through the nose and provides the view of the infected sinus mucosa, osteomeatal complex condition, polyps and etc. The natural ostium is widened surgically and only infected sinus mucosa is removed, leaving the basement membrane intact. Thus, natural sinus mucosa is preserved and mucocilliary clearance is not disturbed. Due to the proximal contact to anatomical structure such an orbital nerve, internal carotid and eyes, this procedure requires high experience and precision (18). Literature describes excellent results performing endoscopic sinus surgery and dental treatment or oral surgery however, a clear sequence of management and time are not presented (2, 4, 6, 25). Studies suggest dental treatment and ESS has to be done but the recommendations differ between the studies (2, 6). The literature presents the information that concomitant endoscopic sinus and dental surgery are necessary for full resolution of disease, prevent from revisions and complications (2, 16).

Felisati *et al.* (19) included over 250 patients in their study and showed success rate of 99% after endoscopic sinus surgery was simultaneously performed with elimination of odontogenic source. The elimination of dental infection is crucial; missing/leaving the causative tooth, treatment outcome is poor or the improvement is only for a short period of time, revision surgery is required, which will also result in failure (8, 16-18).

Literature provides the information about fess effectiveness for removing small foreign bodies, teeth and roots from the maxillary sinus. Also there

are studies which show FESS being a successful rate for removing implants (14, 15). It is effective and useful when the object is in the upper part of the sinus. However, access to the lower part of the sinus is complicated due to acute angle from the inferior meatus to the bottom of the sinus (21, 14). While this technique is suggested as safer than CL surgery, there are some possible complications that can be done (20). The retrospective study performed by Chou *et al.* showed the main complications of endoscopic sinus surgery. Out of 997 patients in this research, 78 (7, 8%) suffered from various failures. Five patients underwent major complications such as cerebrospinal fluid rhinorrhea, medial rectus muscle damage and retrobulbar hematoma. 73 patients experienced minor complications such as perioperative estimated blood loss of over 15% of total body blood volume, a breach of the lamina papyracea, orbital cellulitis and postoperative bleeding.

Some studies suggest eliminate dental infection source and perform sinus surgery only if symptoms persist (4, 6, 7, 23). Bomeli (24) prefer a conservative treatment of odontogenic sinusitis, and say that clinicians should focus on the removing dental infection and only later consider about ESS. It should be performed only if the disease symptoms persist after the dental procedures. Longhini, Berrylin J. Ferguson (6) study revealed very good results when only causative tooth extraction. Out 21 patients that were involved in that study, 19 patients recovered from sinusitis without any surgical sinus treatment. A close association between odontogenic infection source and sinus disease was confirmed and total recover of sinus mucosa was witnessed on CT scans later. Performing dental extractions alone or with following ESS procedure for odontogenic maxillary sinusitis, patients undergo minimal surgical intervention and most procedures are performed under the local anesthesia (23). As well there is a disadvantage of this treatment regimen because some patients suffer from persistence of symptoms and have to take a medical advice once more. If symptoms persist after dental extraction, there is a need for more comprehensive diagnostics - extra reasons of disease such as foreign bodies, fungal balls, or antral cysts (4). Odontogenic sinusitis does not resolve by dental extractions alone due to obstructed and blocked osteomeatal complex (17, 24).

There is lack of studies about treatment of odontogenic sinusitis performing only etiological factor removal. It is still unclear sequence and timing when sinus surgery should be started, when removing of infection source does not ensure the resolution of disease.

CONCLUSION

Literature suggests various options for odontogenic sinusitis treatment. The usage of Caldwell-Luc approach is limited these days and recommended only when a better access to sinus is needed, for example, removing large foreign

bodies. Endoscopic sinus surgery is widely used these days to remove the inflamed sinus mucosa, foreign bodies, displaced teeth, while preserving physiological function of the sinus. Moreover, elimination of dental infection concomitant or before sinus surgery is necessary to achieve excellent treatment outcome.

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