Gold Laser Resection of the Concha Bullosa: Description of a New Technique

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Abstract

Introduction: Concha bullosa is the most common anatomic abnormality of the lateral nasal wall, and inflammation or infection of the concha bullosa can result in headaches and nasal obstruction. Functional endoscopic sinus surgery is the treatment of choice for refractory or recurrent symptoms despite medical management, and can present a challenge to the otolaryngologist due to the vascularity of the concha bullosa, as well as propensity for scarring postoperatively, which may lead to recurrence. Presented here is a safe, novel technique for surgical management of the concha bullosa.

Methods: The Gold Laser (Medical Energy, Pensacola, FL) is a 980 nm laser containing gallium, indium and arsenide phosphate. The delivery system incorporates a suction hand piece with the laser fiber, allowing simultaneous cutting/coagulation and smoke/blood evacuation. The chisel-tip of the fiber allows cutting and ablation of soft tissue and thin bone in contact mode, and coagulation of bleeding tissue in non-contact mode.

Results: Long-term follow-up data on 33 patients treated with the Gold Laser are presented. All patients reported improved symptoms postoperatively, with decreased nasal obstruction and headaches, and fewer episodes of rhinosinusitis. There were no postoperative complications such as scarring or significant bleeding.

Conclusions: The Gold Laser is a safe, facile means of treating concha bullosa. The excellent hemostasis afforded allows for excellent visualization and safe surgery, and the symptomatic improvements are maintained for years postoperatively.

Keywords: Concha bullosa; Lasers; Endoscopic sinus surgery

Introduction

The concha bullosa, wherein the middle turbinate is pneumatized, represents the most common anatomic abnormality of the lateral nasal wall [1]. This congenital anomaly often results in an oversized middle turbinate which can predispose the patient to sinusitis. Subsequent results may include obstruction of normal sinus outflow tracts, polyposis within the turbinate, headaches from increased pressure within the pneumatized cavity of the turbinate, contact between mucosal surfaces, and pyocele of the middle turbinate secondary to retained secretions within the cavity [1-4].

Numerous methods have been described to surgically address concha bullosa, from crushing with endoscopic instruments, resection via marsupialization using combinations of blunt and sharp dissection or powered microdebriders, to laser treatment [5-7]. When considering Functional Endoscopic Sinus Surgery (FESS), the very small working space dictates that visibility and hemostasis are paramount, and this is also true of surgical management of concha bullosa. Other endoscopic methods may be effective in long-term disease control, but the ideal method will be both efficacious and facile for the surgeon, eliminating unnecessary intraoperative bleeding.

The use of lasers in endoscopic sinus surgery is not new; multiple lasers have been utilized with varying degrees of success. CO₂, KTP-332, argon laser, and pulsed diode laser have all been described in FESS for a variety of nasal complaints, each with its own limitations and successes [8-11]. The ideal laser for endoscopic sinus surgery is one that is able to ablate thin, vascular tissue of the nasal mucosa for hemostasis and polyp destruction, as well as relatively hypovascular bony tissue such as the concha bullosa or anterior ethmoid bulla. While a perfect laser for these applications remains elusive, the Lightforce Gold Laser (Medical Energy, Pensacola, Florida, USA) provides these features and, in our experience, is a facile tool for endoscopic sinus surgery and concha bullosa resection.

Methods

Retrospective chart review was undertaken of all patients having undergone Gold Laser resection of a concha bullosa by the senior author (N.K.W.) from 2007 – 2011. Indications for procedure, any concurrent surgical procedures, intraoperative and postoperative complications, and postoperative recurrent ipsilateral rhinosinusitis or headache symptoms were recorded.

The mean age of patients at the time of surgery was 52 years old (range: 15 to 77 years old) and mean follow-up time was 30 months (range: 1 to 51 months). Fourteen patients were female and 19 were male. Indications for concha bullosa resection, as well as any concurrent rhinologic pathologies, are given in Table 1. The most common indications were chronic ipsilateral maxillary sinusitis (31/33 patients) and nasal obstruction (29/33 patients), while other indications included recurrent ipsilateral acute sinusitis, headache, nasal polyposis, nasal mass, allergic fungal sinusitis and mucocele. Multiple indications were present in 22/33 patients. The most common concurrent non-

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surgical rhinologic diagnosis was allergic rhinitis (10/33 patients), with others including obstructive sleep apnea and rhinitis medicamentosa.

Concurrent rhinologic surgeries of the study patients are given in Table 2. Concurrent rhinologic surgery was performed in 32 of 33 patients, with septoplasty (29/33 patients) and ipsilateral medial maxillary antrostomy (28/33 patients) being the most common procedures performed. Submucosal resection of the inferior turbinate, anterior ethmoidectomy, total ethmoidectomy, sphenoidotomy, and frontal recess exploration were also performed.

**Operative technique**

After obtaining informed consent from the patient, general endotracheal anesthesia was induced, and the nose was prepped with betadine into a sterile field. A mixture of 1% lidocaine with 1:100,000 U epinephrine was injected into the nasal mucosa along the ipsilateral nasal septum and head of the inferior turbinate, as well as into the anterior face of the concha bullosa. Cotton balls soaked with 4% cocaine were then placed into the nostril, and at least 5 minutes was allowed to elapse for these agents to take effect before proceeding with surgery. The cotton balls were then removed, or pushed further into the nasopharynx to minimize secretions or irrigation fluid entering the oropharynx. Utilizing a 0° rigid nasal endoscope, any blood and secretions were removed from the nostril with a Frazier-tipped suction.

The Lightforce Gold Laser (Medical Energy, Inc., Pensacola, FL, USA) hand piece with chisel tipped fiber (Figure 1) was then inserted into the nostril under endoscopic visualization. The anterior mucosal surface of the concha bullosa was incised using the gold laser, at a setting of 6 W, from superior to inferior in a sagittal plane corresponding to the midpoint of the concha bullosa. The laser was then used to incise the underlying bone of the concha bullosa via the mucosal incision. Endoscopic scissors were then used to complete the superior and inferior bony cuts, with one scissor jaw outside the concha bullosa and the other in the cavity. This fully separates the lateral hemisphere of the concha bullosa from the medial hemisphere, which remains attached to the nasal wall via the root of the middle turbinate. This free-floating lateral hemisphere was then removed from the nose with Takahashi forceps. The gold laser was used to ensure hemostasis, though this was rarely needed. A small Merocel (Medtronic, Inc., Jacksonville, FL, USA) sponge was placed between the marsupialized concha bullosa and lateral nasal wall and ostiomeatal complex to prevent scarring or synechiae.

The patients were instructed to use nasal saline sprays four times daily beginning postoperative day two, and were placed on prophylactic antibiotics with anti-Staphylococcus activity to prevent toxic shock syndrome whilst the Merocel was in place. Any remaining Merocel was removed in the clinic on postoperative day five.

**Results**

Thirty-two of 33 patients had an uneventful early postoperative course. One patient developed postoperative ipsilateral epistaxis, treated successfully with anterior nasal packing for 48 hours, after which symptoms resolved. No blood or blood product transfusion was required. This patient had no personal or family history of bleeding diatheses, yet was determined to have hemophillia B via hematologic workup subsequent to this postoperative bleed. Two additional patients developed recurrent ipsilateral maxillary rhinosinusitis in the early postoperative period (within the first 30 days postoperatively). Both reported suboptimal compliance with their nasal saline rinses and had significant residual Merocel in place at the postoperative visit that was unable to be completely removed in the clinic. Both patients were treated uneventfully with oral antibiotics and had good long-term outcomes.

Seven patients developed recurrent ipsilateral maxillary rhinosinusitis greater than one month postoperatively, with mean time to onset 14.3 months (range: 4 – 48 months). All were treated uneventfully with oral antibiotics, and had only one recurrent episode of sinusitis in the study period.

Four patients developed recurrent polyposis greater than one month postoperatively, with mean time to onset 30 months (range: 18 – 48 months). All patients with recurrence reported non-compliance with their prescribed topical nasal steroid sprays and oral antihistamine regimens for at least six months prior to recurrence. Three of four patients were treated successfully with one-week oral prednisone taper and re-institution of topical nasal steroids and oral antihistamines. One patient eventually required repeat FESS for recurrent nasal polyps on the contralateral side from the concha bullosa resection. This patient had undergone prior FESS three times for allergic fungal sinusitis.

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**Table 1:** Indications for concha bullosa resection. Percentages will not add up to 100 due to patients presenting with multiple indications.

<table>
<thead>
<tr>
<th>Indication for resection</th>
<th>Patients No. (%)</th>
</tr>
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<tbody>
<tr>
<td>Chronic ipsilateral maxillary sinusitis</td>
<td>31 (93.9)</td>
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<tr>
<td>Ipsilateral nasal obstruction</td>
<td>29 (87.9)</td>
</tr>
<tr>
<td>Ipsilateral nasal polyposis</td>
<td>10 (30.3)</td>
</tr>
<tr>
<td>Recurrent ipsilateral acute sinusitis</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>Allergic fungal sinusitis</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Mucocele</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Nasal mass</td>
<td>1 (0.3)</td>
</tr>
</tbody>
</table>

**Table 2:** Concurrent rhinologic surgery. Percentages will not equal 100% due to patients undergoing multiple concurrent procedures.

<table>
<thead>
<tr>
<th>Concurrent rhinologic surgery</th>
<th>Patients No. (%)</th>
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</thead>
<tbody>
<tr>
<td>Septoplasty</td>
<td>29 (87.9)</td>
</tr>
<tr>
<td>Medial maxillary antrostomy</td>
<td>28 (84.8)</td>
</tr>
<tr>
<td>Anterior ethmoidectomy</td>
<td>18 (54.5)</td>
</tr>
<tr>
<td>Submucosal resection of inferior turbinates</td>
<td>14 (42.4)</td>
</tr>
<tr>
<td>Total ethmoidectomy</td>
<td>5 (15.1)</td>
</tr>
<tr>
<td>Bilateral concha bullosa resection</td>
<td>3 (0.9)</td>
</tr>
<tr>
<td>Frontal recess exploration</td>
<td>1 (0.03)</td>
</tr>
<tr>
<td>Sphenoidotomy</td>
<td>1 (0.03)</td>
</tr>
</tbody>
</table>
Figure 2: 8 month postoperative results. Note the well-healed middle turbinate, with no exposed bone or synchiae, and normal appearance after resection of the concha bullosa. The medial maxillary antrostomy is widely patent and easily visible in this patient as well.

and nasal polyposis, and had an endoscopic frontal sinus mucocele resection at the time of concha bullosa treatment. With reinstatement of topical nasal steroids and oral antihistamines, the patient is doing well one year after his revision FESS for contralateral disease.

In all patients there were no instances of cerebrospinal fluid leakage, ocular or orbital injury, anosmia, synchiae, exposed bone intranasally, lateralization of the middle turbinate, persistent ipsilateral headaches or nasal obstruction postoperatively.

**Discussion**

There have been many technological advances in recent years in the field of FESS. Among these are the development of smaller, lighter endoscopes and cameras, the advent of high-definition cameras and monitors, and a remarkable variety of endoscopic surgical instruments. Concha bullosa resection, which is frequently performed in conjunction with other endoscopic surgical procedures, has undoubtedly benefited from some of these advances as well. Paramount to successful and safe endoscopic sinus surgery is visibility, which is achieved partly through the use of cameras and monitors capable of delivering high-quality images, but also through surgical technique and surgical instruments capable of maintaining hemostasis.

Preoperative and intraoperative use of topical and injected vasoconstrictive agents has long been the backbone of hemostatic maintenance in FESS, and remains an integral tool. In addition, minimizing trauma, both intentional surgical trauma as well as inadvertent trauma incurred via repetitive withdrawal and reinsertion of multiple surgical instruments, is necessary to achieve this aim. While some authors have described novel methods of handling multiple instruments simultaneously within the nose [12], another technique used to reduce such inadvertent mucosal trauma is to utilize a single instrument capable of performing multiple tasks.

The Lightforce Gold Laser hand piece incorporates a suction tip, as well as the flexible quartz laser fiber, thus allowing this single instrument to cut soft tissue and thin bone, coagulate bleeding vessels, and evacuate smoke, blood, secretions, or irrigation fluid from the operative field without changing instruments. The 980 nm wavelength of the Indium-Gallium-Arsenide Phosphate III laser contained within the Lightforce Gold unit has a reported burn depth of 0.3 mm [13], and can be used in two ways. Placing the tip of the laser fiber in contact with tissue allows precise cutting of vascular nasal mucosal surfaces whilst coagulating the small vessels within the tissue as it cuts, avoiding bleeding. The chisel shape of the fiber tip allows the surgeon, by gently increasing applied pressure with the instrument, to puncture thin bony lamina, such as concha bullosa or ethmoidal cells, while maintaining the same hemostatic ability. The requirement of a subtle, but conscious, increase in force by the operating surgeon makes it very difficult to unintentionally puncture even thin bone. Withdrawal of the tip of the laser fiber 1-2 mm away from the tissue surface defocuses the beam to an area of approximately 2 mm, producing a superficial coagulating effect to control any unexpected bleeding. The shallow depth of burn injury of the Lightforce Gold Laser and precision handling by the operative surgeon both obviate the thick, fibrinous exudate formation in the postoperative healing period reported by Kennedy, and other authors [14,15].

The ability to maintain a virtually bloodless field not only increases the safety and decreases the technical difficulty of the procedure, but increases patient comfort postoperatively as well. Only a small amount of absorbable packing material is left in the nasal cavity, and postoperative nausea is less likely as there is almost no blood to be inadvertently swallowed intraoperatively by the patient.

The use of the Lightforce Gold Laser in concha bullosa resection provides a simple, facile method to achieve long-term successful results (Figure 2), and is a further addition to the rhinologic surgeon’s armamentarium.

**References**