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# Gold laser tonsillectomy—A safe new method☆

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*Objectives:* To determine if Gold laser tonsillectomy is an acceptably safe method of removing tonsils by comparing its complication rates to other established methods, namely Coblation tonsillectomy and cold steel dissection tonsillectomy.

*Study design:* A retrospective review of 748 consecutive patients, ages 2–18, undergoing tonsillectomy at a pediatric teaching institution.

*Methods:* Tonsillectomy with or without adenoidectomy was performed utilizing either the Gold laser ($n = 435$), Coblation device ($n = 153$), or by cold steel dissection ($n = 160$) between August 2005 and August 2007. Hospital charts were then reviewed to determine the rates of post-tonsillectomy hemorrhage and dehydration requiring hospital admission.

*Results:* In the Gold laser group there were 7 bleeding events (1.61%) and 7 dehydration admissions (1.61%). The Coblation group had 9 bleeding events (5.88%) and 1 dehydration admission (0.65%). The cold steel group had 1 bleed (0.63%) and 2 dehydration admissions (1.25%). The hemorrhage rate associated with Gold laser tonsillectomy was statistically equivalent to cold steel dissection ($p = 0.3710$) and significantly lower than in our Coblation control group ($p = 0.0286$).

*Conclusions:* Tonsillectomy by means of the Gold laser can be safely performed in the pediatric population.

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## 1. Introduction

Tonsillectomy is a frequently performed operation. Challenges associated with tonsillectomy include intra-operative hemorrhage and adequate post-operative pain control. Consequently, many different methods for subcapsular tonsillectomy are currently employed. A newly introduced tool is the Gold contact laser [1]. Preliminary studies indicate that this laser may produce measurable decreases in post-operative pain [2]. Anecdotally, a bloodless tonsillectomy is often possible with this technique. The purpose of this study is to catalogue the complications associated with the Gold laser tonsillectomy and compare them to Coblation and cold steel tonsillectomy complication rates.

## 2. Methods

All tonsillectomies, including those performed in conjunction with other procedures (such as adenoidectomy) between 8/1/2005 and 8/1/2007 were identified by searching the hospital database of Children's Hospital of New Orleans using ICD-9 procedure codes (282 and 283). Of the 986 patients identified, 778 patients underwent tonsillectomy by one of the three study methods and had a complete chart available for review. Thirty of these patients were excluded (26 fell outside of the 2–18-year-old age range, 4 were quinsy tonsillectomies). The remaining 748 charts were reviewed and the following data tabulated: age, weight, sex, indication for procedure, and any complications uncovered by review of each individual hospital record (including emergency room records). There were no significant demographic differences between patient groups (Table 1).

Coblation tonsillectomy accounted for 153 of the study patients, while 160 patients underwent cold steel dissection tonsillectomy, and 435 patients underwent Gold laser tonsillectomy. Complete subcapsular tonsillectomy was performed in all cases; subtotal or intracapsular tonsillectomy was not performed. Specifically, for Coblation tonsillectomy, a Coblator II device set to 5/3 (coblate/coagulate) with an Evac 70® wand was used. For cold steel dissection tonsillectomy, final hemostasis was achieved with spot use of a suction electrocautery device, set to 20 W, in lieu of suture control. For Gold laser tonsillectomy, a 2.0 mm ball-tipped suction hand piece (Fig. 1) was used, with the laser set at a 10 W power level.

All surgeries were performed by post-graduate year 2 (PGY-2) or PGY-3 otolaryngology residents under the supervision of one of

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**Table 1**
Patient demographics.

| Method | Age | Weight | Male:female | Indication[a] |
|---|---|---|---|---|
| Coblation ($n = 153$) | 6.31 years | 28.56 kg | 54.9% male | 0.44:1 |
| Cold steel ($n = 160$) | 5.90 years | 29.01 kg | 50% male | 0.48:1 |
| Gold laser ($n = 435$) | 5.74 years | 27.43 kg | 54.5% male | 0.38:1 |
| Overall ($n = 748$) | 5.89 years (range 2–18 years) | 28.01 kg (range 9.5–194 kg) | 53.6% male | 0.41:1 |

[a] Ratio of procedures performed for chronic or recurrent infections versus all other indications.

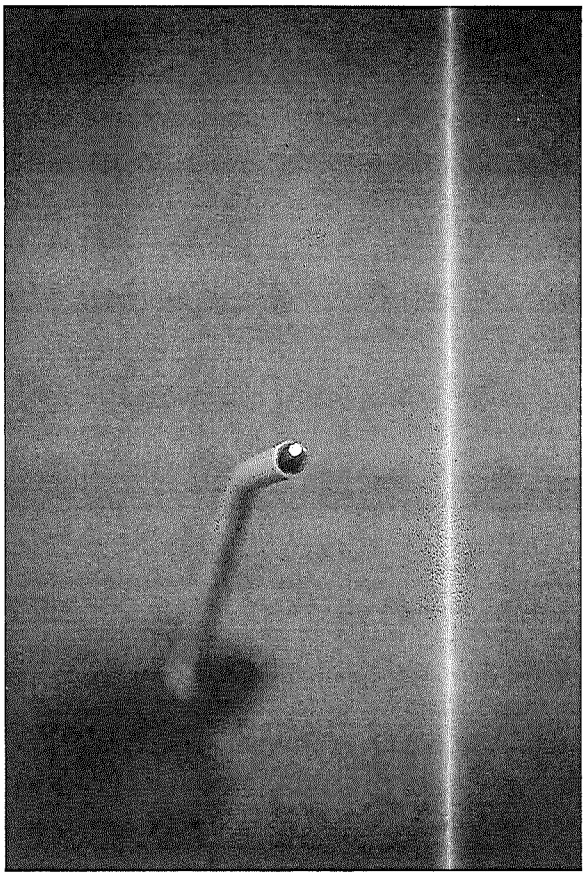

**Fig. 1.** Gold laser suction hand piece.

four attending physicians. All patients routinely received an intra-operative dose of intravenous corticosteroid and a course of post-operative antibiotics. All patients' parents or legal guardians signed an informed consent prior to surgery. The institutional review board at Children's Hospital of New Orleans approved the study. All study data was handled in a manner conforming to the U.S. Health Insurance Portability and Accountability Act (HIPAA) standards.

The results were evaluated for statistical significance using logistic regression on the outcome variables (hemorrhage, dehydration, total complications) by method, adjusting for patient age and sex. A $p$-value $<0.05$ was considered significant.

## 3. Results

Table 2 shows a list of all complications and unexpected events. In the Coblation group there were two cases (1.31%) of primary hemorrhage (occurring <24 h post-operatively) and seven cases (4.58%) of secondary hemorrhage (occurring >24 h post-operatively), four of which required operative control. In the Gold laser group there were no cases of primary hemorrhage and seven cases (1.61%) of secondary hemorrhage, with four requiring operative control. The cold steel group had one case (0.63%) of primary hemorrhage with no secondary hemorrhages.

Statistical analysis of the data shows a significant difference in the overall hemorrhage rate (primary + secondary hemorrhages) between the Gold laser and Coblation groups ($p$-value = 0.0286). The odds for hemorrhage in the Coblation group were 3.2 times more than in the laser group [95% confidence interval (1.13, 9.08)]. There was no significant difference between Gold laser and cold steel hemorrhage rates ($p$-value = 0.3710).

Age was an independent risk factor for post-operative hemorrhage. Older patients had a significant increase in hemorrhage rates compared to the younger patients in the same method group ($p$-value = 0.0046), meaning, with each increasing year of age the odds of a post-operative hemorrhage increased slightly, at an odds ratio = 1.16 per year [95% confidence interval (1.047, 1.286)]. Given the effect of age on outcomes, the study population was statistically re-evaluated after division into two subsets: an adolescent group (ages 12–18) and a pediatric group (age <12). Patients under age 12 only showed a trend toward increased post-operative hemorrhage rate when comparing Gold laser to Coblation patients ($p$-value = 0.0638), whereas there was no trend toward such between Gold laser and cold steel patients ($p$-value = 0.5137). This "under 12" subset of patients showed no significant differences between methods for any other complication type. Among the adolescent subset, we found no significant differences when comparing any complication with respect to tonsillectomy method.

Several patients were identified with post-operative dehydration (Table 2). This diagnosis was assigned to any patients who required intravenous fluids at any point following hospital discharge from the initial surgery. There was no statistical difference between dehydration rates in the Gold laser versus

**Table 2**
Complications.

| Method | Hemorrhage (primary) | Hemorrhage (secondary) | Dehydration | Unplanned admit[a] | Other event | Total events |
|---|---|---|---|---|---|---|
| Coblation | 2 (1.31%) | 7 (4.58%) | 1 (0.65%) | 4 (2.61%) | 4[b] | 16 (10.46%)[c] |
| Cold steel | 1 (0.63%) | 0 | 2 (1.25%) | 3 (1.88%) | 1[d] | 7 (4.38%) |
| Gold laser | 0 | 7 (1.61%) | 7 (1.61%) | 9 (2.07%) | 1[e] | 24 (5.52%) |

[a] From recovery room.
[b] Burned lip, transient upper airway obstruction (2×), asphyxiation.
[c] Eighteen events in 16 patients.
[d] Transient upper airway obstruction.
[e] Post-obstructive pulmonary edema.

Coblation group or in the Gold laser versus cold steel group. No variable showed any significance when comparing rates of unplanned post-operative admissions (those patients admitted directly from the operative recovery room due to failure to demonstrate adequate oral intake) between groups. Comparison between groups for *any* unexpected event (all complications plus unplanned admissions from the recovery room) shows that the odds for having an unexpected event after Coblation is twice as high as in the Gold laser group [$p$-value = 0.04, 95% confidence interval (1.032, 3.875)]. There is a trend toward fewer unexpected events in the cold dissection group compared to the Gold laser group ($p$-value = 0.0714).

## 4. Discussion

The Gold laser (aka "Lightforce" laser, Medical Energy, Pensacola, FL) was FDA approved in 2004 for use in head and neck surgery. It generates electromagnetic radiation for tissue ablation using Gold coated electrodes and inter-electrode islands within a gaseous Indium Gallium Arsenide Phosphate III (InGaAs-PIII) medium. Light energy between 960 and 1000 nm (dependant on the power setting selected) is then emitted through a flexible fiberoptic cable attached to the unit. This cable passes through a suction hand piece and ends in a variety of tip shapes and sizes. We used the 2.0 mm ball-tipped device for this study (Fig. 1). It is a single use device. The tip is brought in contact with the tissue for ablation (Fig. 2). The collateral burn zone is reported to be as small as 0.3 mm, again dependant on the power setting selected [Michelle Scott-Lewing, personal communication, 4/24/2008]. Standard laser precautions are employed, with the exception that no special endotracheal tube is required.

The Gold laser has been shown to be safe in adenoidectomy procedures [1] (although reports suggest that other forms of laser adenoidectomy such as KTP may not be [3]). To our knowledge, this is the first published study describing the use of the Gold laser in tonsillectomy.

Complications associated with Gold laser tonsillectomy included secondary hemorrhage, dehydration, unplanned admission from the recovery room secondary to poor oral intake, and one case of post-obstructive pulmonary edema (POPE). POPE type II is caused by a fluid transudate from the pulmonary vasculature into the lung parenchyma following relief of a chronic obstruction, and is a well described potential complication of tonsillectomy. Its occurrence in the study patient was due to relief of his underlying obstructive tonsillar hyperplasia and would likely have occurred regardless of the method employed. Notwithstanding, the patient was included as a complication of the Gold laser procedure in our calculations.

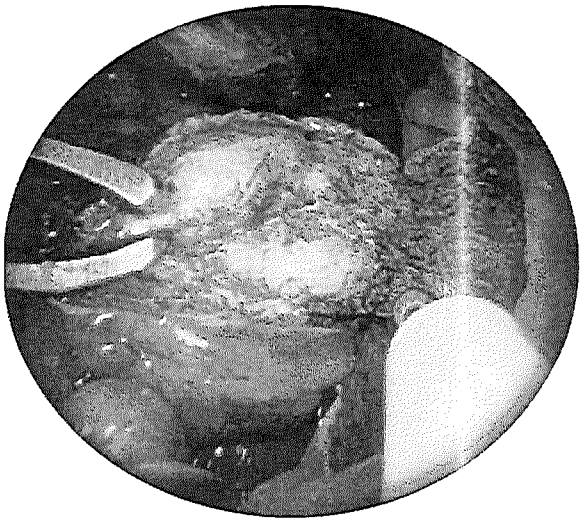

**Fig. 2.** Gold laser tonsillectomy (surgeon's view of right tonsil).

The complications occurring with Coblation tonsillectomy are listed in Table 2, including a case of asphyxiation. The unfortunate patient underwent an uneventful tonsillectomy and was admitted for overnight observation due to his comorbidities (sleep apnea, Trisomy 21, chronic lung disease, need for home suctioning of his oral secretions). He was admitted to a regular floor bed and was found unresponsive by his nurse during the night. The death was thought preventable had the patient been assigned to a unit with a higher level of care.

The complications documented with the cold steel dissection group included a case of transient upper airway obstruction successfully treated with BiPAP ventilation. There were two cases of upper airway obstruction in the Coblation group, both successfully managed with nasal trumpet placement.

A comparison of the fairly high complication rate among the Coblation patients in our study to those in the literature was investigated. Glade et al. [4] performed a study involving 1997 patients that fell in the same age range used in our study. They report a 5.1% incidence of post-operative hemorrhage in their cohort of 745 Coblation tonsillectomies, which was statistically equivalent to the rate of hemorrhage seen in their comparison group (electrocautery). Our Coblation hemorrhage rate (5.88%) approximated their results. In contrast, Belloso et al. [5] report a hemorrhage rate of only 2.25% (0.95% among the pediatric subset) in their review of 844 Coblation tonsillectomies. The discrepancy in hemorrhage rates may be secondary to operator skill and technique, as Belloso describes a microscopic assisted dissection whereas our study and Glade's study were performed at training hospitals. A recent audit [6] of 33,921 consecutive tonsillectomies in Great Britain revealed a 4.6% overall (primary + secondary) hemorrhage rate among the subset of patients undergoing Coblation tonsillectomy (adults and pediatric patients).

There are no studies with which to compare our Gold laser complication rates, but our results using this method compare favorably to other established methods.

Study strengths include a large cohort of patients and a design that incorporated the same operators performing all three types of tonsillectomy. This should minimize inter-operator skill differences as a confounder. Study weaknesses include a retrospective design and a non-blinded review of the data. There may be unrecognized factors leading to a non-random distribution of patients among the study arms. For example, in the Gold laser arm there was a trend toward fewer tonsillectomies performed for recurrent or chronic tonsillitis. Since more laser tonsillectomies were performed compared to the other methods, the low laser complication rate may also reflect increased operator familiarity with the device. Finally, by reviewing records from our hospital alone, it is possible that the complication rate may be under-reported, given that patients may present elsewhere for management of a complication (e.g. hemorrhage). However, we think any missed complications would be rare, given the fact that our hospital ran the area's only pediatric emergency room during the study period, that our data identified children that initially presented at outside facilities and were subsequently transferred to our hospital for either definitive or further care (which seemed to be the standard of practice within our hospital community), and given that none of the treating physicians recall having any patients report a complication or intervention that was unknown to them at any follow-up appointments during the study period.

Further study with the Gold laser could include measuring differences in operative blood loss, operative time, total costs, and post-operative pain scores.

## 5. Conclusions

In our experience, Gold Laser tonsillectomy has been associated with a low incidence of complications, with complication rates comparable to cold steel dissection tonsillectomy. Within our study group, the Gold Laser tonsillectomy patients had a lower risk of post-operative hemorrhage compared to the Coblation tonsillectomies performed at our institution. Based on the results of our study, clinical use of the Gold laser can be recommended for the pediatric population.

## Conflicts of interest statement

No author has disclosed any conflict of interest. This study was internally funded, with no funds, materials, oversight, or supplies provided by Medical Energy, Arthrocare ENT, or any other company.

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