



Hot versus Cold Tonsillectomy

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Introduction

Aurelio Maldonado

With regard to surgical excision of palatine tonsils, there are some important indications in recurrent infectious processes and when there is tonsillar hypertrophy. In the past, tonsillectomy was performed in almost every recurrence of infectious processes. However, after antibiotics became available, there was a marked decrease in surgical indication for this cause. At this time, tonsillar hypertrophy leading to obstructive sleep apnea is the main indication. This is when questions arise: do we have to remove surgically tonsils that we consider to be healthy – they are enlarged, but are they healthy? Is it worth it? Or can we only make them smaller so the child can breathe and eat better, preserving their immune function without further problems?

When the recurrent tonsillitis is infectious, involving problems such as rheumatic fever, glomerulonephritis, I think that there should be no doubts, and tonsillectomy should be performed. I dissect the tonsils with scissors and gauze or use electrocautery. The use of a microdebrider in tonsillectomy is becoming more common. It is necessary to have some experience with the technique, or the capsule could be perforated, and the instrument could reach the neck. Tonsillar remnants can be left behind more easily. Thus, my opinion is that this is not the most convenient option.

Concerning laser tonsillectomy, this piece of equipment is very large and expensive. I always ask my students: why should you use a helicopter to go home if you can drive! When there is bleeding, I suture the vessels that are involved and make a flap from the posterior pillar with a transfixational stitch, leaving no virtual cavity in the tonsillar fossa.

With regard to hypertrophic tonsils, we would have to reduce their size to such a point that adequate breathing would be possible. A microdebrider and radiofrequency could be used. With radiofrequency, a certain amount of radiation is introduced into the tissue and results in a decrease in the size of the tonsils between four and six weeks later. There is cellular destruction caused by the sound that is introduced and produces a vibration in the cells and cell-membrane, which necroses and progresses to a very slow decrease in size. The process can be repeated if the decrease in size after six weeks is not sufficient.

When there is hypertrophy of the adenoids their removal is indicated. We use two types of tips in radiofrequency equipment, one for surgery on nasal conchae and the other for the palate. Uvula-palatal surgery is performed in obstructive apnea

that causes snoring, producing fibrosis in the soft palate. In the nasal conchae we introduce up to 350 – 400 Joules of energy. In the tonsils, however, we can use up to 750 Joules in three procedures without any inconvenience.

Anna Messner

The primary aim of this section is to critically review different tonsillectomy techniques. I want to start by telling you that I am not paid by any companies who have developed tools to remove tonsils. This is important to know because, in the United States at least, many, but not all, of the biggest endorsers of new techniques have performed a lot of paid research for the companies proposing them.

Suppose you are seeing a patient in consultation, and the parents bring you a video showing a child with obstructive sleep apnea. The child is snoring, working hard to breathe, wakes frequently with gasping breaths, is restless and often tired during the day. **You recommend the removal of the tonsils and adenoids and the parents are in agreement. What technique will you choose? There are six features of tonsillectomy techniques we will consider.**

The ideal technique would 1) **minimize** intra-operative **blood loss**, 2) **minimize** the risk of **post-operative bleeding**, 3) **minimize post-operative pain, nausea and vomiting**, 4) have a **short operative time**, 5) have **minimal costs of instrumentation**, and 6) **minimize the risk of regrowth of the tonsils requiring a second surgery**. There are many techniques, more than can be discussed here. This paper will focus on tonsillectomy using a **monopolar electrocautery (hot technique)**, **knife/scissors and snare (cold knife technique)**, **coblation®**, **bipolar scissors**, and **also the intracapsular or partial tonsillectomy using coblation® or microdebrider**.

At least two studies have shown that **monopolar electrocautery or hot technique** (also known as the “bovie”) **is the most common instrument used to remove tonsils in the United States**. The first was a survey of members of the American Academy of Otolaryngology-Head & Neck Surgery, and the second was a survey of members of the American Society for Pediatric Otolaryngology (ASPO)^{1,2}.

In the **“cold” technique scissors or a sickle knife, as well as a snare are used**. True purists will say that to do a proper cold tonsillectomy you should not use any cautery at all — you should tie off any bleeders. Others say it is okay to use either monopolar electrocautery, with or without suction, for hemostasis. An alternative cold technique uses the snare, with no prior dissection. Generally it requires a minimum of cautery afterwards.

In the **coblation®** (Arthrocare Corporation, Austin, Texas) **technique radiofrequency bipolar electrical current is passed through normal saline which results in the production of a plasma field of highly ionized particles. These ions are able to break down intercellular bonds thereby separating the tonsil from the surrounding tissue**. The theoretical advantage of this technique is that it is not heat-related. With electrocautery, the tissue heats up to 450°C to 600°C, compared to coblation®, which heats the tissue to approximately 70°C. If there is less heat then you theoretically will have a better post-operative recovery.

These three techniques have been compared in the medical literature. Leinbach et. al. systematically reviewed six **studies comparing monopolar electrocautery versus cold knife dissection tonsillectomy** ³. In all six studies reviewed, monopolar cautery had less intraoperative blood loss. The National Prospective Tonsillectomy Audit from the United Kingdom has provided excellent data on tonsillectomy blood loss ⁴. In this audit an analysis of 33,921 tonsillectomy patients was performed. The overall postoperative hemorrhage rate was 3.5%, 0.6% were primary hemorrhages and 3% were secondary hemorrhages. **The technique with the fewest postoperative hemorrhages was cold steel dissection and ties. Compared to the cold steel group, bipolar diathermy forceps, bipolar scissors, monopolar diathermy forceps, and coblation all had increased risk of hemorrhage.**

In 2005, a study published in the Irish Medical Journal investigated rates of post-operative hemorrhage in 545 children undergoing tonsillectomy ⁵. The overall rate of hemorrhage was 3.6%-- well within normal standards. The secondary rate of hemorrhage, however was double (2.3%) if electrodissection (electrocautery) was used to perform the procedure, compared to 1% with the cold dissection technique. **Patients rated pain to be more severe in the electrodissection group compared to the cold dissection group.** These studies are the reason that currently, **in the United Kingdom, my understanding is that the otolaryngologists are using mostly cold knife techniques.**

What about **post-operative pain**? In four of the six prospective studies reviewed by Leinbach et al, the patients had one tonsil removed by cold-knife technique and one removed by the electrocautery technique ³. The electrocautery side had worse pain in over half the patients and the cold side worse in just 11% of patients. Interestingly the pain was worst on post-operative days four to ten. At Lucile Packard Children's Hospital at Stanford we performed a prospective, randomized study of 219 children, looking at the role of both intraoperative steroids and tonsillectomy technique. **The group that had the least amount of postoperative pain was the group who received intraoperative steroids and had their tonsils removed by the cold-knife technique** ⁶.

Shapiro and Bhattacharyya performed a prospective, randomized, single-blind trial of 46 pediatric patients (age range 2-16 years, average 6.7 years) undergoing adenotonsillectomy using the cold dissection method or coblation® ⁷. They looked at **surgical time for coblation-assisted tonsillectomy** (with total removal of the tonsils) **versus cold dissection tonsillectomy**, and the **coblation-assisted adenotonsillectomy took less time** (11.2 minutes versus 17.0 minutes, $p < .001$). **Intra-operative blood loss was less for the group who had a coblation® tonsillectomy**, but pain scores were no different, time to return to a normal diet was no different, and time to return to normal routine was no different between the two groups.

So, add up all the different studies, what do you get? **Intra-operative blood loss is probably the least with electrocautery**, but realistically, **how much does this matter? Are kids who have cold-knife tonsillectomies requiring blood transfusions? No!** So, even though intraoperative blood loss is a little less using

electrocautery, probably this is not the most important comparative criterion to consider when choosing a technique.

Which technique has the **least operative time**? Either the **electrocautery or coblation®** techniques appear to be the quickest to perform. In general cold-knife procedures take a bit longer. **Less postoperative hemorrhage is seen with the cold technique.** In the study from the United Kingdom, cold procedures had less postoperative hemorrhage, and if there is any one criterion that should decide which technique to use, it should be this criterion. **The technique with the least postoperative morbidity is either cold-knife technique or coblation®,** they both appear to result in less postoperative pain compared to monopolar electrocautery. **What is the risk of re-growth of tonsillar tissue? If you take out the whole tonsil the risk is essentially zero.**

What about **cost**? If you consider the surgical time in the operating room, which in the U.S. is very expensive, **electrocautery would be the cheapest.** I suspect that one of the reasons why electrocautery is used so much is because it is quicker and easier for the surgeon, though not necessarily better for the patient. Also with electrocautery there are no extra instruments needed. **In the United States the instruments for coblation® cost approximately US\$200 extra per case,** but I don't know what the cost would be in other countries.

I am going to mention **partial tonsillectomies, using either the microdebrider or coblation®** to perform the procedure. A survey of people in the American Society of Pediatric Otolaryngology (ASPO) found that **partial tonsillectomy (also called intracapsular or subcapsular or subtotal tonsillectomy)** in children was most commonly performed using a microdebrider (51.4%) compared to coblation® (30.8%), although some otolaryngologists used bipolar instruments. Partial tonsillectomy is not a new idea, it was first reported in the 1800's. A surgeon from that era reported that "the operation can be finished in a moment's time, the pain is little, and hemorrhage is so moderate that it had not required any attention in any of his four cases."

A microdebrider has a rotating head within a metal shaft. Originally, as far as tonsils and adenoids are concerned, it was used to remove adenoids. To remove the adenoids, you place the microdebrider in the nasopharynx, starting next to the vomer, work towards the oropharynx, then use suction cautery to cauterize the bed of the nasopharynx, to obtain hemostasis.

Dr. Peter Koltai, an advocate of the microdebrider adenoidectomy, started doing partial tonsillectomies using the microdebrider, with removal of approximately 90-95% of the tonsil. In this technique the tonsil is removed until you begin to see the capsule, deep in the tonsillar fossa. **The theory is that if you do not take out the whole tonsil the children will have less pain because you have left the capsule to act as a natural dressing.** After most of the tonsillar tissue is removed, suction cautery is used to cauterize any remnant bleeding areas.

Coblation® is also used to perform a partial tonsillectomy. The same instrumentation as is used for total tonsillectomy is used for the partial tonsillectomy. The procedure is performed with saline solution filling the oropharynx. The surgical wand should be moved continuously, if you stop and hold it in one spot then the

wand will plug. About 95% of the tonsil is removed, down to the capsule. Once most of the tonsil is removed the instrument setting is changed to coagulation and hemostasis is obtained.

Why consider a partial tonsillectomy? There have been a few prospective studies looking at this technique. In one prospective, randomized study of 101 children, total tonsillectomy using electrocautery was compared to partial (**intra-capsular**) tonsillectomy **using coblation®**⁸. Surgical time and estimated blood loss was similar in the two groups. **Coblation® patients had less pain and greater oral intake postoperatively.** They also **returned to normal activity level sooner and used slightly less analgesics.**

Total tonsillectomy using the electrocautery has also been compared to partial tonsillectomy using the microdebrider. Derkay et al conducted a prospective, single-blind, randomized controlled trial of 300 children looking at these two groups⁹. They found that surgical time, intraoperative blood loss, time to resume a normal diet postoperatively and postoperative complications for the two techniques was essentially the same. The children who had the microdebrider partial tonsillectomy resumed normal activity sooner. Postoperative pain scores on the day of surgery were no different. Unfortunately this study did not record any other pain scores for the rest of recovery. The author's conclusion was that the **microdebrider partial tonsillectomy seemed to be a little better**, although when you look at all the parameters, the difference was not striking.

A study published by Park et al prospectively examined partial (subtotal) bipolar tonsillectomy compared to total monopolar tonsillectomy¹⁰. The study was a randomized, blinded trial in 39 otherwise healthy children. This was a much smaller study, but the authors did measure postoperative pain over the entire postoperative course, and they looked at oral intake, return to activity, vomiting, retching, and complications. They found no difference between total and partial procedures in any of these parameters. But then again, it was a small study.

Schmidt et al compared the medical charts of 2944 patients undergoing **tonsillectomy with or without adenoidectomy**¹¹. There were 1731 patients in the microdebrider intracapsular (partial tonsillectomy) group compared to 1212 patients in the traditional electrodissection tonsillectomy group. There was a 1.1% incidence of delayed hemorrhage in the intracapsular group compared to a 3.4% incidence of postoperative hemorrhage in the electrodissection group. Treatment in the emergency room or hospital for pain or dehydration was required in 3% of those who had a partial tonsillectomy procedure, and in 5.4% of the group who had an electrocautery tonsillectomy. The study concluded that **there were fewer postoperative complications in the intracapsular (partial) tonsillectomy group**. The advantage of this study is that the authors examined the charts of a large number of children, the disadvantage was that it was retrospective, as opposed to prospective. Retrospective studies are generally not considered as accurate as prospective studies because inevitably not all information is present in the patient charts.

If an **intracapsular (partial) tonsillectomy procedure** is performed approximately 90% of the tonsil is removed and **10% of the tonsil left in the patient.**

When some tissue is left behind **there is the risk that it will become infected in the future, or that it will grow and you will need to do the surgery once again. It is difficult to know the incidence of this**, because people really only started doing partial tonsillectomy 7 or 8 years ago, and only at a few institutions. **In the retrospective study described above, 11 of 1731 patients returned to the operating room for a “completion” tonsillectomy.** In these children **the tonsils grew back, causing either obstructive of infection problems and they required a second procedure.** The mean length of follow-up in these children was quite short- only 18 months. It is not known what will happen to the patients long-term. How many more will need a second tonsillectomy? In the large, prospective study described above by Derkay et al, at the one-month follow-up in the clinic, the children who had undergone a partial microdebrider tonsillectomy were five times more likely to have visible residual tonsillar tissue compared to the children who had complete removal of their tonsils. It is not surprising that some of these children will end up needing to have their tonsils taken out for a second time.

In conclusion, **either the electrocautery or coblation® tonsillectomy result in the least intraoperative blood loss. Electrocautery tonsillectomy is probably the quickest surgical procedure — although one needs to ask how important is an extra minute or two of surgical time. The cold-knife tonsillectomy or possibly the partial tonsillectomy results in fewer postoperative bleeds. Postoperative pain is less in either partial tonsillectomy or a cold technique — these were fairly equivalent.** If you do not want the risk of regrowth of the tonsils possibly requiring a second tonsillectomy surgery then take out the entire tonsil- not just 90%. The procedure with the **shortest operative time (electrocautery)** is likely **the least expensive** — if you consider the cost of time in the operating room. If you consider the **cost of the device** then one of the techniques for total tonsillectomy is best, **either electrocautery, or a cold knife technique.** Bottom line: **any of the tonsillectomy techniques describe here works well. It just depends on which one you prefer, and the one you have the ability to perform.**

Questions from the audience

1- First: do you consider that if we use suture we will end up with less bleeding? Second question is: if you are using electrocautery, and then in post-op the child is bleeding, and when you return to stop the bleeding the scar bleeding area is like “butter”: What would you do?

Answer: Dr. Messner

The first question has to do with electrocautery versus a cold technique for total tonsillectomy. The best data on cold knife tonsillectomy comes from Great Britain in the study describe above. In their data, the authors clearly show that post-operative hemorrhage was less using a cold technique. Your second question; what would you do if you had a bleed after an electrocautery tonsillectomy? You can simply take the child back and cauterize it again. Only rarely will I place stitches to provide hemostasis.

Dr. Peter Bull, from Great Britain (a comment, from the audience)

Can I make a comment, first of all? Before I deal with the question of bleeding? Partial tonsillectomy — for those of us who practiced in the older days — I started off doing tonsils, I suppose, in the late 1960's, without a tube, using a guillotine. And you had to be very slick; there was a knack to doing it. But in a proportion of those patients you would end up doing a partial tonsillectomy. I wouldn't, but some people would. And a lot of them, about 10%, finished with incomplete tonsillectomy. A lot of those patients ended in getting recurrent tonsillitis, and ended up having the tonsillar remnant removed. So in those times, removal of the tonsillar remnant was not an uncommon procedure. So I think that we've been there, perhaps we don't need to revisit it. Dr. Messner do you have a feel for how long it would take to develop tonsillitis?

Answer: Dr. Messner

I think that typically it takes at least 2-3 years.

Dr. Peter Bull

It may be that it took that long to forget how awful it was to have your tonsils removed, to make you come back, because it is an unpleasant procedure. But if I come back to question of the trial that has been done, it is really a continuing audit, under the auspices of the Royal College of Surgeons, in England, and the British Association for Otolaryngology. It started off because of concerns with Cruetzfeld-Jacob disease. A Department Edict said that in order to continue doing tonsillectomy we would have to use disposable instruments. And this edict was issued with no notice at all. So, who had lots of disposable instruments? Nobody. So, a lot of manufacturers rushed to produce disposable instruments which were of very poor quality.

There was a particular problem with the diathermic forceps, because of the tip design. They were producing a lot of tissue necrosis, and it was seen that the incidence of post-operative hemorrhage went very high. And so, this was looked at and people eventually have been allowed to revert, by and large, to proper instruments, which were of good quality. But the trial has looked at different ways for taking out tonsils, and I think that perhaps there is a difference in Britain, as compared to the United States... where what people who are not used to doing coblation will do is to do a co-dissection of the tonsil, and use bipolar forceps, not monopolar. Almost nobody uses monopolar for doing tonsillectomy. It is seen as a very antiquated technique. But they use bipolar, and just to cauterize a small vessel that is bleeding as you go along.

So you can do a virtually bloodless dissection. You are not cauterizing the whole field. So, all you are finishing up with is a clean dissection by cold instrumentation, with small areas of coagulation where you have dealt with a vessel. It is either that technique or the technique of using ligation of vessels that has led to the lowest rates of post-operative hemorrhage.

The experience with coblation is relatively limited to a relatively small number of people who have become very expert at it. They would claim much better figures for both operating time and post-operative hemorrhage, but that is not a universal

experience. A lot of people who have not done very much coblation have found it very troublesome.

But I think the real thing in the recommendations from these English doctors which are still continuing is that all trainees in the technique should learn a cold technique in tonsillectomy, because it was clear that a lot of people did not know how to do it. I think this is part of what led to the problem; there was an overuse of diathermal electro-coagulation. I think the point is that most people would now use simply bipolar forceps to coagulate the vessels as you go along with the dissection.

2- Dr. Messner -how about radiofrequency?

Answer: Dr. Messner

With the Somnus equipment, a probe is inserted into the tonsil to shrink it down. As Dr. Maldonado said, it takes four to six weeks. As far as I know, there are no good long-term studies, or no studies at all, that look at bleeding. The advantage of the radiofrequency technique in an adult is that you can do it in the office setting with the patient awake. But if you are putting a child under anesthesia anyway, why not do a true tonsillectomy procedure that takes completely takes care of the problem?

3- How about pain and radiofrequency?

Answer: Dr. Messner

I have not seen any data on postoperative pain in children undergoing radiofrequency tonsillectomy compared to other techniques.

A comment (from the audience)

When we use electrocautery we have more pain.

4- Dr. Messner, do you have some experience with a yellow powder (haemostatic) called bismuth subgallate?

Answer: Dr. Messner

If I understand your comment: electrocautery tonsillectomy causes more pain, and I think that is true. What consistently comes out in the studies is that if you use more electrocautery, then you have more pain. However, there are lots of different types of electrocautery dissection, and I did not talk about the finer points of electrocautery dissection. For example, you can use a small needle point tip and low power... and those children have an easier post-operative course compared to those who have their tonsils removed using a wider tip, with a lot of power. So, if you are very meticulous in your dissection, and stay on the tonsil, even with the electrocautery patients do fairly well.

About the bismuth use, I have little experience with it. I used it when I was a pediatric otolaryngology fellow, in Canada. In the United States we do not use it. As far as I know there is no prospective study that looks at whether it helps or not — which really should be done. One thing I have learned about tonsillectomy is that just about anything works.

Dr. Richard Rosenfeld from USA (a comment, from the audience)

I want to get back to the UK audit because I think it has the best data, and perhaps Dr. Peter Bull would like to comment. But there are two aspects to interpreting those data. The first is that you focused on the point estimates, but the point

estimates have limits of confidence on them, that might change the interpretation a little bit. And the second is the issue of statistics, in general applying to large groups and not always to individual patients, or individual surgeons.

So if we adjust. I think you cited an odds ratio of roughly four for the increase of hemorrhage, secondary hemorrhage with electrocautery versus cold techniques. When they adjust it for age, sex, and indication for surgery, that drops to about 2.7. And if you look at the 95%-confidence limits, it would go down to 1.6 or 1.5, which certainly is not quite as impressive as 4. So there is a range of variability there, because it is such a rare event, is hemorrhage, and it is tough to draw firm, hard, fast conclusions from those data.

And as you indicated, not everybody does an electrocautery tonsillectomy the same way. I personally think I do a very good one, and I use low current, and I have very good results in my patients. The bottom line is that everyone needs to do what works for them. This is sort of going away from statistics, doing anecdotal medicine, but ultimately it is what you end up with, with this procedure: that you find what you are comfortable with, what works best. We cannot impose use of a cold technique on everybody, because of an audit, although these do well in the UK, and we will see how that works out.

Dr. Peter Bull

Dr. Rosenfeld: fair enough. I don't disagree with you. I think it does definitely depend on the practitioner, and what you are best at. What about fibrin glue when there is bleeding? It is used for other places.

Answer: Dr. Messner

I have yet to see a study that looks at fibrin glue for use in tonsillectomy. I don't know — one of my partners started to use it once, and the child bled that night. But that is purely anecdotal. I have a lot of doubt about how much of the glue actually stays in the tonsillar fossa, because it is an open area. So, I have not used it. I don't know if anybody else here has, but there are no data to support or refute the use.

Dr. Javier Cervera from Spain (a comment, from the audience)

I would like to mention costs. In our hospital we do at least 20 tonsillectomies per week. We cannot afford to add an extra cost of US\$200 for a coblator. Which economy could afford that? I consider that there is a lot of importance nowadays attached to coblation and radiofrequency for tonsillectomies, and very few places could afford to use these systematically.

Answer: Dr. Messner

I agree with you very much, as far as the cost of these instruments. And, more important, it is not just the economy that cannot sustain it, but also that the money could be used for something else which is needed, when you have other techniques that have results that are as good.

5- Question from the audience

Some doctors from some communities say: "we (or I) have a new technique to perform a tonsillectomy (laser, coblation, radiofrequency, etc). We are the best because we are modern!" What is your opinion?

Answer: Dr. Messner

Just a comment about families that come to you and say: “oh, but X doctor down the road can do it, because they have the newer technology.” I have patients come in my office all the time, who want *the laser*. I don’t know about your patients but they think *the laser* is great. So what I tell them, and they usually listen, is: I tried the laser. It did not work any better, and the children had more pain after tonsillectomy. And that usually settles it. But this is a problem in our field, where some doctors like to promote themselves by saying they are using a new, better technology, which may be no better than the old technology- but the patients don’t know that.

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From Anna Messner’s presentation and edited chapter

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