Laser tonsillotomy versus tonsillectomy – an attempt to assess the current situation

L. Eger

Summary

Laser tonsillotomy (LTT) represents a useful, less invasive alternative to tonsillectomy as a treatment for symptomatic tonsillar hyperplasia in children, and is associated with greatly reduced risks. The main characteristics that distinguish this procedure from tonsillectomy are a significantly reduced risk of secondary bleeding, a shorter recovery, reduced pain and the fact that it can be performed on an out-patient basis. An additional benefit is constituted by the fact that the procedure does not remove the tonsillar parenchyma, which may still be immunocompetent. LTT is not indicated in cases of chronic tonsillitis with recurrent episodes of angina tonsillaris.

Fig. 1: "Kissing" tonsils

Fig. 2: One day after surgery

Introduction

Parents are increasingly questioning the necessity of their children being treated with a tonsillectomy (TE) when pediatricians refer them to an ENT specialist. This question would appear to be a valid one, in particular given the inevitable secondary bleeding that is so often mentioned in the lay media.

While the only choices in the past were to leave the pathological symptoms untreated or to perform a tonsillectomy, a range of surgical options are now available. In addition to the traditional tonsillectomy, which involves removing the palatine tonsils in their entirety (including the tonsil capsules), many doctors in Germany now use methods to remove only part of the tonsillar tissue or all of the tonsillar tissue while leaving the capsules intact. Various physical means are employed for this purpose, i.e. laser, high-frequency electrical current or ultrasound.

The method of "tonsil trimming" with a tonsillotome (a type of "tonsil guillotine"), which was a bloody means of lopping off hyperplastic tonsils, was frequently practiced in Germany up until the 1950s. The main advantage of this procedure was that it could be completed very quickly under short-term ether anesthesia. Recurrent episodes of swelling and the formation of abscesses in the remaining tonsill stumps were the main reasons why this method was eventually excised from ENT surgical textbooks in Germany and replaced by the tonsillectomy. However, despite all of the technical and anesthesiological advancements that have been made to date, even the most state-of-the-art tonsillectomy is still associated with post-operative bleeding, in some cases, to a dangerous degree (between 0.5% and 12%) (see 2, 9, 15). For this reason, the indications for TE must be sufficient to justify using this procedure. Even today, up to ten people die in Germany each year either during or as a consequence of TE (2, 9). Windfuhr (2003) (15) cites a TE mortality rate of 0.07%.

Since the early 1990s, tonsillotomy has been experiencing something of a renaissance thanks to the use of lasers. The effectiveness of this method and the attendant lack of secondary bleeding have been
testified to in a major study conducted by the working group around Scherer, in which more than 800 children were treated using laser tonsillotomy (6).

Laser tonsillotomy is now widely used in clinics and surgical practices.

Fig. 3: Four days after surgery

Indications for laser tonsillotomy

In addition to chronic recurring tonsillitis, obstructive tonsillar hyperplasia represents the main indication for tonsillotomy in children. Only where tonsillar hyperplasia is not accompanied by the typical history of acute tonsillitis can conventional tonsillectomy be replaced by laser tonsillotomy, which is not suitable, however, for treating any of the many other undisputed indications for TE.

Fig. 4: Surgical site

Symptoms of tonsillar hyperplasia

Parents do not always describe loud snoring as the main symptom of tonsillar hyperplasia. In some cases, the child's night-time breathing sounds more like a hissing intake of breath, which may not be heard in the parents' bedroom. If the child is already an habitual snorer, the parents may instead notice that schoolwork is suffering (5) or that the child may even be displaying characteristics of ADHD (11).

The following symptoms are typical:

- Snoring at night, in some cases with phases of apnea
- Disturbed sleep (arousals), sleeping with the head tilted back and jugular retractions
- Mouth breathing while awake
- Unclear speech
- Difficulty eating with a loss of appetite and failure to thrive
- Middle ear effusion despite adenotomy
- Frequent infections of the lower respiratory tract

An obligatory diagnosis by a sleep laboratory would not appear to be warranted, even as a prerequisite for performing the procedure when the clinical symptoms are unmistakable. In my opinion, the maternal instinct that is awoken by the suffering of the sleep-deprived child and which ultimately leads the mother to bring the child for assessment is a key indicator, although, of course, it is insufficient on its own. Occasionally, if the parents have been extraordinarily lax, the pediatrician may uncover a long-standing obstruction to the child's breathing, or even a thoracic deformity (such as funnel chest). Surgery is not indicated if tonsillar hyperplasia is present but is causing no distress to the child or parents, or where the symptoms became apparent no more than a few days or weeks prior to the consultation.

Fig. 5: Snoring intensity before and after surgery

<table>
<thead>
<tr>
<th>Schnarchintensität in %</th>
<th>Snoring intensity in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>nicht zu hören</td>
<td>not noticeable</td>
</tr>
<tr>
<td>leise</td>
<td>soft</td>
</tr>
<tr>
<td>gerade noch erträglich</td>
<td>just bearable</td>
</tr>
<tr>
<td>beängstigend</td>
<td>alarming</td>
</tr>
<tr>
<td>Präoperativ</td>
<td>pre-operative</td>
</tr>
<tr>
<td>Postoperativ</td>
<td>post-operative</td>
</tr>
</tbody>
</table>
Surgical technique

The surgical site is accessed through the mouth, as in adenotomy and tonsillectomy. The procedure is performed under general anesthesia (figure 4). In our practice, we use a 30-watt diode laser. The laser's infrared light is conducted into a handpiece using an optical fiber, and it separates the tonsil tissue like a scalpel. The same result can be achieved using many other lasers and a range of techniques.

Partial removal of the palatine tonsils enables unobstructed nasal breathing and breathing in the region of the pharynx. The objective of the procedure, i.e., to remove the mechanical obstacle to breathing, is therefore achieved.

Fig. 6: Apnea phases before and after surgery

<table>
<thead>
<tr>
<th>Apneophasen in %</th>
<th>Apnea phases in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keine</td>
<td>none</td>
</tr>
<tr>
<td>vereinzelt</td>
<td>isolated</td>
</tr>
<tr>
<td>häufig</td>
<td>frequent</td>
</tr>
<tr>
<td>besorgniserregend</td>
<td>worrying</td>
</tr>
<tr>
<td>Präoperativ</td>
<td>pre-operative</td>
</tr>
<tr>
<td>Postoperativ</td>
<td>post-operative</td>
</tr>
</tbody>
</table>

Recovery

Patients are given ibuprofen suspension as pain relief. One third of patients experience an appreciable degree of pain for up to one day after the operation (fig. 9). Occasionally, we also prescribe 100 mg of Prednisolone supp. for our little patients in order to help postoperative uvular edema to subside. The children are able to eat anything they may have an appetite for on the same day the procedure is performed. Some even go straight to a nearby fast-food restaurant with their parents as a reward for being so brave!

High temperatures are a common experience in the first few days after surgery. This is the body's way of responding to the pyrogenic combustion products of the laser treatment and is not a cause for concern.

Approximately two to four days after surgery, the children begin to experience very bad breath (fig. 2). The odor is caused by the bacteria that break down the tonsil tissue remaining on the tonsil stump, which was charred by the laser. This problem disappears without treatment after a couple of days.

The child should be kept at home and not attend kindergarten or school for a total of five to seven days, and should not play sports for three to four weeks.

Fig. 7: Timescale for a noticeable improvement in pre-operative symptoms

<table>
<thead>
<tr>
<th>Besserung der präoperativen Symptomatik in %</th>
<th>Improvement in pre-operative symptoms in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>In der ersten Nach OP</td>
<td>during the first night after surgery</td>
</tr>
<tr>
<td>nach 2 Tagen</td>
<td>after 2 days</td>
</tr>
<tr>
<td>nach 5 Tagen</td>
<td>after 5 days</td>
</tr>
<tr>
<td>nach 1 Woche</td>
<td>after 1 week</td>
</tr>
</tbody>
</table>

Fig. 8: Age profile for TE and LTT (*based on the surgical data of the ENT practice at the Helios clinic in Erfurt, 2003)

<table>
<thead>
<tr>
<th>Operations-Daten in %</th>
<th>Proportion of operations in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alter in Jahren</td>
<td>Age in years</td>
</tr>
</tbody>
</table>
What are the possible complications?

According to statistics from Sweden (8) and Germany (1, 6), recovery from laser tonsillotomy is quicker than from traditional tonsil surgery, and is also less painful because part of the tonsils remains in the tonsill bed and so there are no open wounds to cause pain. Children are pain-free after three days on average. Temporary voice changes are often experienced. Pre-operative closed nasality becomes open (to produce a nasal sound as in a child with cleft palate). However, after just a few hours, the soft palate and uvula are fully adjusted to the new physiological situation and the Rhinolalia aperta (open nasality) disappears in most cases. Many parents, in particular those of small boys, are amazed at how the pitch of their child’s voice is raised after surgery (I often hear the comment “He sounds like a girl now!”).

One of our own patients experienced unilateral hypoglossal paresis (i.e. one side of the tongue became weak) due to the pressure of the applicator on the tongue during the procedure. However, this effect resolved itself fully after one month.

In extremely rare cases, the sense of taste is temporarily impaired. If the immunological defense mechanisms of the remaining tonsil tissue are subsequently stimulated to a significant degree, the hyperplasia may recur. However, it rarely reaches proportions that would affect breathing. The possibility cannot be excluded that the remaining tonsil tissue may have to be surgically removed in later life due to a different indication.

Analysis

Between 2001 and 2004, over 150 out-patient laser tonsillotomies were performed at our group practice using a diode laser and general anesthesia. In all cases, the children met the criteria for surgery because the obvious clinical symptoms of tonsillar hyperplasia had been present for at least three months, and they and their parents were suffering a sufficient degree of psychological distress. All of the 117 children who had undergone the procedure by the time the retrospective study was begun were interviewed using a questionnaire. The response rate was 77%. 11 months on average (1 - 29) had elapsed since the surgery was performed. The results presented are, of course, heavily influenced by the parents, and were not verified using objective measurement methods. Nevertheless, they indicate some clear trends.

Fig. 9: Expected versus actual levels of pain

<table>
<thead>
<tr>
<th>Schmerzerwartung in %</th>
<th>Expected level of pain in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schmerzen stärker als erwartet</td>
<td>Pain worse than expected</td>
</tr>
<tr>
<td>Schmerzen wie erwartet</td>
<td>Pain the same as expected</td>
</tr>
<tr>
<td>Schmerzen geringer als erwartet</td>
<td>Pain less than expected</td>
</tr>
</tbody>
</table>

Results

- Snoring intensity was reduced in 100% of cases, and eliminated in 84% (fig. 5).
- Apnea phases were significantly reduced in 100% of cases, and eliminated in 94% (fig. 6).
- Obstructed swallowing was eliminated in 95% of cases.
- Loss of appetite was eliminated in 77% of cases.
- Failure to thrive was eliminated in 95% of cases.
- Post-operative bleeding requiring medical attention did not occur.
- 99% of parents rated the outcome of the procedure as “good” or “very good”.
- In 94% of cases, post-operative pain was only as severe as or less severe than had been expected (fig. 9).
- All of the parents would recommend the operation to parents of children with the same symptoms.
- Occasional post-operative acute tonsillitis occurred in just 1% of cases within the observation period.

**Discussion**

At this point, it must be mentioned that surgical alternatives to tonsillectomy that preserve some of the organ tissue are still the subject of heated debate among ENT doctors in Germany, both in terms of the method and the indications.

In contrast to the method of interstitial radio-frequency tonsillectomy (RF-TT) presented by Klimek (7), among others, laser tonsillotomy offers the benefit of producing the immediate effect (fig. 7) of unobstructed breathing, while the volume reduction of the tonsil tissue can be calculated more accurately. Furthermore, in the extreme case of pre-operative "kissing" tonsils (where the tonsils are touching), RF-TT may "lead to problems" (7) due to a reactive post-operative increase in tissue volume. Indeed, I have personally experienced a tracheotomy becoming necessary as a result.

Coblation tonsillotomy or tonsillectomy is another method that appears to be very promising. This procedure involves electro-surgical ablation of the tonsillar parenchyma, leaving the tonsil capsules intact and with very little loss of blood. This method is already very widespread in Great Britain.

So, which are the most frequently cited arguments against laser tonsillotomy?

**Abscess formation in trimmed tonsils?**

The experiences both of the pioneers of LTT and of its many practitioners to date indicate that, contrary to what has been historically reported, the development of abscesses are not to be expected if this procedure is strictly limited to the treatment of tonsillar hyperplasia, and is not used in cases where there is a history of chronic recurring tonsillitis. This is demonstrated, for example, by Helling (6) in a study of more than 800 patients, and by Elies (4) in a study of approximately 500. Abrams (1) also reports personal experience of seeing the frequency of acute tonsillitis declining in children who have had a tonsillotomy. Amazingly, this means that the indications for LTT were extended somewhat in this case, to include patients with a certain degree of recurring acute tonsillitis. In spite of this, no abscesses were detected in the remaining tonsil tissue. Clearly, the tonsils can tolerate a vertical resection by laser better than the bloody procedure of horizontal tonsillotomy in the upper third of the tonsils, which was used in the past. We must make it clear, however, that tonsils that have withstood recurring episodes of strep infection will not improve by having half of their tissue removed. The remaining half has the same anamnesis and is very likely to plague its "host" with further episodes of tonsillitis.

**Isn't the newly formed tissue surface after laser TT immunologically active?**

Both Henning (6) and Unkel (14) found no notable infection or scarring, as well as deep open crypts in conjunction with existing follicular hyperplasia in histological TE specimens after treatment with LTT. We can therefore assume that the anatomical structures of the immune function of the tonsils are obviously preserved after the wound has healed.

It will be difficult to prove that these immunological responses are preserved, not least because long-term studies do not indicate any deficiencies in the immune systems of children whose tonsils have been completely removed with TE (3).

However, a lack of such evidence does not constitute a contraindication for LTT, considering that LTT provides an alternative to TE. In any case, even a complete loss of tonsil function after this procedure has been viewed as an acceptable consequence to date.

**Aren't lasers dangerous?**
In principle, it cannot be denied that lasers are potentially dangerous. The thermal effects of the laser on the surgical site can certainly cause unwanted side-effects on the surrounding areas. However, most of these are temporary and reversible. Occasionally, they require supportive medication, such as Prednisolone, to prevent obstructive uvular edema. Of course, laser-specific safety measures, such as covering the surrounding tissue with damp gauze, must be followed. Technology that combines fibers with lasers (as in diode lasers or Neodym:YAG lasers) are associated with a lower risk of “shooting off target” because the energy density required to destroy the tissue is only reached directly at the fiber tip.

In 2003 survey of 20,000 endolaryngeal procedures in Germany using a CO$_2$ laser, Sesterhenn (12) recorded some 15 incidences of laser-induced tube fires. In six of these 15 cases, protective tubing had been used with the laser. This clearly indicates that tube fire represents a genuine risk, and that protective tubing for lasers does not offer absolute protection against this possible serious occurrence.

Is protective tubing essential when performing a laser tonsillectomy with a diode laser?

Firstly, it should be noted that the risk of accidental damage is much lower in the case of procedures that use a fiber-guided (diode) laser rather than the free beam of a CO$_2$ laser. When seeking to answer this question, we must consider the fact that the tube can be inserted below the mouth gag and tongue decompressor, and kept completely separate from the surgical site. As a result, it is very unlikely that the tip of the laser fiber optic will come into contact with the tube.

In consultation with my anesthetist colleagues, I have personally performed over 140 laser tonsillectomies without any complications and without using these very expensive special tubes. Note, however, that caution is required in relation to the use of a larynx mask because a prolapse of the cuff into the area targeted by the laser is possible.

On the whole, it can be said that the laser, just like any other invasive instrument, may produce unwanted side effects in an organism. However, the benefits outweigh the risks to a sufficient degree.

How will I fill my beds if LTT can be performed on an out-patient basis?

The fears of some of my colleagues who are based exclusively or partly in an in-patient clinical setting that laser tonsillectomy could result in a mass exodus of patients from hospital beds is unfounded. For one thing, as people age, the more likely it becomes that chronic recurring tonsillitis will necessitate the use of TE (fig. 8). Experience indicates that, past the age of 10 years, patients will rarely present with symptoms of hyperplasia only. On the other hand, I see no reason to deny a laser tonsillectomy to a 15-year-old purely on the grounds of age.

Among our own patients, 62% of children who had a tonsillectomy were aged five years or younger, with another 32% falling into the six to 10 age bracket. If we postulate that approximately one in two children in the first group, and one in four in the second group present for surgery for tonsillar hyperplasia alone, the frequency with which TE is used would only decrease by 8%. If the contra-indications for out-patient surgery are taken into account, we would only expect to see a decrease in TE-related hospital bed occupancy of around 4% to 5%.

Fig. 10: A typical negative assessment by the Medical Review Board of the Statutory Health Insurance Funds

Tonsillectomy with a tonsillotome, which was commonly used in the past to treat children with tonsillar hyperplasia (usually in conjunction with an adenotome), is now discredited as a harmful practice based on practical clinical experience, and therefore can no longer be considered a responsible course of treatment. The scar tissue that forms as a result of this procedure may cause a complete closure of portions of the deep tonsillar crypt system, thereby contributing to the spread of chronic infection to the tonsill tissue. The same logically applies to the planned procedure of laser tonsillectomy.


Financing
Cost reimbursement for this procedure by the compulsory health insurance funds is still insufficient because a Social Court ruling frees them from any obligation to cover services that are not yet contained in the new German doctors' fee scale, even though there may be clear medical indications for these. However, since this procedure very clearly has the potential to save the compulsory health insurance funds a considerable amount of money, many of these (and in particular, the smaller funds) have agreed to reimburse the costs of the doctors' bills for this procedure (based on the regulated price list) on a case-by-case basis. The costs covered "privately" by the patients themselves range from 80 to 1,000 euros. Since the Medical Review Board of the Statutory Health Insurance Funds has yet to come out in favor of covering the costs of this procedure (fig. 10), this chaos is set to continue.

Conclusion

Laser tonsillotomy provides a useful alternative to tonsillectomy if the surgical indication is based on a clinically relevant tonsillar hyperplasia without a history of recurring tonsillitis. We estimate that one in six tonsillectomies in children and adolescents could be replaced with laser tonsillotomies.