

Comparison of the Duration of Patency and Closure Rate between Laser-Assisted Myringotomy and Incisional Myringotomy in Infants with Acute Otitis Media

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OBJECTIVES: There has been a renewed interest in myringotomy in recent years due to the limited results of antibiotic treatment and undesirable effects of ventilating tubes. The purpose of this study was to compare the duration of patency and closure rate between laser-assisted myringotomy (LAM) and incisional myringotomy (IM) applications in infants with acute otitis media (AOM).

PATIENTS AND METHODS: The study included 397 consecutive infants with AOM, younger than 12 months old. All the cases were divided into two groups according to the date of presentation at which one type of myringotomy was performed, that is, before 1997 (IM, 32 ears) and from that time forth (LAM, 494 ears). After parental informed consent was obtained from all cases, myringotomy was performed as the sole procedure without the use of antibiotics, followed by monitoring for seven to eleven days. The mean time to closure and the mean closure rate were calculated for both groups.

RESULTS: The mean myringotomy size was 6 mm² (1 mm by 6 mm) in the IM group and 2 mm² (radius, 0.8 mm) in the LAM group. The mean time to closure significantly differed between the two groups, being 3.31±2.1 days for IM and 12.71±6.9 days for LAM (p<0.0001). Similarly, the mean closure rate was significantly lower in the LAM group (0.20±0.10 mm²/day *versus* 2.28±0.8 mm²/day, p<0.0001).

CONCLUSION: Prolonged LAM patency in infants provides a longer duration of ventilation to the middle ear, which increases the chance to recover and minimizes the need for antibiotic treatment. These results may also have implications for the general use of laser techniques in otolaryngology and other specialties.

The treatment policy for acute otitis media (AOM) in infants remains controversial.^[1-4] Yet, the majority of authors still believe that a good and prolonged drainage is advantageous over antibiotic treatment.^[5,6] There has been a renewed interest in myringotomy in recent years due to the limited results of antibiotic treatment on one hand, and undesirable effects of ventilating tubes on the other.^[6,7] Laser-assisted myringotomy (LAM),^[8] an improved laser myringotomy technique (OtoLAM^[9-12] from Lumenis Inc., USA) is a recent development proposed as an alternative to conventional incisional myringotomy (IM) to provide intermediate-duration middle ear ventilation.

It is well-known from clinical experience that IM patency lasts only few days (usually one to three). Surprisingly, we could not find an exact closure time in the literature; this may be because the size of the IM is not measurable and much versatile. In two previous publications^[11,12] we reported on prolonged LAM patency in humans. The purpose of the present study was to compare the duration of patency and closure rate between LAM and IM performed infants with AOM.

PATIENTS AND METHODS

A total of 397 consecutive infants aged 12 months or younger, suffering from symptomatic AOM (bulging and redness of the tympanic membrane, with general symptoms such as restlessness) were included in this study. After parental informed consent was obtained from all cases, all were treated by myringotomy only without the use of antibiotics. They were monitored for seven to eleven days. Those who developed undesirable symptoms such as fever were excluded from the study and were given antibiotic treatment.

All the cases were divided into two groups according to the date of presentation at which one type of myringotomy was performed, that is, before 1997 (IM, 32 ears) and from that time forth (LAM, 494 ears). Cases were consecutive in both groups. All the ears were examined at least twice under the microscope, on the third to fourth and on the seventh to eleventh days after the procedure. The tympanic membrane's condition, especially existence of a perforation, was noted. The duration of closure time was defined as the number of days

between the two visits at which the myringotomy was open and it was found closed, respectively. The mean time to closure and the mean closure rate were calculated. The latter was found by dividing the total time to closure by the total number of square areas of the patencies induced by IM (6 mm²) or LAM (2 mm²).

Statistical analyses were made with the use of a two-tailed t-test. A *p* value of <0.05 was considered significant.

The technique

The IM was created as an arch-shaped incision from the area just anterior to the round window up to the anterior superior quadrant, at least 6 mm in length. All the IM incisions were performed and followed by the same author (DC). Laser-assisted myringotomies were performed using the OtoLAM laser system (TM of Lumenis Ltd., Yokneam, Israel, formerly Sharplan Lasers). This is a CO₂ laser device that rotates a focused beam on a pre-planned circular area. The size, depth (intensity), and location of the myringotomy can be preset according to the clinical indications. The beam ablates the target area in the tympanic membrane and creates a round hole. The procedure was found to cause no damage to the infant ear. The size of the LAM hole was 1.6 mm in diameter in the inferior part of the tympanic membrane.

RESULTS

There were 32 ears in the IM group and 494 ears in the LAM group. The mean myringotomy size was 6 mm² (1 mm by 6 mm) in the IM group and 2 mm² (radius, 0.8 mm) in the LAM group.

The mean time to closure significantly differed between the two groups, being 3.31±2.1 days for IM and 12.71±6.9 days for LAM (*p*<0.0001). Similarly, the mean closure rate was significantly lower in the LAM group (0.20±0.10 mm²/day *versus* 2.28±0.8 mm²/day, *p*<0.0001).

DISCUSSION

Our results showed that LAM significantly lasted longer than did IM (12.71 vs 3.31 days), with a significantly slower closure rate (0.2 vs 2.28 mm²/day). These differences may arise from the differences in

the shape of myringotomy holes induced by the two techniques. When an IM is created, the rims of the perforation retract elliptically as estimated in our study to be at least 6 mm in length, and 1 mm in width, with a total area of 6 mm², compared with LAM with a cross-distance of 1.6 mm and a total area of 2 mm². It may be speculated that the wider the gap between the two edges of the patency, the more time it takes for the regeneration of the tissue to close the gap.

On the other hand, the significant difference in the closure time between the two myringotomy techniques may denote an inhibitory effect of the laser on the regeneration of tissues. A possible explanation for the cause of prolonged LAM patency was given by Soderberg et al.^[13,14] who postulated that laser applications might cause milder inflammatory reactions.

The duration of myringotomies was studied by Szeremeta et al.^[15] in children having otitis media with effusion. The authors compared the duration and efficacy of IM performed in 48 ears with a 2-mm radial incision in the anterior portion of the tympanic membrane with those of LAM in 39 ears having a diameter of 1.7 mm. The results showed a longer patency on the part of LAM, but this was not correlated with improvement in otitis media with effusion.

Valtonen et al.^[16] compared the closure time on chinchillas and found it to be significantly longer in LAM than in IM. The authors concluded that CO₂ laser myringotomy also allowed perforations of different shapes and sizes.

Some studies examined the recovery of tissues from laser surgery in other organs such as the tonsils. Strunk and Nichols^[17] reported a slower recovery rate for KTP laser compared to the dissection tonsillectomy technique. We speculate that the thermal damage can be the cause of this delay, making LAM advantageous over the traditional IM in AOM.

In addition to longer patency and smaller size, another advantage of LAM is that the size of the myringotomy may be preplanned according to the patient's condition.

In conclusion, prolonged LAM patency in infants provides a longer duration of ventilation to

the middle ear, which increases the chance to recover and minimizes the need for antibiotic treatment. These results may also have implications for the general use of lasers in otolaryngology and other specialties.

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