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ORIGINAL ARTICLE

The efficacy of CO_2 laser myringotomy in serous otitis media

Seröz otitis media tedavisinde CO_2 lazer miringotominin etkinliği

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Objectives: We evaluated the efficacy of CO_2 laser myringotomy combined with adenoidectomy in children with serous otitis media (SOM) unresponsive to medical therapy and compared the recurrences in the follow-up period with the control group who underwent adenoidectomy and ventilation tube (VT) insertion.

Patients and Methods: The CO_2 laser myringotomy group included 25 children with a mean age of 5.6 years and there were 10 children with a mean age of 6.3 years in the VT control group. The laser used was a Sharplan 1030 CO_2 laser, attached to Zeiss Universal S3 operation microscope with a 300 mm objective, using a Microspot optical delivery system.

Results: Mean (±SD) healing time was 13 (±2.16) days in 4 ears with myringotomies less than 2 mm diameters, and 25 (±2.34) days in 46 ears with myringotomies with 2 mm diameters. During the 6 months follow-up period there were 11 recurrences (22%) in CO_2 laser group and 4 recurrences (20%) in the control group, which was not statistically significant ($p>0.05$).

Conclusion: We prefer laser myringotomy in SOM cases who do not need long time middle ear ventilation; we use the ventilation tubes in cases with thick mucoid effusion and recurrent effusion after laser myringotomy.

Key Words: Otitis media with effisuon/surgery; carbon dioxide; lasers/therapeutic use; middle ear ventilation; tympanic membrane/pathology/surgery.

Amaç: Bu çalışmada medikal tedaviye cevap vermeyen seröz otitis media'lı (SOM) olgularda adenoidektomi ile kombine yapılan CO_2 lazer miringotomi etkinlik ve rekürrens açısından adenoidektomi ve ventiasyon tüpü (VT) tatbiki yapılan kontrol grubu ile karşılaştırıldı.

Hastalar ve Yöntemler: CO_2 lazer miringotomi grubunu ortalama yaşları 5.6 yıl olan 25 kontrol grubunu ise ortalama yaşları 6.3 yıl olan 10 çocuk oluşturmaktaydı. Çalışmada Zeiss Universal S3 ameliyat mikroskobuna bağlı Sharplan 1030 CO_2 lazer cihazı ve 300 mm objektif takılı mikrospot manuplatör kullanıldı.

Bulgular: 2 mm çaplı miringotomi yapılan 46 kulakta ortalama (±standart sapma) kapanma süresi 25 (±2.34) gün olarak tespit edilirken, 2 mm'den küçük miringotomi yapılan dört kulakta ortalama kapanma süresi 13 (±2.16) gün olarak belirlendi. Altı aylık takip süresince CO_2 lazer miringotomi grubunda 11 rekürrens (%22) saptanırken, kontrol grubunda dört kulakta rekürrens (%20) görüldü, fakat fark istatistiksel olarak anlamlı bulunmadı ($p>0.05$).

Sonuç: Uzun süreli orta kulak ventilasyonu gerekmeyen SOM olgularında CO_2 lazer miringotominin yapılması, efüzyonun tekrar ettiği veya koyu mukoid efüzyon tespit edilen olgularda VT takılması uygun seçenek olacaktır.

Anahtar Sözcükler: Effüzyonlu seröz otitis media/cerrahi; karbon dioksit; lazer/tedavi amaçlı; orta kulağın havalandırılması; kulak zarı/patoloji/cerrahi.

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Serous otitis media (SOM) is an inflammation of the middle ear, with effusion behind an intact tympanic membrane.[1] The morbidity associated with SOM, including impaired hearing, delay in development of cognitive, linguistic, auditive and communicative skills, is substantial and the costs of medical and surgical therapy for children under age of 5 are estimated to be a few billion dollars in USA.[2]

The incidence of SOM in Turkish population reported by different authors range between 11.2 and 18.8.[3-5]

Ventilation of the middle ear cavity is the most important aim for the treatment of SOM. Myringotomy and insertion of ventilation tubes (VT), introduced by Armstrong in 1954, have become the most widely used treatment options. Myringotomy without VT insertion usually remains open for a few days and is no more effective than medical therapy.[6] Adenoidectomy is proved to be effective and combined with VT insertion, used as a primary treatment modality for SOM especially in children with concomitant obstructive adenoid hypertrophy and chronic rhinosinusitis.[7] However myringotomy by using CO_2 laser is recently becoming more popular, since laser perforations heal within a period of approximately three weeks which is adequate to treat SOM, thus, obviating the necessity for the VT.[8]

In this study our objective was to evaluate the efficacy of adenoidectomy and CO_2 laser myringotomy in children with SOM and compare the rate of early and late recurrences in the follow-up period with the control VT group.

MATERIALS AND METHODS

50 ears of 25 children with SOM, whose ages ranged between 3 and 8 years (mean: 5.6 years, SD: 1.65 years) were prospectively enrolled in ENT Department of Ankara University Faculty of Medicine. Patient selection criteria to be included in the study was presence of SOM not responding to medical therapy including a combination of antibiotics (sulbactam-ampiciline suspension, 50 mg/kg/day, q8h, for 10 days), allergy treatment (loratadine suspension, 5 mg, once a day) when indicated, systemic decongestants (pseudoephedrine HCl suspension 90 mg /day, q8h) and systemic steroids (methylprednisolone acetate 20 mg i.m., single dose). Control group consisted of 10 children with a mean age of 6.3 years (range: 4-8 years, SD: 1.56 years) who underwent adenoidectomy and bilateral ventilation tube insertion, and whose ventilation tubes had been extruded spontaneously. Patients participated after the diagnosis of SOM were confirmed by otoscopy and supported by a tympanogram. Indication for adenoidectomy was determined by patient history and physical examination.

Under general anaesthesia all the patients underwent adenoidectomy and CO_2 laser myringotomy. The laser used was a Sharplan 1030 CO_2 laser, attached to Zeiss Universal S3 operation microscope with a 300 mm objective using a Microspot optical delivery system (Fig. 1); the power setting ranged between 6-12 watts (mean: 11.12 watts, SD: 1.53 watts) in 0.1 second, single pulse mode, and myringotomies ranged between 1.5-2 mm (mean 1.97 mm, SD 0.09 mm) were obtained. The operations were recorded by a camera attached to the

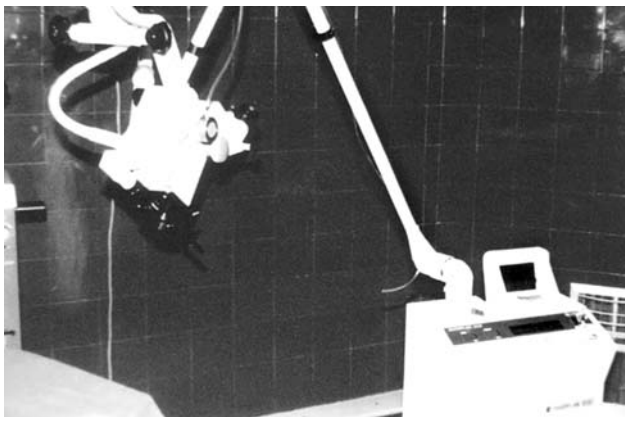

Fig. 1 - *"Microspot" (Sharplan) laser manipulator and Sharplan 1030 Laser.*

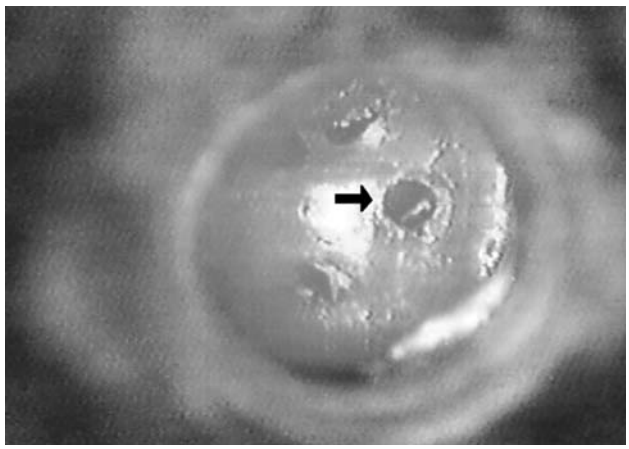

Fig. 2 - *CO_2 laser myringotomy.*

microscope and myringotomy diameters were measured (Fig. 2, 3 a-d).

Follow-up examinations were done by otoscopy twice a week until all the tympanic membranes healed and the patency periods were recorded. Then the follow-up data including the early and late recurrences were obtained in 1, 3, and 6 months. Recurrences within 3 months were recorded as early and the ones after as late recurrences. Clinical efficacy was defined as the absence of SOM confirmed by otoscopy and tympanometry which were performed at each visit.

Myringotomy diameters, patency periods and their relations with recurrences were analysed statistically by "Fisher's Exact Test" and "Pearson Correlation". Also recurrences in CO_2 laser myringotomy cases and the VT control group were analysed statistically again with "Fisher's Exact Test".

RESULTS

Patency periods were 13±2.16 days (mean ±SD) in 4 ears with myringotomies less than 2 mm diameters, and 25±2.34 days (mean ±SD) in 46 ears with 2 mm myringotomies.

In postoperative third month examinations 3 bilateral recurrent SOM were diagnosed in CO_2 laser group. 2 of them were treated successfully with medical therapy, and one underwent VT insertion. In the 6th month controls bilateral recurrent SOM were diagnosed in 1 patient while unilateral recurrent SOM were diagnosed in 3 patients and all were cured with medical therapy. In the control group 2 of the 10 patients had bilateral recurrent SOM in the 3rd month controls and underwent VT insertion, others had no recurrences observed in the control visits during the 6th month follow-up period.

Patency period in 45 of the CO_2 laser myringotomy group were 20 days and longer, and in 5 ears shorter than 20 days. 4 of the 5 cases with patency times shorter than 20 days were the ones with myringotomies less than 2 mm diameters. Early recurrent SOM was diagnosed in 4 of the 5 ears (80%) with patency times shorter than 20 days and

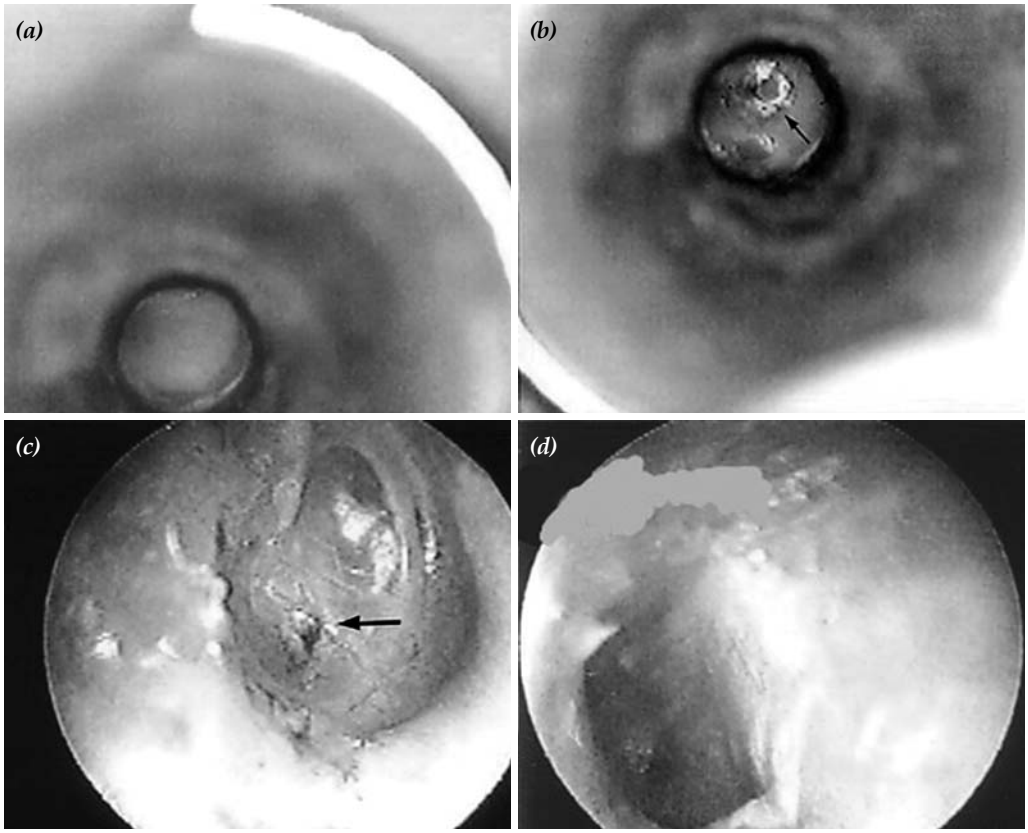

Fig. 3 - ***(a)*** *Preoperative tympanic membrane;* ***(b)*** *CO_2 laser myringotomy;* ***(c)*** *postoperative 1st week;* ***(d)*** *postoperative 3rd week.*

TABLE I

THE DISTRIBUTION OF RECURRENCES ACCORDING TO PATENCY TIMES

Patency times	Early recurrence ears	%	Late recurrence ears	%
≤20 days (n=5 ears)	4	80	1	20
>20 days (n=45 ears)	2	4.4	4	8.9

TABLE II

THE DISTRIBUTION OF RECURRENCES ACCORDING TO MYRINGOTOMY DIAMETERS

Myringotomy diameters	Early recurrence ears	%	Late recurrence ears	%
<2 mm (n=4 ears)	3	75	1	25
2 mm (n=46 ears)	3	6.5	4	8.7

in 2 of the 45 ears (4.4%) with patency times longer than 20 days (Table I). The relation between patency period and early recurrence was analysed using "Fisher's Exact Test" and the result was found to be statistically significant ($p<0.01$).

Late recurrent SOM was diagnosed in 1 of the 5 ears (20%) with patency period shorter than 20 days and in 4 of the 45 ears (8.9%) with patency period longer than 20 days. The relation of patency time and late recurrence was analysed with "Fisher's Exact Test" and the result was statistically insignificant ($p>0.05$).

Regarding the myringotomy diameters and the rate of recurrences, early recurrent SOM was diagnosed in 3 of the 4 ears (75%) with myringotomies less than 2 mm diameters, while in 3 of the 46 ears (6.5%) with 2 mm myringotomies (Table II). Using "Fisher's Exact Test" a statistically significant relation was found between the myringotomy diameter and early recurrence ($p<0.01$). Late recurrent SOM was diagnosed in 1 of 4 ears (25%) with myringotomies less than 2 mm diameters, while in 4 of the 46 ears (8.7%) with 2 mm myringotomies which was statistically not significant ($p>0.05$).

Overall early and late recurrences were diagnosed in 11 (22%) of the 50 ears in CO_2 laser group and 4 (20%) of the 20 ears in the control group. The difference was not statistically significant ($p>0.05$).

In the CO_2 laser group the myringotomy diameters and patency times were analysed with 'Pearson correlation' and statistically high significant relation was found (Pearson correlation coefficient $r= 0.802$) ($p<0.01$).

DISCUSSION

SOM is the most common infection in children after upper respiratory system infections and the most frequent indication for antimicrobial or surgical therapy in this age group. Current therapies include watchful waiting, a combination of antibiotics, intranasal or systemic steroids, decongestants and ventilation of the middle ear cavity with a myringotomy and VT combined with adenoidectomy when indicated.[3,9]

Adenoidectomy is frequently advocated for the prevention of the recurrence of SOM. Combined with VT insertion, it is used as a primary treatment modality for SOM especially in children with concomitant obstructive adenoid hypertrophy and chronic rhinosinusitis. Myringotomy without VT insertion usually remains open for a few days and is no more effective than medical therapy.[6,7,9-12]

VT are often beneficial but in half of the cases, they stay longer than needed and the chance for the complications increase including otorrhea (12-40%), tube cholesteatoma, persistent tympanic membrane perforation (1-2%) and tympanosclerosis.[7,11,13] In our study we did not observe any complications in the VT group.

Minimal effective middle ear ventilation time to cure the usual case of SOM is not known, but in many cases 2-3 weeks period is reported to be sufficient.[8] CO_2 laser myringotomy was first described by Wilpizeski (1977) and followed by Lyons et al. (1978), Williams et al. (1981) and Goode (1982) and became popular as an alternative to VT.[14]

Recent advances in both laser technology and optic delivery systems have made CO_2 laser myringotomy feasible in the office setting. Different studies were performed in different institutions using the OtoLAM tm (ESC/ Sharplan, Yokneam, Israel) device.[7]

Garin and Remacle[15] reported that 84% of the 19 ears were normal after adenoidectomy with CO_2

laser myringotomy using the OtoLAM. Cook et al.[7] treated 96 ears with adenoidectomy ± tonsillectomy and CO_2 laser myringotomy and showed clinical resolution in 88%, 86%, 83% of the treated ears in 1, 2, and 3 months, respectively. Silverstein et al.[16] have reported 70 patients treated with CO_2 laser myringotomy and obtained 1.6 mm average myringotomy diameters and 3.14 weeks average patency periods with no recurrences in 3 months follow-up period. In another study by Silverstein et al.[6] 23 SOM cases were treated with OtoLAM. In the average 4.7 weeks follow-up time they reported 46% of the ears had no effusion and 49% required VT insertion. In our study we observed clinical resolution in 78% of the patients in CO_2 laser myringotomy group and 80% in the VT group during 6 months follow-up period.

Studies from different centres[8,14] showed that 2 mm myringotomies have approximately 3 weeks patency period, while larger perforations will heal in a longer period and sometimes become permanently patent. In our CO_2 laser myringotomy group, we observed no permanent perforations or macroscopic pathology in the tympanic membranes. We observed more recurrences in the cases with myringotomies less than 2 mm diameters causing a short middle ear ventilation period less than 3 weeks ($p<0.01$).

We prefer laser myringotomy in SOM cases who do not need long time middle ear ventilation; we use the ventilation tubes in cases with thick mucoid effusion and recurrent effusion after laser myringotomy.

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