

Abstract

Objective

Cholesteatomas have a high-rate of recidivism, regardless of the surgical approach used. Our hypothesis was that use of the handheld, flexible CO₂ laser would reduce the prevalence of cholesteatoma by removing microscopic disease, particularly in challenging or difficult –to-treat areas.

Methods

A retrospective study was performed and reviewed 384 staged tympanomastoidectomies performed by a single-surgeon between 2006-2011. Of these, 45 met study inclusion criteria (22 were in the non-laser group and 23 in the laser group). Outcome measures included residual cholesteatoma noted at the second look and complication rates. Independent variables included smoking status, bilaterality, and the extent of disease as assessed by Marres staging criteria(1984). Chi-square or Fisher Exact test was used for analysis.

Results

Average follow-up was 25 months; average separation between the first and second stage was 8 months. There were 1 Marres stage one, 29 stage two, 1 stage three, and 13 stage four patients; the distribution between the two groups was similar. There were no facial nerve paralysis case and 1 sensorineural (SNHL) hearing loss after the first procedure in the non-laser group. There was no difference in the rate of recidivism noted at the second stage between the laser group (34.8%) and non-laser group (30.4%). There was no apparent correlation between smoking status or bilaterality of disease and recurrence.

Conclusion

While the safety of cholesteatoma surgery with handheld laser is confirmed without any incidence of SNHL or facial nerve paresis, in this retrospective study, there does not appear to be any reduction in the rate of recidivism. A prospective study is clearly warranted to demonstrate efficacy, particularly as the flexible CO₂ laser is more expensive to use than standard micro-instrumentation or many other types of lasers.

Introduction

Cholesteatomas typically arise due to predisposing conditions such as Eustachian tube dysfunction. Hence, with surgical extirpation, the recidivism is high. This term encompasses both recurrent and residual disease. The rate of recidivism is 20-30% in the literature.

The use of a laser may be beneficial in eradicating cholesteatoma due to:

- 1.No mechanical manipulation but tissue removal by vaporization; thus, less potential risk of iatrogenic sensorineural hearing loss
2. Devascularize microscopic disease through thermal injury
3. Better visualization with coagulation during disease removal

The ultimate question is whether the use of CO₂ laser is indicated and validated by its efficacy. Hamilton used a KTP laser to examine the hearing outcome when the ossicular chain is systematically preserved with the laser. His study showed the benefit of using a laser to preserve the ossicular chain and that it is safe with comparable risks. Our study aims to compare the residual disease rate between laser and non-laser cases with staged cholesteatoma surgery.

Materials and Methods

Our study inclusion criteria were: age between 12 and 80, patients undergoing staged cholesteatoma surgery (either canal wall up or canal wall reconstruction/mastoid obliteration) cases. If it is a revision case, the surgery should have been done by a community surgeon more than 5 years ago. The charts were reviewed including audiograms done pre-operatively and post-operatively. 22 were placed in the microscopic instrument group (non-laser) and 23 in the laser group. Information recorded from chart review include location of cholesteatoma, type of tympanomastoidectomy the patient had, and whether the ossicular chain was disrupted. The presence of sensorineural hearing loss or facial nerve paralysis was recorded. Information taken from the second look surgery include type of approach, residual disease rate, type of prosthesis placed, and graft materials. Also, we noted whether the patient is a current smoker and the presence of bilaterality of disease (as a rough indicator of Eustachian tube dysfunction severity).

Relationship between outcome measure of recurrence rate and independent variables was tested using chi-square analysis or Fisher Exact test as appropriate. Independent variables included laser versus non-laser (micro-instruments only), smoking status, bilaterality of disease, and the extent of disease as assessed by the modified cholesteatoma staging by Marres (1984).

Marres Cholesteatoma Grading System (1984)

- Grade-I (Only attic involved)
- Grade II (Attic and middle ear)
- Grade III (Attic and mastoid)
- Grade IV (Attic, middle ear and mastoid).

	Number of patients	Recurrence Rate
Stage 1	2	50% (1/2)
Stage2	29	34.5% (10/29)
Stage 3	1	0 % (0/1)
Stage 4	13	28.5% (5/13)

Table 1: Recurrence rate by Extent of cholesteatoma classified by Marres staging system

Methods of extirpation	Recurrence Rate
Cold steel	36%
Laser	34.8%

Table 2: Recurrence rate by laser vs. non-laser groups

Smoking status	Recurrence Rate
Smoker	35.3% (6/17)
Non-smoker	35.7% (10/28)

Table 3: Recurrence rate by smoking status

Laterality	Recurrence
Bilateral disease	45.5% (5/11)
Unilateral disease	32.4% (11/34)

Table 4: Recurrence rate by laterality of disease

	Stage 1	Stage 2	Stage 3	Stage 4
Non-Laser		59.1%		40.9%
Laser	8.7%	69.6%	4.4%	17.4%

Table 5: Breakdown of disease extent by laser and non-laser group

Results

There were 24 female and 21 male patients. The average age was 44 years with age range of 17-79 years. There were 8 canal wall up and 37 canal wall reconstruction/mastoid obliteration surgeries. There were 5 endaural, 29 transcanal and 11 post-auricular approaches for second stage evaluation.

The overall rate of residual disease was 35.5%, consistent with what is quoted in literature (Rambo et al.) The extent of cholesteatoma graded by Marres divides cholesteatoma into 4 categories based on the affected locations. It categorizes the cholesteatomatous involvement in four grades (see panel to left). Surprisingly, The results showed that there was no correlation between the recurrence rate and cholesteatoma location. The majority of cases were Marres grade II followed by grade IV. This pattern was similar in both groups.

There was no significant association between the method of extirpation (non-laser vs. laser) and the rate of residual disease. This is contrary to our hypothesis that use of the laser will be beneficial in eliminating microscopic disease. There was no apparent association between smoking status or bilaterality of disease and recurrence. There was only one complication in the entire series, sensorineural hearing loss in the non-laser group. Whether the laser has a beneficial protective effect with regards to hearing preservation is not clear, due to the small number of patients.

Summary

• In our series, there is no improvement in the residual disease rate of cholesteatoma with the added use of a handheld, flexible CO₂ laser in cholesteatoma surgery

• There is no apparent association between smoking status or bilaterality of disease with recurrence rate

•There is no increase in complications with the use of laser such as sensorineural hearing loss or facial nerve paralysis

• There needs to be a prospective study looking at the rate of recurrence in laser vs. standard microinstrumentation.

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