Surgical treatment of cholesteatoma in children

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Summary
Objectives: To present our experience in the surgical treatment of cholesteatoma in children. Study design: Retrospective clinical trial. Patients and method: Charts of 114 patients who met the inclusion criteria of the study were examined. Surgical results were compared with respect to applied surgical methods. Cholesteatoma recidivism (CR) and hearing improvement were the main parameters which were examined. Results: The mean age was 13 years and mean follow-up period was 3.7 years. A total of 200 operations performed on 114 children: 114 children operated at the first stage, 84 children underwent a second surgery, and 2 a third surgery. At initial operation; canal wall-up (CWU) tympanomastoidectomy was the choice of surgical procedure in 35 (31%) patients, and canal wall-down (CWD) tympanomastoidectomy was preferred for the other 79 (69%) patients. At final analysis; 26 of 114 (23%) patients had CWU procedure, 67 patients (59%) had CWD procedure and 21 patients (18%) had radical mastoidectomy. (CR) rate was 26 and 16%, respectively for CWU and CWD procedures for initial surgeries (P = 0.248). Hearing improvement was achieved in 36% of CWU procedures and 38% of CWD procedures (P = 0.957). Hearing deterioration was observed in 36% of CWU procedures and 38% of CWD procedures (P = 0.957). Conclusion: There was no significant difference between CWU and CWD procedures with respect to CR, hearing improvement, and hearing deterioration. Therefore, choose of surgical procedure should be individualized for each patient. In our opinion; open techniques must be employed in the presence of extensive disease, whereas the closed technique is reserved for those with a more localized problem.

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1. Introduction

Cholesteatoma is one of the major topics of otological research which has some differences with respect to clinical features and management between children and adults. Cholesteatoma in children (CC) has a more aggressive growth pattern and often involves the entire mastoid and mesotympanum which necessitates early surgical treatment [1]. The rapid tissue growth, the greater degree of infection and inflammation brought on by the Eustachian tube, and well pneumatized mastoid are the major contributing factors for the cholesteatoma being so extensive in children [2,3].

The goals of cholesteatoma surgery are: (1) to eliminate mucosal and bone disease to produce a dry and safe ear; (2) to restore serviceable hearing;
and (3) to prevent recurrent disease. It is not always possible to reach these goals and cholesteatoma may not be eradicated permanently following the initial surgery. Both residual and recurrent disease recidivism are possible. Residual disease is defined as persistence of cholesteatoma following an incomplete removal. Recurrent cholesteatoma is a newly developed cholesteatoma, usually secondary to a retraction pocket extending into the attic, antrum, mesotympanum, eustachian tube, facial recess. Recurrent cholesteatoma can also develop due to either epithelial migration from margins of a recurring perforation, or a papillary ingrowth occurring to underlying granulation tissue. The incidence of both residual and recurrent cholesteatoma is reported to be higher in children than in adults [1,4,5]. For this reason, there has been much debate about the surgical procedures that should be performed on pediatric patients. Canal wall-up tympanomastoidectomy (CWU), canal wall-down tympanomastoidectomy (CWD), and radical mastoidectomy are the most commonly employed surgical procedures for the treatment of CC. In the cases of CWD procedures, the cavity may be left open or obliterated and canal wall may be reconstructed.

In the present study, we have retrospectively documented our CC cases with respect to types of surgical procedure applied and the long-term results.

2. Patients and methods

Charts of the patients with cholesteatoma younger than 16 years old who had been operated at the ENT clinic of Ministry of Health, Ankara Research and Training Hospital in between January 1992 and May 2000 were examined retrospectively. Only the cases whose primary surgeries were done in our institution with a minimum follow-up period of 2 years were included in the study.

All of the patients were operated under general anesthesia. CWU tympanomastoidectomy, CWD tympanomastoidectomy and radical mastoidectomy were the applied surgical procedures. Selection of the applied surgical technique was made according to pre- and intraoperative evaluations. Socioeconomic status of the patients, extension of the disease, state of the mastoid anatomy, and surgical experience of surgeons were the factors which determine the selection of surgical method. CWU procedure was preferred in those patients who had a high socioeconomic level, had a large mastoid, and had a limited disease. In the cases of CWD procedures; the cavity was left open and was not covered by skin grafts or by musculo-periosteal flap, canal wall was not reconstructed. Entrance to the ear canal was enlarged to facilitate the self-cleaning in all CWD cases. Incus and head of the malleus and sometimes whole malleus were removed if it was needed to facilitate the eradication of disease and to explore the anterior attic in both CWU and CWD procedures. Ossicular chain reconstruction was performed at the same time in suitable cases, otherwise, it was staged. Second look operations were conducted at least 6 months after the initial surgery in all staged cases. Autologous temporal muscle fascia was used for tympanic membrane reconstruction. Autologous ossicle was the first choice, homograft the second, and other prosthetic materials were the third choice for ossicular reconstruction.

The medical records of all patients were reviewed with respect to the type and number of the conducted surgeries, pre–peri–post operative complications, hearing level, status of the disease and tympanic membrane in each visit. Both residual and recurrent cholesteatomas are designated as cholesteatoma recidivism (CR) in this study. Different surgical techniques were compared to each other. Speech reception threshold (SRT) was used to compare pre- and postoperative hearing status of the patients. Hearing improvement was defined as a decrease of SRT below 30 dB in patients with preoperative SRT’s over 30 dB. Hearing deterioration was defined as an increase of SRT over 30 dB in patients with preoperative SRT’s below 30 dB. Statistical analysis of data were done by \( \chi^2 \)-test.

3. Results

One hundred and fourteen patients met our inclusion criteria. Seventy-one (62%) of them were male and 43 (38%) were female. The mean age was 13 with a range of 6–16 years. The mean follow-up period was 3.7 years (range 2–5 years). Twenty-nine (25.4%) of patients had a follow-up period of 5 years. A total of 200 operations were performed on 114 children: 114 children operated at the first stage; 84 children undergone 2nd surgery; and 2 had a third operation.

The localization of cholesteatomas at the first operation were as follows: only in attic (epitympanum) on 6 (5%) patients; in attic and mesotympanum on 42 (37%); in tympanic cavity; attic and antrum on 45 (40%), and in tympanic cavity, attic, antrum and all mastoid cells on 21 (18%) patients.
At initial operation; CWD tympanoplasty was the most preferred surgical procedure (79 cases, 69%) and CWU tympanoplasty was the 2nd choice (35 cases, 31%). The surgery was staged in 54 of 79 (68%) CWD cases and 24 of 35 (69%) CWU cases.

During the second look operation; development of healthy mucosa without the sign of cholesteatoma was found in 45 of 54 (83%) staged CWD cases and 17 of 24 (71%) staged CWU cases. CR was encountered in seven of 24 (29%) staged CWU cases. Surgery was converted to radical mastoidectomy in four of them (4/24, 16%) and to CWD tympanoplasty and ossicular reconstruction in the other three patients (3/24, 13%). Two of these three patients showed CR during follow-up period and they had the third operation, and radical mastoidectomy was performed in both cases. CR was encountered in 9 of 54 (17%) staged CWD cases and radical mastoidectomy was the preferred surgery for these cases.

On the other hand, there were 36 (36/114, 32%) patients whose surgery was not staged during the initial surgery; 11 in CWU group and 25 in CWD group. Two of 11 (18%) CWU cases and 4 of 25 (16%) CWD cases has shown development of CR in the follow-up period. All these patients underwent radical mastoidectomy.

At final analysis; 26 of 114 (23%) patients had CWU procedure, 67 patients (59%) had CWD procedure and 21 patients (18%) had radical mastoidectomy. Fig. 1 summarizes all employed surgical procedures. CR rate was 26 and 16%, respectively for CWU and CWD procedures for initial surgeries and the difference was not significant statistically (P = 0.248).

Epithelization of the mastoid cavity was completed within 6–8 weeks in all CWD cases. Sometimes aural discharge was detected in a few cases and controlled with antibiotic ear drops without complications.

At the last control visit there was no sign of development of retraction pocket in all CWU cases. Tympanic membrane perforation (less than 3 mm diameter in all cases) was detected in 3 of 26 CWU (11.5%) and 6 of 67 CWD (8.9%) cases.

Preoperative audiologic information was not available for 12 (11%) patients. For the remaining 102 patients SRT was equal or less than 30 dB in 48 (42%) patients, and more than 30 dB in 54 (48%) patients. Hearing improvement was achieved in 36% of CWU procedures and 38% of CWD procedures. Hearing deterioration was observed in 36% of CWU procedures and 47% of CWD procedures. On the other hand, there were four patients in CWD cases and one patient in CWU cases whose preoperative SRTs were over 30 dB, and postoperative hearings got worse (up to 15 dB). There was no significant difference between two groups with respect to hearing improvement and deterioration (P = 0.957 and 0.328, respectively).

There were eight patients who applied with a complication of the disease such as fistulated mastoiditis (four cases), Bezold abscess (two cases), facial paralysis (one case), and cerebral abscess (one case). Immediately after surgery, two additional patients developed facial paralysis and all of which improved with steroid therapy.

4. Discussion

The primary goal in the management of CC is the total eradication of the disease and prevention of recurrence with the optimal hearing restoration. However, it is well known that recurrent CC is higher when compared to adults. Sheehy [6] reported 51% cholesteatoma recurrence and Glasscock [1] reported 23% recurrence in children. Therefore, the most controversial issue is what type of surgical treatment is optimal for the CC, is it CWU or CWD technique.

The principal advantages of the CWU technique are the more rapid healing and obviation of many long term postoperative concerns. Healing of intact canal mastoidectomy is usually rapid, periodic ear cleanings are not necessary and the incidence of external ear infections is not increased. However, the technique itself is difficult to perform and requires special training. Without proper training and careful selection of cases, the postoperative results are poor. Extension of the epithelium into the facial recess or the sinus tympani is considered one of the most common causes of failure of the CWU procedures. Therefore, most of the authors prefer second look operations [7,8]. Preoperative concerns which dictate a CWD procedure include operating on an only-hearing ear, a child who is a poor anesthetic risk, or a child in whom follow-up is problematic [9]. In most cases, the decision to remove the canal wall is made during surgery, and is based on mastoid anatomy or specific disease findings. For example, a low-lying middle cranial fossa dura and an anteriorly positioned sigmoid sinus create a small mastoid and limit access into the anterior epitympanum. Maintaining the canal wall in this circumstance can complicate disease removal [9].

In the present study, choice of the surgical procedure was CWD mastoidectomy in most of the cases (69%). The reasons are: most of our patients came from rural areas of the country and regular follow-up was a problem; extensive cho-
lesteatoma constituted most of our cases and they were not good candidates for CWU procedure; since teaching is a major concern in our institution, most of the cases were operated by trainees who had little surgical experience to perform a CWU procedure.

We preferred to leave the mastoid cavity open due to existence of risk of leaving residual disease behind the obliteration. Our experience showed that sufficient enlargement of entrance of the ear canal usually ensures the self-cleaning of the ear. An other disadvantage of canal wall reconstruction and mastoid obliteration that it lengthens the operation time.

Although it is usually believed that staging is not necessary in CWD cases, we preferred to stage most of the CWD procedures (68%). Because in many cases requiring a CWD procedure, surgeons on training will have more difficulties in chain reconstruction because of the inflammatory disease originated by a large cholesteatoma. On the other hand, it is more comfortable to make chain reconstruction in a middle ear covered with a healthy mucosa and sufficient aeration.

While comparing the results of surgical techniques for removal of CC, the two most important parameters are the rate of recidivism and hearing improvement. Many authors believe that CR is more common in CWU procedure with respect to CWD procedure. Rates of CR in children have ranged from 37 to 61.2% for CWU procedures, and from 12 to 29% for CWD procedures [4, 9–13]. However, there are also studies in the literature, in which, there was no difference between CWU and CWD procedures with respect to rate of CR [5, 14–18]. Some authors believe that there are some risk factors which cause development of CR instead of the type of surgery [5, 16]. It was found that development of residual-recurrent disease was associated with ossicular erosion [5]. In another study it was proposed that posterior mesotympanum involvement, ossicular chain interruption after disease excision (and moreover combination of both), relative lack of experience of the surgeon, and presumed incomplete removal are independent risk factors highly correlated with residuals’ development [16]. CR rate, in our study, was 26 and 16% for CWU and CWD procedures,
respectively for initial surgery. Our CR rate for CWU procedure is lower than the most published studies [4, 9–13]. Although CR rate in CWU procedure in our study was found to be higher than CWD procedure, the difference was not significant ($P = 0.248$). This finding is contradictory to many studies [4, 9–13]. The cause of this low CR rate may be the selection of CWU technique for the only patients who had more localized disease.

When we deal with the hearing improvement, serviceable hearing (SRT $\leq 30$ dB) was achieved in 57–72% of the patients regardless of the type of surgery [9, 19]. Many authors believe that a CWD or CWU procedure has little impact on hearing results [9]. The presence or absence of the stapes superstructure between two groups with respect to hearing improvement and hearing deterioration confirming the previous studies. It was proposed that hearing success depends primarily on middle ear parameters such as mucosal status, condition of tympanic membrane, depth of middle ear cleft, and the presence or absence of the stapes superstructure [9].

In conclusion; based on the literature and our surgical results, management of CC needs individualization of the surgical procedure to be applied for each patient. No single philosophy is applicable to all children with cholesteatoma. Instead, the surgeon should individualize the treatment by considering the location and extent of the cholesteatoma, the overall status of infections and hearing, socioeconomic issues of access to follow-up and future surgery. On the other hand, the surgeon has to be skilled with all types of surgical methods and must be able to change the surgical plan intraoperatively according to surgical findings. In our opinion; open techniques must be employed in the presence of extensive disease, whereas the closed technique should be reserved for those with a more localized problem. We think that CC must be dealt more carefully and aggressively to improve surgical success. Conduction of the surgeries in children by more skilled surgeons may also improve surgical success. However, prevention of the cholesteatoma development is more important than the choose of surgical techniques and surgeons when the aggressive nature of the disease in childhood is thought.

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References


