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Anatomical and Functional Outcomes After Surgical Management of Tympanic Membrane Retraction Pockets: A Retrospective Study

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ABSTRACT

Background: Tympanic membrane retraction pockets (RPs) are localized invaginations resulting from chronic Eustachian tube dysfunction and progressive loss of tympanic membrane elasticity. Without timely management, they may progress to ossicular chain erosion, conductive hearing loss, or secondary cholesteatoma.

Methods: We conducted a retrospective descriptive study of 74 patients with non-cholesteatomatous tympanic membrane RPs managed surgically at the Department of Otorhinolaryngology and Head and Neck Surgery, 20 August 1953 Hospital, Ibn Rochd University Hospital, Casablanca, Morocco. Cases with cholesteatoma, incomplete records, or follow-up < 12 months were excluded. Primary outcomes were anatomical success (tympanic membrane closure) and postoperative air–bone gap (ABG) at 12 months.

Results: The mean age was 35 years, with a female predominance (65%). The leading symptoms were hearing loss (82.4%) and otorrhea (89.2%). RPs were most commonly located at the attic (39.2%) and in the posterior quadrants (31.1%). Conductive hearing loss was present in 59.5% of patients and mixed hearing loss in 32.4%. Ossicular chain disruption was identified intraoperatively in 55.4% of cases, predominantly involving the incus. Anatomical success was achieved in 93.2% of patients. The mean ABG in improved from 25.6 dB preoperatively to 17.3 dB postoperatively (mean gain: 8.3 dB). Secondary cholesteatoma occurred in 1.4% of cases.

Conclusion: Non-cholesteatomatous RPs are progressive lesions with a significant risk of ossicular damage and secondary cholesteatoma. Cartilage tympanoplasty achieved anatomical success in 93.2% of cases. However, functional recovery remained modest overall, given the high rate of ossicular chain disruption observed intraoperatively, underscoring the importance of early surgical intervention before irreversible ossicular damage occurs.

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Introduction

Tympanic membrane (TM) retraction pockets (RPs) are defined as localized invaginations of the tympanic membrane into the middle ear cavity, most often resulting from chronic Eustachian tube dysfunction and persistent negative middle ear pressure [1-3]. While some RPs remain stable or even regress spontaneously , others may progress to ossicular chain erosion or evolve into cholesteatoma, a serious complication in otologic practice [4-6].

The management of RPs remains debated. Stable, self-cleaning lesions may be observed safely, whereas progressive or non-self-cleaning forms generally require surgical intervention, often based on cartilage tympanoplasty, to prevent irreversible damage [2,7].

Most existing studies have emphasized cholesteatomatous disease, while fewer have focused specifically on non-cholesteatomatous retractions. The present study therefore aimed to characterize the epidemiological, clinical, and functional profile of non-cholesteatomatous RPs and to evaluate surgical outcomes in this subgroup.

Materials and Methods

This was a retrospective study conducted at the Department of Otorhinolaryngology and Head and Neck Surgery, 20 August 1953 Hospital, Ibn Rochd University Hospital, Casablanca, Morocco, from January 2020 to January 2023. All patients who underwent surgical management for tympanic membrane retraction pockets during the study period were eligible for inclusion. Cases with cholesteatoma were excluded, as were patients with incomplete records or a follow-up of less than 12 months, yielding a final cohort of 74 patients.

Data were extracted from medical records and operative reports and included demographic characteristics, presenting symptoms, otoscopic findings, pure-tone audiometry with air–bone gap (ABG)

calculation at 500, 1000, 2000, and 4000 Hz, high-resolution temporal bone CT findings, intraoperative ossicular chain status, surgical procedure performed, and postoperative outcomes at 12 months.

The surgical approach tympanoplasty, antro-atticotomy or transcanal atticotomy was selected according to the extent and location of the retraction pocket, and tympanic membrane reconstruction was performed using autologous cartilage grafts (conchal or tragal), with ossicular chain reconstruction when indicated by intraoperative findings.

The primary anatomical outcome was tympanic membrane closure at 12 months; the primary functional outcome was postoperative ABG at 12 months. Data were analyzed using IBM SPSS Statistics; descriptive statistics were used throughout, with continuous variables expressed as means and categorical variables as frequencies and percentages.

Results

This retrospective study included 74 patients with non-cholesteatomatous tympanic membrane retraction pockets, collected over a 3-year period (January 2020 to January 2023), with a mean follow-up of 12 months. The mean age was 35 years. Females were more frequently affected than males, representing 65% of the cases (sex ratio ≈ 2:1).

The most common presenting symptoms were hearing loss (82.4%) and otorrhea (89.2%). The two symptoms co-occurred in 71.6% of patients, while 17.6% presented with otorrhea alone and 5.4% with hearing loss alone. Tinnitus was reported in 5.4% of cases and otalgia in 1.3%.

Retraction pockets were most often located in the attic (39.2%) and posterior quadrants (31.1%), together accounting for more than 70% of cases. Total atelectatic forms represented 16.2%, anterior retractions 10.8%, and adhesive retractions 2.7%. The majority of retractions were non–self-cleaning (79.7%). Perforation of the retraction pocket was present in 16.2%, and inflammatory stigmata such as attic polyps were noted in 12.2%.

Audiometric assessment revealed conductive hearing loss in 59.5% of patients, mixed hearing loss in 32.4%, normal hearing in 5.4%, and cophosis in 2.7%. The mean preoperative air–bone gap was 25.6 dB. The most common air–bone gap range was between 11 and 20 dB (42.7%).

Radiological evaluation by temporal bone CT revealed mesotympanic opacification in 35.1% of patients, mastoid involvement in 32.4%, epitympanic lesions in 27%, and hypotympanic extension in 13.5%. Scutum blunting was present in 4.1% and tegmen tympani erosion in 2.7%. Ossicular chain resorption was frequent, predominantly affecting the incus (25.7%), followed by the malleus (14.9%) and the stapes (10.8%).

Peroperative findings confirmed these tendencies: the ossicular chain was interrupted in 55.4% of patients, with complete lysis observed in 18.9%. Partial resorption involved mainly the incus (13.5%), followed by the malleus (5.4%) and the stapes (2.7%). Combined lesions most frequently affected both the incus and malleus (8.1%) or the incus and stapes (6.8%). The tympanic mucosa was abnormal in the majority of cases, appearing inflammatory or polypoid in 74.3%, while it was normal in 25.7%.

Surgical procedures consisted of tympanoplasty in 40.5% of cases, antro-atticotomy in 32.4%, and transcanal atticotomy in 27.0%. Reconstruction was predominantly performed using conchal cartilage (95.9%), while tragal cartilage was used in 4.1%.

Postoperative outcomes demonstrated excellent anatomical results: complete closure of the tympanic membrane was achieved in 93.2% of patients. Residual perforation occurred in 2.7%, recurrence of a controllable retraction pocket in 2.7%, and development of secondary cholesteatoma in 1.4%. Functionally, the mean air–bone gap improved from 25.6 dB preoperatively to 17.3 dB postoperatively, corresponding to an average hearing gain of approximately 8.3 dB.

Table 1: Clinical and Demographic Characteristics (n = 74)

Variable	N	%
Sex		
Female	48	65.0
Male	26	35.0
Symptoms		
Hearing loss	61	82.4
Otorrhea	66	89.2
— Hearing loss + otorrhea	53	71.6
— Isolated otorrhea	13	17.6
— Isolated hearing loss	4	5.4
Tinnitus	4	5.4
Otalgia	1	1.3
Location of retraction pocket		
Attic	29	39.2
Posterior quadrants	23	31.1
Total atelectasis	12	16.2
Anterior	8	10.8
Adhesive	2	2.7
Otoscopic findings		
Non-self-cleaning retraction	59	79.7
Pocket perforation	12	16.2
Attic polyps	9	12.2

Table 2: Preoperative Audiometric Findings (n = 74)

Variable	N	%
Type of hearing loss		
Conductive	44	59.5
Mixed	24	32.4
Normal hearing	4	5.4
Cophosis	2	2.7

Table 3: Ossicular Chain Involvement: CT Scan vs. Intraoperative Findings (n = 74)

Structure	CT scan, n (%)	Intraoperative, n (%)
Incus	19 (25.7)	10 (13.5)
Malleus	11 (14.9)	4 (5.4)
Stapes	8 (10.8)	2 (2.7)
Complete lysis	—	**14 (18.9)**
Total disruption	—	**41 (55.4)**

Table 4: Postoperative Outcomes at 12 Months (n = 74)

Variable	N	%
Surgical approach		
Tympanoplasty	30	40.5
Antro-atticotomy	24	32.4
Transcanal atticotomy	20	27.0
Cartilage graft		
Conchal cartilage	71	95.9
Tragal cartilage	3	4.1
Anatomical outcomes		
Complete TM closure	69	93.2
Residual perforation	2	2.7
Retraction pocket recurrence	2	2.7
Secondary cholesteatoma	1	1.4

Discussion

Tympanic membrane retraction pockets are defined as localized invaginations of the membrane into the middle ear cavity, most often resulting from chronic negative middle ear pressure and progressive loss of membrane elasticity [1,2,8]. Their clinical course is highly variable: while some remain stable for years or even regress spontaneously, others progress to ossicular chain erosion or evolve into cholesteatoma [4-6]. To better classify this heterogeneity, several systems have been proposed, distinguishing pars tensa from pars flaccida involvement and, more importantly, differentiating self-cleaning from non–self-cleaning retractions, the latter being at higher risk of progression and therefore of greater clinical significance [9-11].

Within this conceptual framework, our study focused exclusively on non-cholesteatomatous retraction pockets, deliberately excluding cases of overt cholesteatoma. By restricting the cohort, we aimed to provide a clearer understanding of the epidemiological, clinical, and functional profile of these lesions, independent of the confounding effects of advanced disease.

From an epidemiological perspective, previous studies have indicated that retraction pockets tend to occur more frequently in young adults, with a slight female predominance [5,11]. Hearing loss and recurrent otorrhea are consistently described as the leading symptoms, while tinnitus and otalgia are less common and often secondary [12]. The attic and posterior quadrants have been identified as the most frequent sites of involvement, reflecting their anatomical vulnerability and impaired aeration [3]. Our findings closely mirror this epidemiological and clinical profile: retraction pockets were more frequent among females, with a mean age of 35 years, and the predominant symptoms were hearing loss and otorrhea. Tinnitus and otalgia were less common, and the attic and posterior quadrants accounted for more than 70% of the cases in our series.

Radiological and intraoperative findings provide additional insight into the natural history of these lesions. High-resolution CT is widely recognized as a reliable tool for preoperative assessment, frequently revealing ossicular chain erosion, most commonly affecting the incus due to its delicate vascular supply and anatomical exposure [5]. The stapes and malleus are generally less affected, and incus necrosis is often considered the hallmark of advanced retraction, even in the absence of overt cholesteatoma [5]. In our study, partial ossicular erosion was present in 36.5% of cases, with the incus being the most frequently involved structure, while the malleus and stapes were preserved in the majority of patients. This predilection for incus erosion has also been reported in pediatric populations, where retraction pockets without overt cholesteatoma may nonetheless cause significant ossicular damage [13]. While CT reliably identified the presence of ossicular involvement, it tended to overestimate individual ossicular erosion, consistent with known limitations of CT accuracy previously reported [14]. These structural changes are directly reflected in functional outcomes. Conductive hearing loss has been reported in over two-thirds of patients with retraction pockets, with severity strongly influenced by ossicular involvement [5,12]. In our series, hearing loss was present in the majority of cases, and the high rate of ossicular chain disruption (55.4%) is consistent with the limited functional gains observed overall.

Management strategies for retraction pockets remain controversial, balancing conservative observation with surgical intervention. Stable, self-cleaning retractions may be monitored safely, while progressive, non–self-cleaning forms require surgical management to prevent irreversible damage [2,7]. A variety of surgical approaches have been described, including tympanoplasty with or without ossiculoplasty, often using cartilage reinforcement given its biological resistance to resorption, as well as endoscopic techniques for attic disease [15,16]. Ozbek et al. reported tympanic membrane closure in over 90% of ears using cartilage tympanoplasty, with no patient requiring reintervention for recurrent retraction and Cabra and Moñux showed that cartilage grafts achieved significantly higher morphologic success than temporalis fascia [17,18]. Long-term outcomes are also favorable, with Dornhoffer reporting durable auditory results in the majority of patients following cartilage tympanoplasty in a large series of over 1,000 cases [19].

Our results reinforce these data while highlighting key prognostic elements. Surgical intervention in our series yielded a measurable improvement in hearing, despite the high rate of ossicular chain disruption observed intraoperatively. It is worth noting that the mean postoperative air–bone gap of 17.3 dB met the commonly used threshold of a residual ABG of 20 dB or less, although the mean hearing gain of 8.3 dB did not reach the more stringent 10 dB gain threshold sometimes used to define functional success in tympanoplasty (20). This partial functional outcome likely reflects the high rate of ossicular chain disruption in our series (55.4%), which inherently limits hearing restoration regardless of the surgical technique employed. The partial discordance between radiological and intraoperative findings observed in our series reinforces the role of CT primarily as a screening tool for ossicular

involvement, with surgical exploration remaining necessary to define its precise extent. By focusing specifically on non-cholesteatomatous retraction pockets, our study provides a more nuanced understanding of their clinical behavior, emphasizing the importance of early identification, careful follow-up, and timely surgical intervention to preserve both anatomical integrity and auditory function.

Limitations

This study has several limitations that should be acknowledged. First, its retrospective design introduces potential selection and data collection biases inherent to medical record review. Second, as a single-center series from a tertiary referral institution, our cohort may not be representative of the general population, and results should be interpreted with caution before generalization. Third, the follow-up period of 12 months, while sufficient to assess early anatomical and functional outcomes, may underestimate the true recurrence rate, as retraction pocket recurrence and secondary cholesteatoma formation are known to occur beyond this timeframe. Fourth, the absence of a control group precludes any comparative analysis of surgical approaches or graft materials.

Conclusion

Tympanic membrane retraction pockets are heterogeneous lesions with a risk of progression to ossicular damage and hearing loss (1,2,5). By focusing on non-cholesteatomatous forms, our study highlights the high prevalence of incus erosion in this population and its plausible contribution to auditory deficit, with CT providing reliable preoperative assessment. Surgical management, particularly cartilage tympanoplasty, yielded favorable anatomical and functional outcomes, consistent with published evidence (16-19). These findings emphasize the importance of early detection and timely intervention to optimize prognosis [20].

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Declarations

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Conflicts of Interest: The authors declare no conflict of interest.

Ethics Approval and Consent to Participate: This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of 20 August 1953 Hospital. Written informed consent was obtained from all participants prior to inclusion.

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