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Morphological and Functional Results of Cartilaginous Tympanoplasty

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Abstract

Tympanoplasty is a procedure done to repair tympanic membrane and middle ear sound conducting mechanism.

The purpose of this prospective study was to analyze the anatomical and audiologic results in more than 86 cartilage tympanoplasties. The inclusion criteria were simple perforation, tympanic retraction and cholesteatoma.

We noticed that the ossicular chain was pathologic in 45,3%, and the incus was the most fragile ossicle.

The cartilage graft was harvested from the concha in 82,6% of the cases and from the tragus in 17,4% of the cases. This cartilage was used to reconstruct the eardrum in all our patient.

Based on morphologic and functional criteria, the evaluation was done after at least one year of follow-up. Cartilage tympanoplasty achieves good anatomical and audiologic results, regarding the functional results, the group of the simples COM was the entity with de best scores.

Keywords: cartilaginous tympanoplasty, Otoendoscopy, tympanum, Temporalis fascia, COM

1. INTRODUCTION

Middle ear surgery has always been of interest since the 17th century (Banzer 1640) **(1)**. The chronic otitis media (COM) are the pathologic entity responsible of the majority of the lesions of the middle ear (1 to 3% of population) (2). The tympanoplasty is the surgical procedure intended to repair the lesions caused by the COM (tymapanic membrane, ossicular chain, attic wall…). Several materials of reconstruction were used for that as fascia temporalis, fat, cortical bone and also some composit material (hydroxyapatite, titan, ionomere ciment…), but with some no negligible limits as the resistance to the atmosphéric variations into the middle ear, a perfect compliance, and also the cost often high of these materials (3).

Because of the cartilage wide availability and maneuverability, it offers the possibility of being used both as ossicular and bone reconstruction material, thus combining a very good compatibility with the environment of the middle ear and representing the most economical

prosthetic solution.

3. MATERIAL AND METHODS

The target population was the patients presenting a chronic otitis media eligible for a surgical treatment, from western Algeria.
This prospective study included 86 patients (Inclusion criteria: simple perforation, tympanic retraction and cholesteatoma. Exclusion Criteria: antecedents of radical mastoidectomy), from 2015 to 2018.

One-year postoperative evaluation of both morphological (neotympanic membrane integrity) and functional crieria (AAO-HNS criteria).

Surgical Technique

Tympanoplasty with or without mastoid drilling with a retro-auricular or EAC approach depending on the type of COM.

Cartilage harvest

The removal of the cartilage was done either from the region of the tragus or the conchae (fig. 1) according to the chosen approach.

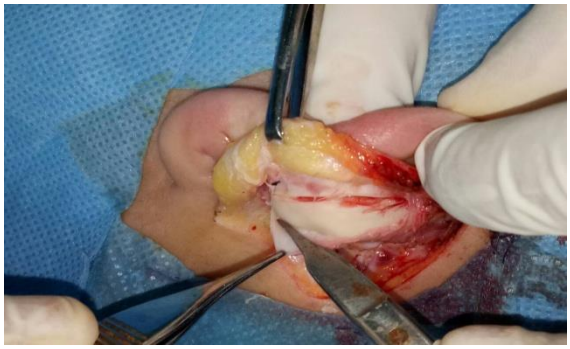

Fig. 1

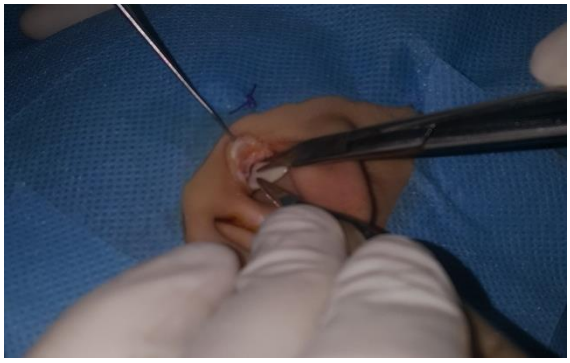

Fig. 2

The cartilage was used in reconstruction of the tympanum, lysis of the ossicular chain and lysis of the tympanic frame.

Cartilage trimming

The cartilage must be thinned and trimmed in order to obtain a thickness of approximately 0.5mm, and a size that is suitable for the tympanic closure and the bony framework.
In other some institution a cartilage shaver especially dedicated to this task is used to thinn and trim cartilage. For economic reasons, we simply used a surgical blade (n° 11) to harvest, and thinner the cartilage.
The cartilage was separated from its perichondrum (Fig. 3)

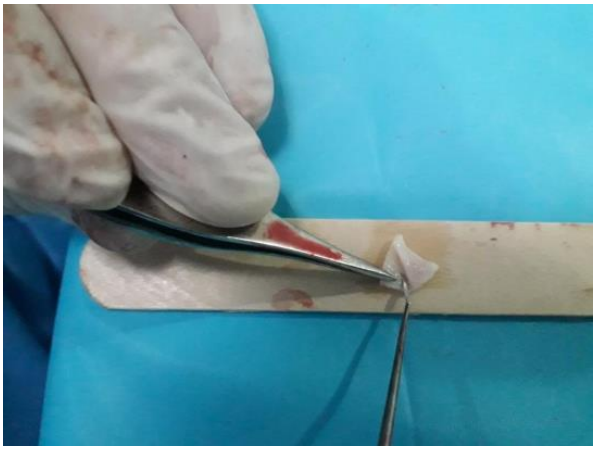

Fig. 3

Eardrum reconstruction

Underlay technique is our preference in this case. The cartilage is shaped into foils of different sizes, with a thickness of 0.5 mm.
Perichondrum and cartilage are used separately to reconstruct the eardrum (from surface to depth: eardrum remanant-perichondrum-foils of cartilage) (Fig. 4)

Ossicular chain reconstruction

Cartilage is used in the ossicular chain reconstruction when the long process of the uncus is eroded with an intact suprastructure of the stapes, this assembly is currently known as a chondrostapedopexy **(4)** (fig. 5)

Attic wall reconstruction

Large defect of the attic or in the posterior part of the tympanic frame have to be reconstructed to avoid the constitution of retraction pocket in these areas of weakness.

Foils of cartilage are used to cosolidate these desfect.

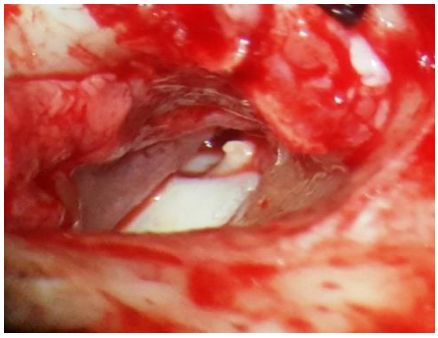

Fig. 4

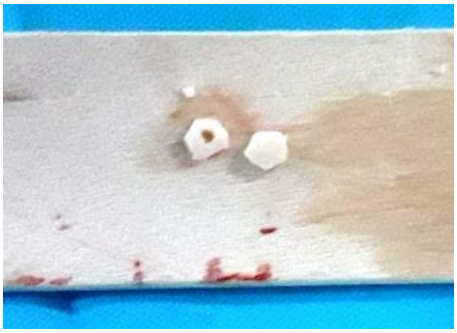

Fig. 5

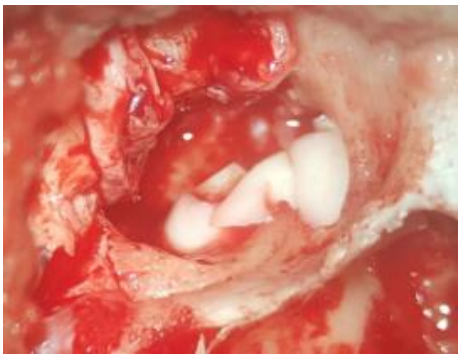

Fig. 6

Results evaluations

Evaluation is based on the morphological results (data from the examination under a microscope), and the functional results (postoperative tonal audiometry) at one year of follow-up. We assessed success for each of the morphological and functional components separately first, then pooled data from both characteristics to determine the overall success rate.

Morpholigical criterias

the following morphological criteria were used to asses the good results:

- The disappearance of the otoscopic signs observed during the preoperative period, namely: otorrhea, perforation and retraction,
- Absence of any complications inherent to the cartilage graft, such as medialization, lateralization (Blunt) and graft atrophy.

Functional criterias

The functional results were evaluated by comparing the preoperative audiogram with the audiogram at 01 year of postoperative follow-up, in accordance with the recommendations of the American Committee for Hearing and Equillibrium **(5)** by determinating:

- Post operative air-bone gap
- Hearing gain
- Inner ear statute

RESULTS

The mean age of our patients was 36,3 years, with a range from 9 to 81 years. There were 44 femals and 42 males. Otitis in the childhood was the most reported antecedent (52%).

The ranging of the differents COM was: simple COM (38,4%), retractions (32,5%) and cholesteatomas (29,1%). The pre-operative mean air bone gap (ABG) was 32+/-1;15 dB.

In the peroperative time, we noticed that the ossicular chain was pathologic (partialy or totaly eroded) in 45,3% of cases, and the incus was the most fragile ossicle (eroded or absent in 48,9% of cases).

The cartilage graft was harvested from the concha in 82,6% of the cases and from the tragus in 17,4% of the cases. This cartilage was used to reconstruct the eardrum in all our patient and also used to repair the ossicular chain (chondrstapedopexy (CSP) done in 33,7% of our patients).

Based on morphologic and functional criteria, the

evaluation was done after at least one year of follow-up.

Morphologic evaluation

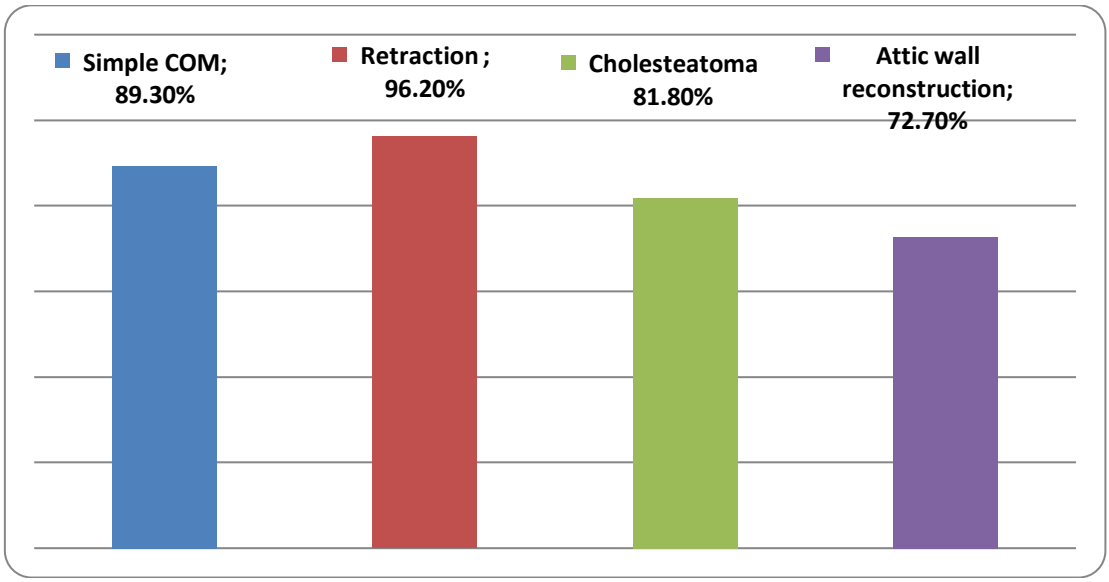

Fig. 7

The retraction group was the entity with the higher rate of morphologic success (96,2%). (Fig.7)

Functional evaluation:

Pathologic group	Postoperative ABG (dB)	Aberage ABG gain (dB)	ABG <20 dB (%)	Rate of labyrinthisation
Simples COM	14,69±1,15	16,31±2,16	85,7	7,1
Retraction	19,81±2,72	12,31±2,51	73,1	7,7
Cholesteatomas	18,24±1,60	17,05±2,50	63,6	9,1
Group with CSP	19,86±2,20	13,66±2,59	69,2	7,7

Fig. 8

Regarding the functional results, the group of the simples COM was the entity with de best scores. (Fig.8)

DISCUSSION

The use of cartilage as a grafting material can be indicated in the reconstruction of multiple lesions of chronic otitis media especially in the cases of cholesteatomas (tympanic perforation and bony erosions), it can also be used in complex perforations like in cases at high risk for graft failure such as large, subtotal, total perforations, adhesive tympanic membrane, tympanosclerotic and atropic changes of remanant tympanic membrane, recurrent perforations and in cases with chronic eustachian tube dysfunction.

Cartilage graft is preferred in such situations as it provides stability against negative middle ear pressure preventing its medialisation or lateralisation.

In our study, we gathered the three groups of COM more often eligible for a surgical treatment, inaccordance with previous authors which had the same approach, by largely using the cartilage graft in several situations (6,7)

We harvested our cartilage from the concha or the tragus, some authors did it either from tragus only (8, 9,7) or from the concha only (10).

Our rate of mopholigical succes was about 89,5%, it is nearly similar to the rates of the others authors such as, Elasfour et al. (88,9%) (10), Khalilullah et al. (90%) (11), and Shekharappa et al. (93%) (12).

69,2% of our patients who benifited of a CSP had an postoperative ABG less than 20 dB, the same result was obtained by Quérat et al. (67,6%) (13).

CONCLUSION

The use of cartilage offers numerous solutions to repair the numerous dammages of COM. It have the advantage of being a widely available and a very economic graft to reconsunt either the eardrum, attic wall or the ossicular chain lesions.

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