Tympanic membrane retractions in children: Clinical features and surgical outcomes

Poches de rétraction tympaniques chez l'enfant : Caractéristiques cliniques et résultats thérapeutiques

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RÉSUMÉ

Objectif: Préciser les caractéristiques des poches de rétraction chez l'enfant et évaluer les résultats thérapeutiques.
Méthode: Etude rétrospective de 37 poches de rétraction (stade II et III de Charachon) chez 27 enfants durant une période de douze ans [2007 - 2018]. Tous les patients ont eu une otoscopie, une endoscopie nasale, une audiométrie tonale et des explorations radiologiques.
Résultats: L'âge moyen de nos patients était de 10,9 ans. Une prédominance masculine a été notée avec un sex-ratio de 1,64. Le tabagisme actif ou passif a été noté dans huit cas. Les poches de rétraction étaient classées stade II de Charachon dans 38% des cas et stade III dans 62% des cas. Tous nos patients ont été opérés: 78 % avaient eu une tympanoplastie type I et 22% une tympanoplastie type II. La chirurgie était bilatérale dans 14 cas. On a utilisé une greffe associant cartilage et périchondre dans 28 cas, cartilage et fascia temporale dans quatre cas et uniquement du cartilage dans cinq cas. Une lyse de la chaîne ossiculaire a été notée dans dix cas. L'ossiculoplastie était faite en utilisant du matériel autologue dans huit cas et une prothèse totale type (TORP) dans un cas. Une adénoidectomie a été faite dans quatre cas.La durée moyenne du suivi post opératoire était de 32 mois. On avait constaté de bons résultats anatomiques dans 87%, une perforation de la greffe dans un cas 1 et une rétraction de la greffe respectivement dans un cas. L'amélioration moyenne du seuil auditif était de 12dB avec une ascension moyenne de la courbe osseuse de 16,2dB.
Conclusion: La prise en charge chirurgicale des poches de rétraction nécessite une technique chirurgicale adaptée permettant le rétablissement de l'effet columellaire et la prévention des récidives. Un suivi à long terme est nécessaire pour s'assurer de la stabilité des résultats.
Mots clés: Poche de rétraction, Enfant, Tympanoplastie, Audiométrie..

ABSTRACT

Objective: The aim of our study was to specify the characteristics of retraction pockets (RP) in children and to evaluate the outcomes of their surgical treatment.
Methods: A retrospective study about 37 retraction pockets (stage II and III Charachon) in 27 children during a period of twelve years (between 2007 and 2018). All patients had otomicroscopic examination, nasal endoscopy, audiometric exam and radiological investigations (tomodensitometry or cone beam).
Results: The average age of our patients was 10.9. A male predominance was found with a sex ratio of 1.64. 38% of retraction pockets were stage II Charachon and 62% were stage III. 78 % had cartilage tympanoplasty type I and 22% had cartilage tympanoplasty type II. The surgery was bilateral in fourteen patients. We performed a reinforcement tympanoplasty with a retro auricular approach in all cases using: a cartilage- perichondrium composite graft in 28 cases, a cartilage- temporalis fascia composite graft in four cases and only cartilage in five cases. Intraoperatively, the erosion of the ossicular chain was noted in 10 cases. Ossiculoplasty was performed using autologous ossicules in eight cases and total ossicular replacement prosthesis (TORP) in one case. Adenoidectomy was performed in 4 cases. Four patients had septoplasty after few months of the tympanoplasty.
The post-operative mean follow up was 32 months. We had good anatomic results in 87% of cases. We noted a graft perforation in one case and graft retraction in one case. The average hearing improvement in our patients was 12dB with a mean air-bone gap of 16.2dB.
Conclusion: Surgical treatment of retraction pockets requires the selection of a suitable technique for the exploration of the middle ear, the restoration of the columellar effect and the prevention of recurrence. A long-term follow-up is required to assess the stability of the results.
Key-words: Retraction pockets, Children, Tympanoplasty, Audiometry.

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INTRODUCTION:

Retraction pockets (RP) of the eardrum are a common pathology, especially in children, and can progress rapidly from relatively limited disease to cause ossicular chain erosion and cholesteatoma. Eustachian tube dysfunction and weakening of the tympanic membrane from otitis media with effusion have been identified to be the two major contributors to retraction pockets [1]. Unstable pockets are dangerous and rapidly progressing especially in children, requiring surgical treatment. Surgery is an essential part of the management of RP. The principle of this surgery is based on the dissection of the pocket from the structures of the middle ear and the reinforcement of the tympanic membrane with cartilage [2, 3].
The aim of our work is to specify the main contributors of this pathology and to evaluate the results of surgery.

Methods:

We conducted a retrospective study about 37 retraction pockets (stage II and III Charachon) in 27 children during a period of twelve years (between 2007 and 2018). We have included patients who have been treated surgically with a limit of age of 16 years old.
Children with cholesteatoma discovered intraoperatively were excluded from the study.
All patients underwent otoscopy, otoendoscopy, nasal endoscopy and pure tone audiometry. They all had CT scan of temporal bones and underwent a reinforcement tympanoplasty with cartilage.

RESULTS:

The average age of our patients was 10.9 years [3-16years]. There was a male predominance with a sex ratio of 1.64. Active or passive smoking was noted in eight cases. Five patients had a gastro esophageal reflux history and eight were treated for otitis media with effusion. One child was suffering from Down's syndrome with cleft palate. Nine children had a history of removal of the adenoids and five underwent a removal of both tonsils and adenoids (Table I).
The average time between the onset of symptoms and the first visit was 25 months (3 months to 5 years).

Table I: Medical history and contributors facts

Medical history and contributors facts	Cases number
Smoking (active/passive)	8
Gastro oesophageal reflux	5
Otitis media with effusion	8
Cranio facial deformities : Down syndrom and cleft palate	1
Adenoids removal	9
Adenoids and tonsils removal	5

The main clinical signs were otorrhea in 16 cases, hearing loss in seven cases and association between otorrhea and hearing loss in 13 cases. A language delay was found in one case (Figure1).

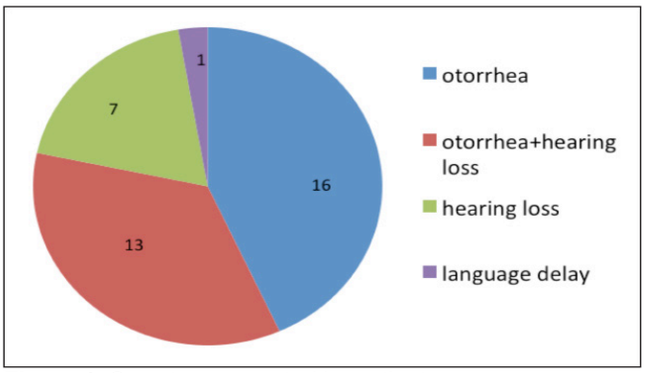
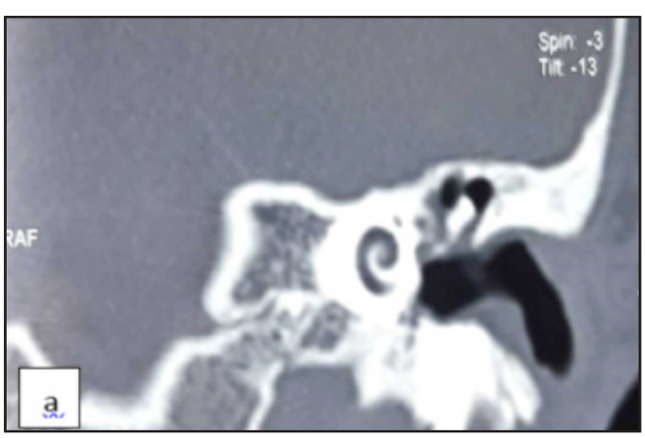


Figure 1: Symptoms reported by patients

On otoscopic examination, the pocket was: posterior in 17 cases, total in four cases, attical in 3 cases, central in 2 cases and anterior in one case. Thirty eight per cent of pockets were stage II Charachon and 62% were stage III. Examination of the controlateral ear was: normal in nine cases, showed a retraction pocket in 14 cases: (4 RP (28%) were stage I Charachon, 7 RP (50%) were stage II Charachon and 3 RP (22 %) were stage III Charachon) and we noted a perforation in four cases.
In rhinoscopy, we noted a deviation of the nasal septum in eleven patients and hypertrophy of inferior turbinates in six patients. The nasal mucosa was congestive in five cases and we found adenoidal hypertrophy in six children. The rest of ENT examination revealed a palate cleft in one case and hypertrophied tonsils in six children. No facial paralysis was noted.
Pure tone audiometry revealed a conductive deafness in 34 cases with a pure tone average of 28dB (15 to 50dB). We found a congenital complete loss of hearing in one case. It should be noted that in 62.5% of cases the threshold was less than 35dB. Tympanometry showed flat traces in 80% of cases and negative middle-ear pressure in 20% of cases.
Either a temporal bone tomodensitometry or a cone beam was performed in all cases and it showed a filling of the middle ear without ossicular lyses in 19 cases. This last was noted in four cases (figure2, 3).



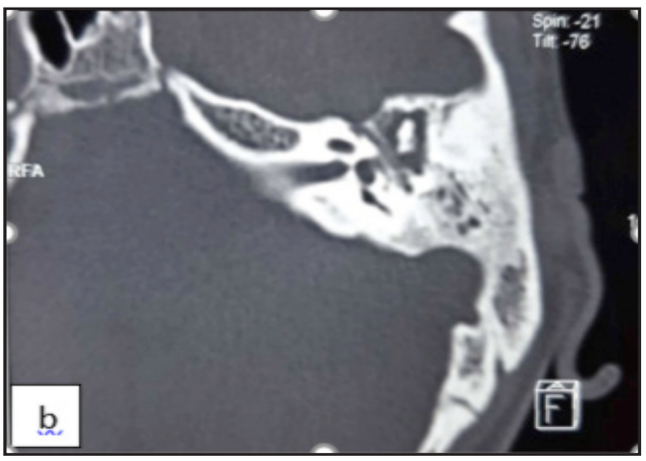


Figure2: Temporal bone CT scan: coronal (a) and axial (b) view showing a filling of left middle ear without ossicular lyses.

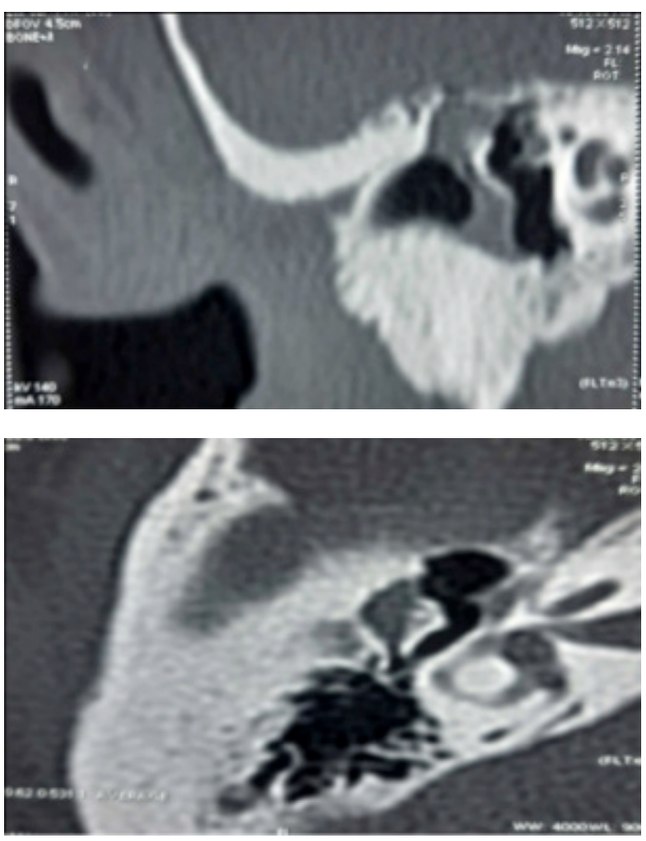


Figure 3: coronal (a) and axial (b) view of tomodensitometry showing lyses of the right middle ear malleus.

All our patients underwent surgery: 78 % had cartilage tympanoplasty type I and 22% had cartilage tympanoplasty type II. We performed a concomitant intraoperative T-tube insertion in four cases on the controlateral ear (RP stage I Charachon). The surgery was bilateral in 14 cases (10 RP (7 RP stage II; 3 RP stage III Charachon) and 4 perforations on the controlateral ear): a cartilage tympanoplasty type I was performed within a few months of the first surgery.
We performed a reinforcement tympanoplasty through a retro auricular approach in all cases using a cartilage-perichondrium composite graft in 28 cases, a cartilage-temporalis fascia composite graft in four cases and only cartilage in five cases. We used cartilage from either the pinna (29 cases) or tragus (8 cases).
Intraoperatively, we found an inflammatory mucosa in eight cases, effusion in four cases, epidermosis in one case and the erosion of the ossicular chain was noted in 10 cases with lyses of the scutum in six cases (Figure 4).

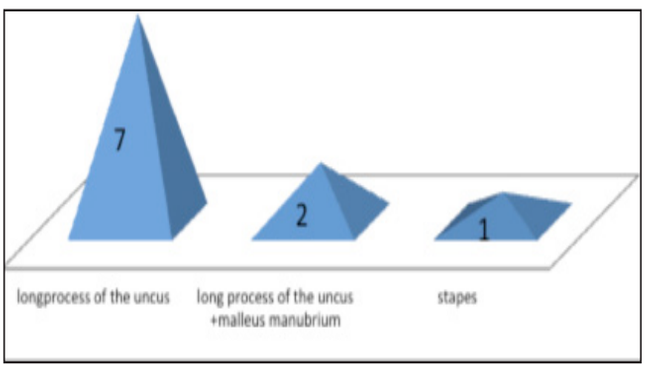


Figure 4: Lysis of the ossicular chain.

Ossiculoplasty was performed using autologous ossicules in eight cases and total ossicular replacement prosthesis (TORP) in one case.
Patients were also treated for some conditions, which are source of Eustachian tube dysfunction: four had adenoidectomy and one was reoperated for cleft palate at the same operating time.
Septoplasty was performed in 4 cases after few months of the tympanoplasty. Twelve children were treated for allergic rhinitis and five for gastro esophageal reflux.
The postoperative mean follow up in our study was 32 months with extremes between six months and ten years. We had good anatomic results in 87% of cases. We noted a graft perforation in one case after 18 months and graft retraction in one case after nine months. The average hearing improvement in our patients was 12dB with a mean air-bone gap of 16.2dB.

DISCUSSION:

The Eustachian tube and tympanomastoid cavities are known as the “tubotympanic system”. The system as a whole is covered by mucosa, which provides continuity, although with certain particularities from one area to another and plays a primordial role. Thus, in physiological conditions, gas diffusion across the tympanomastoid mucosa largely ensures the equilibrium of pressure between the middle ear and outside environment. The pressure-regulation role of the mastoid cells has been described by several authors. Gas exchanges are the most elevated as the mastoid is pneumatized. The Eustachian tube acts as a highly sophisticated valve, restoring pressure balance on either side of the tympanic membrane as necessary [1].
Over recent years, greater insight has been gained into the pathophysiology of retraction pockets. This has identified eustachian tube dysfunction and weakening

of the tympanic membrane from otitis media with effusion to be the two major contributors [2]. The normal eustachian tube serves to equilibrate the pressure in the middle ear and prevent nasopharyngeal reflux into the middle ear. Contraction of the tensor veli palati attached to the anterior portion of the tube, for example during yawning or chewing, causes the eustachian tube to open. Eustachian tube dysfunction can be due to a number of factors ranging from mucosal swelling of whatever origin, abnormalities of the tensor veli palati or postnasal space masses such as enlarged adenoids [3]. This is supported by the observation that children with cleft palate have increased middle-ear abnormalities. Since the eustachian tube is continuous with the nasopharynx, mucosal swelling resulting from respiratory tract infection, allergy and reflux can also easily block it. This problem is exacerbated in children who possess a narrower, shorter eustachian tube than adults [4].

The point prevalence of tympanic membrane retractions in healthy children aged 5 to 16 years has been reported to be 14 to 26% in pars flaccida and 0.3 to 3.7% in pars tensa [5].

The finding of retraction pockets may be purely incidental and from the patient's perspective entirely asymptomatic. Symptomatic patients tend to present with recurrent ear infections, hearing loss and occasionally otalgia [6]. Diagnosis is entirely clinical and requires a visual examination of the tympanic membrane using an otoscope, microscope or even oto-endoscope [7].

Distinguishing stable from progressive disease is challenging to any otologist. The most commonly used staging system is Charachon classification with 3 stages [8, 9]:

Stage 1: mobile retraction pocket;

Stage 2: fixed and controllable retraction pocket;

Stage 3: fixed and uncontrollable retraction pocket.

In our study, we have excluded patients with stage 1 Charachon retraction pockets as they were not been managed with surgery.

On presentation to an otologist, pure tone audiometry and tympanometry are carried out. Pure tone audiometry may be entirely normal in the early stages progressing to a conductive hearing loss. Tympanometry can show negative middle-ear pressure due to eustachian tube dysfunction or with flat traces due to concurrent glue ear [10, 11]. The main problem at diagnosis is distinguishing stable from progressive disease. With children, the disease tends to pursue a more aggressive course compared to adults, requiring frequent follow up to allow identification of progression [12].

In selected cases, progression of grade I and II towards grade III occurs. Then, a CT scan of temporal bone is recommanded to evaluate the anatomy before surgery and to assess the presence of ossicular erosion and absence of cholesteatoma [13, 14].

The management options include observation, medical treatment and surgery [15]. The treatment indication depends on the Charachon stage of the retraction pocket. Patients should be investigated for allergic rhinitis and gastro esophageal reflux, and if necessary, the appropriate medical treatment in the form of proton pump inhibitors and anti-allergy medication may be commenced especially in stage 1 retraction pockets [16]. Obstruction of the eustachian tube by persistently enlarged adenoids may make adenoidectomy another possible option in conjunction with insertion of ventilation tubes [16, 17]. Management of stage 2 is controversial. Surgery is indicated when the retraction pocket is associated with multiple risk factors or contributors [15].

Surgery has a much-defined role in grade III retractions where the lamina propria of the tympanic membrane has undergone irreversible degeneration. This is, usually, indicated if there is deterioration in hearing or if a non-cleansing pocket is formed, predisposing to a higher risk of cholesteatoma and erosion of the ossicles, especially the long process of the incus [18].

A reinforcement tympanoplasty is the better option and the cartilage is the most used graft. In fact, perichondrium and temporalis fascia are associated with higher risk of recurrence [19, 20].

Ossiculoplasty should be done when it is possible (good middle ear mucosa condition) and autograft prosthesis is especially recommended in Portmann II cases. Total ossicular replacement prosthesis (TORP) is the method of choice in Portmann III cases [21, 22].

Finally, to prevent this pathology, medical treatment (decongestants, anti-allergy medication or proton pump inhibitors) is normally adopted with ventilation tube insertion in case of chronic serous otitis media [4, 23].

CONCLUSION:

The aim of retraction pockets surgery is to avoid atelectasia and progression to cholesteatoma. Using cartilage perichondrium composite graft is the best technique to avoid recurrence. Other conditions, which represent a source of eustachian tube dysfunction or tubal inflammation, should be treated at the same time.

Compliance with ethical standards

Conflict of interest: The authors stated that there is no conflict of interest.

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