

CIPROFLOXACIN OTIC DROPS FOR PREVENTION OF OTORRHOEA FOLLOWING MYRINGOTOMY AND VENTILATION TUBE INSERTION AMONG CHILDREN

Ammar A Selman^{*}, Ahmed A Alansary[#] & Abdulwahab B Abdulwahab[@]

^{*}MB,ChB, Arab board candidate, ENT Dept., Basrah General Hospital. [#]MB,ChB, FICMS, Consultant Otolaryngologist, Head-ENT Dept, Basrah General Hospital. [@]MB,ChB, FICMS, ENT Specialist, ENT Dept, Basrah General Hospital.

Abstract

This study aimed to determine the effect of topical otic drops on the rates of postoperative ventilation tube otorrhoea and ventilation tube occlusion in children after myringotomy and ventilation tube insertion in children.

A randomized comparative interventional study was carried out on 45 children (84 years) attending Basrah General Hospital, they were 32 males (71%) and 13 females (28.9%), 39 cases have bilateral otitis media with effusion and 6 with unilateral disease, the age range was 3-17 years old. After full assessment of patients, myringotomy and ventilation tube insertion was done for every one with or without adenoidectomy and tonsillectomy or both. They were divided into three groups: first group with no local intervention, second group with single application of ciprofloxacin otic drops at surgery, third group with continuous application of ciprofloxacin otic drops for four days after surgery. A follow-up visit was instructed after 14 days for all. The rates of postoperative ventilation tube otorrhoea and ventilation tube occlusion were recorded.

With application of statistical analysis on the results, there was a statistically significant reduction in the rate of postoperative otorrhoea with using the ciprofloxacin otic drops for four days after surgery (P-value 0.043) with a reduction in the incidence of otorrhoea from 29.6% to 7.6% as compared to the group without using the drops. No significant results obtained with a single drops application at time of surgery. There were no statistically significant results in regard to the rates of postoperative ventilation tube occlusion among the study groups.

In conclusion, ciprofloxacin otic drops application for few days after myringotomy and ventilation tube insertion appears to be effective to reduce the rate of postoperative ventilation tube otorrhoea. Neither the single nor the continuous otic drops applications could reduce the rates of postoperative ventilation tube occlusion.

Introduction

Otitis media with effusion is a chronic accumulation of fluid within the middle ear and sometimes the mastoid air cells system, without evidence of infection. Symptoms usually involve hearing loss or aural fullness but typically do not involve pain or fever. In children, hearing loss is generally mild and is often detected only with an audiogram^{1,2}, it is thought to be due to acute and later chronic inflammatory changes in the middle ear mucosa, induced by upper respiratory tract infections, acute otitis media and/or allergy, followed by mucous production in the middle ear. Other important factor is eustachian tube

dysfunction due to mechanical obstruction or physiological interference with the mucous clearance³. The most common bacteria in acute otitis media, in order of frequency, are *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*. These pathogens are also the most frequent organisms associated with sinusitis and pneumonia. Together, these pathogens account for 85% of acute ear infections. Additional bacterial pathogens include *Strept.pyogenes*, *Staphyl. aureus*, gram-negative enteric bacteria, and anaerobes. When an effusion is present for longer than 3 months, *Pseudomonas* species predominate. The only

difference with the pathogens in otitis media with effusion compared with acute otitis media is that the frequency of *S. pneumoniae* is not as high, and *H. influenzae* and *Moraxella, catarrhalis* are moderately more common². The disease has a bimodal distribution with first peak at 2 years of age, second peak at 5 years of age. At 6 or 7 years old, the incidence decreases substantially, and by 11 years old, the annual incidence is 2%. Fifty percent of the episodes are lasting about 3 months³. However, middle ear effusion can be present without preceding acute otitis media, as in the case of serous otitis media after barotrauma. The most common presentations are features

consistent with decrease hearing. Parents may notice that television volume is too loud and that the child sits close to the television, does not respond when called (new onset), and often asks "What?". Associated findings during history taking may include a recent upper respiratory tract infection (URTI), a recent plane trip, or current environmental allergies. Otoscopic findings are air-fluid levels (which may be vertically oriented), a translucent membrane with diminished mobility, prominence of the lateral process, a more horizontal orientation of the malleus, and movement only with negative pneumatoscopy (Figure 1).

Figure 1: Endoscopic view of left ear shows retracted position of malleus handle in otitis media with effusion.



Management involves full evaluation of the patient's language, speech, behavior, and learning abilities. Three main management options for otitis media with effusion^{2,3}:

Watchful waiting: 50% of children with OME resolve spontaneously in 3 months. During this period, auto-inflation is advised via Valsalva maneuver, with or without assisting device (Otovent).

Hearing aid: despite many children may be a poor complaint, but remain a good alternative to surgery in resistant cases.

Ventilation tubes with or without adenoidectomy.

Medical management includes antibiotics, steroids, decongestants, mucolytics, anti-inflammatories, and surfactant. No

sufficient evidence to support their benefit.

Patients and methods

This is a randomized comparative interventional study carried out on children admitted to Department of Otolaryngology, Basrah General Hospital, for the period from July 2014 to April 2015.

Studied cases were 45 (84 ears), 32 (71%) were males and 13 (28.9%) were females, of them, bilateral persistent otitis media with effusion cases were 39, whereas unilateral cases were 6, the age range was 3-17 years. All patients were diagnosed as persistent otitis media with effusion.

Inclusion criteria: Children with symptomatic persistent otitis media with effusion, unilateral or bilateral, with concomitant adenoidectomy or tonsillectomy or both.

Exclusion criteria: Previous ventilation tube placement. Allergy to topical ear drops. Craniofacial malformations, as Down syndrome, cleft palate. Noncompliance.

According to these criteria, 7 cases (14 ears) were excluded for the following reasons: Noncompliance-4 cases. Cleft palate-2 cases. Previous ventilation tube placement-1 case.

After taking a fully informed consent from each child parents or close relative caregivers regarding the explanation of the disease process, its complications, the surgical maneuver intended, the complications of both the surgery and general anesthesia, the postoperative care, each child patient was subjected for full evaluation by a detailed history that involved the chief complaint and duration with full analysis of the hearing status and the severity of hearing difficulty with its implications on the patient general activities, interaction with parents and siblings, school performance, speech and language development and the associated

manifestations like any recurrent ear discharges, recurrent sore throat, difficulty swallowing, fever, malaise, nasal obstruction, nasal discharge, mouth breathing, snoring at night, and a history of repeated upper respiratory tract infections, as well as the past medical and surgical history, social history, and any history of drug allergy or chronic drug intake. The patient's previous investigations were reviewed, including the previous audiological tests, like the pure tone audiograms and tympanograms or other hearing evaluations for the patient's previous visits. Then a thorough ear, nose and throat and head and neck examinations were done, with a special concentration on ear examination, otoscopic examination of the external auditory canal and tympanic membrane, and tuning fork testing of hearing, Rinne's and Weber's tests were done on the cooperative group. After that, each was sent for preoperative recent hearing assessment in the Department of Audiology. In the majority of patients, the pure tone audiometry and tympanometry were performed. The machine which was used for both of these tests is called Impedance Audiometer AA222, by Interacoustics A/S (Figure 2).

Figure 2: Impedance Audiometer AA222.



Then each patient was sent for the Department of Radiology to perform radiological images of the chest and the post-nasal space to assess the patient's cardiopulmonary status and the presence or absence of adenoidal hypertrophy,

respectively. Then a prepared study questionnaire is filled and the patient's information was taken as in the next page. After completing assessment, each case was divided into one of the three study groups:

First group: no local intervention after tube insertion, to be regarded as a comparative group

Second group: instilling ciprofloxacin ear drops 0.2%, 4-6 drops/ear immediately after tube insertion.

Third group: same as the second group with the same drops, but with continuous

application for 4 days, in a dose of 3 drops per ear twice daily. During surgery, myringotomy with ventilation tube insertion was done for each single case; the type of tube used is Shepard tube (with wire) that is made of fluoroplastic material, of white color (Figure 3).

Figure 3: Shepard ventilation tube.



The ear drops were the same in regard to the chemical constituents and pharmaceutical industry. All patients were given systemic antibiotics and analgesia in the day of surgery and to be continued for at least one week after surgery.

All the patients were instructed to avoid water ear contamination during swimming in the postoperative period, and to consult their surgeon urgently if any ear discharge developed. Follow-up visits were instructed by 14th days postoperatively. During that visit, each patient was evaluated by his or her surgeon and resident with taking a history of ear discharge, duration, color, and amount of the discharge if present, hearing status, any treatment side effects. Also otoscopic

and microscopic ear examinations were done to assess the tympanic membrane status, ventilation tubes, and to examine for invisible scanty discharges. Tympanometry was ordered to assess the patency of the tube inserted. All the data was recorded in the patient's specific questionnaire.

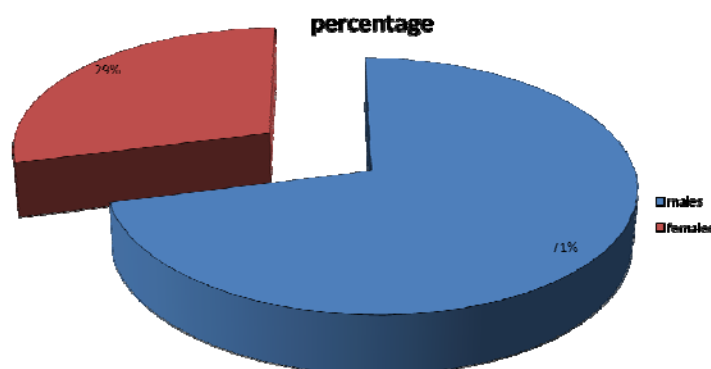
Results

The study sample is divided into three age groups; the majority of the patients, 73.3% of children with persistent otitis media and effusion are located within 3-7 years old age group. While 17.8% are within 8-12 years old, and 8.9% are within 13-17 years old, as shown in Table I.

Table I: Age groups distribution.

Age group(years)	No.	Percentage
3-7	33	73.3%
8-12	8	17.8%
13-17	4	8.9%
Total	45	100%

While in regard to sex distribution, the majority of the study sample, 71% are males and 28.9% are females (Figure 4).

Figure 4: Gender distribution.

There were no great differences between the three study groups in regard to age and sex of the participants(Table II).

Table II: Age and gender distribution between study groups.

Parameters		1st group (15 child)	2nd group (16 child)	3rd group (14 child)
Sex	Male	9(60%)	12(75%)	11(78.6%)
	Female	6(40%)	4(25%)	3(21%)
Mean age (years)		6.7	7.2	6.2

In regard to the postoperative otorrhoea rate, there was a higher rate in the first group as compared to the second and third groups, as shown in table III.

Table III: Rate and percentage of postoperative otorrhoea.

Otorrhoea	First group	Second group	Third group
No. of discharging ears/total ears	8/27	3/31	2/26
Percentage %	29.6%	9.7%	7.6%

After application of statistical analysis using nonparametric test, Mann-Whitney test, there was a statistically significant reduction in the rate of postoperative otorrhoea in the third group as compared to the first group (P-value 0.043), but there was no a statistically significant

reduction in the otorrhoea rate as compared to the second group. Similarly, there was no statistically significant difference in otorrhoea rate reduction between the first and second groups of the study samples (Table IV).

Table IV: Statistical analysis of postoperative otorrhoea rates in-between groups.

Groups	1st group vs. 2nd group	1st group vs. 3rd group	2nd group vs. 3rd group
P-values	0.055	0.043	0.794

In regard to the ventilation tube patency, using the type of tympanograms of the patients as indicators for tubes patency, there was a higher rate of ventilation tubes plugging among the first group as compared to the second and third groups (Table V).

Table V: Ventilation tubes plugging rates among groups.

Groups	First group	Second group	Third group
No. of plugged tubes/total	6/27	4/31	3/26
Percentage %	22.2%	12.9%	11.5%

With application of statistical analysis using nonparametric test, Mann-Whitney test, there were no statistically significant differences in the ventilation tubes plugging rates among all the study groups (P-value >0.05) (Table VI).

Table VI: Statistical analysis of ventilation tubes plugging rates in-between groups.

Groups	1st group vs. 2nd group	1st group vs. 3rd group	2nd group vs. 3rd group
P-values	0.353	0.305	0.877

Depending on the per operative findings of the post nasal space examination under general anesthesia for the presence or absence of adenoids hypertrophy and adenoidectomy, there was no significant statistical correlation between the presence or absence of adenoids hypertrophy and the rate of postoperative ear discharge after myringotomy and ventilation tube insertion (P-value is 0.791) (Table VII).

Table VII: Rates of otorrhoea according to adenoid hypertrophy.

Patients' group	Otorrhoea	No otorrhoea	% otorrhoea
Adenoid present	11	62	15%
Adenoid absent	2	9	18%
Total	13	71	P-value is 0.791

Discussion

Otitis media with effusion is a common health problem in children and considered as a leading cause of hearing loss in pediatric age group. It carries a potential for speech and language developmental delay, especially in case of persistent otitis media with effusion that further provides an exceptional risk for the proliferation of bacteria². One of the most important management options is surgery that is myringotomy and ventilation tube insertion. The commonest complication of that surgery is postoperative otorrhoea after ventilation tube placement. Other important complication of concern is

ventilation tube occlusion that occurs in about three times more commonly in presence of middle ear fluid than in cases of absent middle ear fluid after placement of ventilation tube². This study is designed to deal mainly with these two complications by using a prophylactic topical ear drops in group of patients with persistent otitis media with effusion and compares their efficacy to decrease the postoperative otorrhoea rate and ventilation tube occlusion with another studied group that did not given the topical medication. A ciprofloxacin otic drop 0.2% was chosen for two reasons,

because it is a fluoroquinolone antibiotic that has a broad spectrum antibacterial activity and it does not cause vestibular or cochlear toxicity that is recognized with aminoglycosides^{4,5}.

In this study, the postoperative ventilation tube otorrhoea rate was reduced with using the otic drops; both for single application at time of surgery (9.7%) or for continuous application for four days later (7.6%) in comparison to non-using the drops (29.6%). This reduction in otorrhoea rate appears to be statistically significant only for continuous otic drops application for four days after surgery (P-value 0.043). This result may be similar to the following studies:

Nawasreh and Al-wedyan I A (2004)⁶ used ciprofloxacin otic drops that resulted in a significant reduction in the postoperative otorrhoea rate from 16.5% for control group (no intervention) to 8.4% for single application at time of surgery, and to 8.2% for prolong application for five days after surgery. He advised for a prolong application if the middle ear content was mucoid at time of surgery.

Giles et al (2007)⁷ compared the use of ciprodex otic drops (ciprofloxacin 0.3% plus dexamethasone 0.1%) with a prolong application for 5 days against control in cases of otitis media with effusion. The otorrhoea rate was reduced from 34.39% in control to 4.95% in study group.

Poetker et al (2006)⁸, a comparison was made between control and prolong applications of ofloxacin otic drops; the result was reduction in postoperative otorrhoea rate from 15% to 8% in the ofloxacin group.

Heslop A et al (2010)⁹, a comparative study was made between the use of oral amoxicillin, topical saline and topical ciprofloxacin drops. The result reflects a significant reduction in the postoperative otorrhoea rate in the group of ciprofloxacin drops as compared to the other interventions. Zipfel et al (1999)¹⁰, control cases were compared with a single

application of ciprofloxacin otic drops at time of surgery. They found that the rate of otorrhoea was significantly reduced from 9.1% among control to 3.9% among the study group. This result may be due to a bigger sample of patients involved in the study.

In a review study of Garcia P et al (1994)¹¹, it was recommended to use a prolong application of topical antimicrobial drops after ventilation tube insertion especially in cases of mucoid or purulent middle ear effusion present at surgery.

A more recent review study of Syed M I et al (2013)¹², they recommended the single use of isotonic saline irrigation or topical antibiotics otic drops at time of surgery and not prolong thereafter in order to reduce the risk of ototoxicity potential.

In a further review study of Vaile L et al (2006)¹³, the authors neither could identify the most effective intervention nor to assess the associated risks of these interventions. As well, they concluded that there was no significant long term benefit obtained with addition of topical or systemic corticosteroids to the antibiotics.

Regarding the other important complication of ventilation tube insertion which is the postoperative ventilation tube plugging, there was a higher plugging rate among the first group than the second and third groups, although none of these values were statistically significant during the statistical analysis. This result was not consistent with the study of Poetker et al (2006)⁸ that compares the use of ofloxacin drops against control cases and the result was a significant reduction in the ventilation tube plugging in comparison to control cases. This may be explained by a bigger study sample involved.

In another study of Kumar VV et al (2005)¹⁴, they found that oxymetazolin solution is as effective as ciprofloxacin solution in prevention of postoperative otorrhoea and tympanostomy tube occlusion.

According to the results of the study, application of topical otic drops after myringotomy and placement of ventilation tube in cases of persistent otitis media with effusion appears to be effective if used continuously for few days after surgery, which gives a good result for reducing the rate of postoperative ventilation tube otorrhoea. A ciprofloxacin otic drop appears to be a good choice to achieve the desired effects since it's a broad spectrum antibiotic and a free of potential for cochlear and vestibular ototoxicity. A future suggestion for research is to study the relationship between the grades

of adenoid hypertrophy in the preoperative period and the rate of postoperative ventilation tube otorrhoea and tube occlusion. A second important suggestion of view is to study the relationship between the types of middle ear aspiration at time of surgery, namely serous or mucoid and the rate of postoperative ventilation tube otorrhoea and tube occlusion with further comparing the effects of various interventions on these parameters. Lastly, a third suggestion is to study the optimum duration of topical otic drops application after surgery.

References

1. M J, Clarke R, Hibbert J, Jones N S, Lund V J, Luxon L M, Watkinson J C. Scott-Brown's Otorhinolaryngology, Head and Neck Surgery volume 1. 7th edition. London: Hodder Arnold; 2008. 72: 877-906.
2. <http://emedicine.medscape.com/article/858990-overview>.
3. Warner G, Burgess A, Patel S, Martinez D P, Corbridge R. Otitis media with effusion. In: Oxford specialist handbook in otolaryngology and head and neck surgery. 1st edition. Oxford: Oxford University Press; 2009. 16: 372-374.
4. <http://emedicine.medscape.com/article/1890977-overview>.
5. Martin J, Claase L A, Jordan B, and et al. Otitis media/ Ear, nose and oropharynx. In: British national formulary. 61th edition. March 2011. 12: 685-688.
6. Nawasreh OO, Al-wedyan IA. Prophylactic ciprofloxacin drops after tympanostomy tube insertion. Saudi Medical Journal 2004; 25(1): 38-40.
7. Giles W, Dohar J, Iverson K, Cockrum P, Hill F, Hill N. Ciprofloxacin/dexamethasone drops decrease the incidence of physician and patient outcomes of otorrhea after tube placement. International Journal of Pediatric Otorhinolaryngology 2007; 71 (5): 747-756.
8. Poetker DM, Lindstrom DR, Patel NJ, Conley SF, Flanary VA, Link TR, et al. Ofloxacin otic drops vs neomycin- polymyxin B otic drops as prophylaxis against early postoperative tympanostomy tube otorrhea. Archives of Otolaryngology- Head and Neck Surgery 2006; 132(12): 1294-8.
9. Heslop A, Lildhodt T, Gammelgaard N, Ovese T. Topical ciprofloxacin is superior to topical saline and systemic antibiotics in the treatment of tympanostomy tube otorrhea in children: the results of a randomized clinical trial. Laryngoscope 2010 Dec; 120(12): 2516-20.
10. Zipfel TE, Wood W E, Street DF, Wulffman J, Tipirneni A, Frey C, et al. The effect of topical ciprofloxacin on postoperative otorrhea after tympanostomy tube insertion. American Journal of Otolaryngology 1999; 20(4): 416-20.
11. Garcia P, Gates GA, Schechtman KB. Does topical antibiotic prophylaxis reduce post tympanostomy tube otorrhoea?. Annals of Otolaryngology, Rhinology and Laryngology 1994; 103(1): 54-58.
12. Syed MI, Suller S, Browning GG, Akeroyd MA. Interventions for the prevention of postoperative ear discharge after insertion of ventilation tubes (grommets) in children (Review). Clinical Otolaryngology 2013; 38(4): 322-323.
13. Vaile L, Williamson T, Waddell A, Taylor G J. Interventions for ear discharge associated with grommets (ventilation tubes). Cochrane Database of Systematic Reviews 2006, Issue 2. (DOI: 10.1002/ 14651858. CD001933. pub2).
14. Kumar VV, Gaughan J, Issacson G, Szeremeta W. Oxymetazoline is equivalent to ciprofloxacin in preventing postoperative otorrhea or tympanostomy tube obstruction. Laryngoscope 2005 Feb; 115(2): 363-365.