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Tympanostomy tube placement and ear drops: Evidence-based cost saving models

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ABSTRACT

Objectives/Introduction: Tympanostomy tube placement is the most common surgical procedure in the pediatric population with important financial implications to our healthcare institutions. The purpose of this study is to apply various cost models in different clinical environments to determine the most cost effective way to prescribe ear drops after tympanostomy tube insertion.

Methods: Two distinct practice models were designed: a Uniform Treatment Model and a Disease Specific Model. Different cost simulations were run based on which medication(s) was chosen for all tympanostomy tube cases performed over the course of 1 year in a practice composed of four pediatric otolaryngologist. Two categories of ear drop medications were seen: high cost and low cost. The cost associated with initiation of drops in the operating room versus initiation as an outpatient via a prescription was evaluated.

Results: In both Uniform Treatment and Disease Specific Models, the most expensive simulations included antibiotic/steroid combination drop use intraoperatively. The treatment with an antibiotic/steroid combination drop was lower when delayed until the post-operative period. The hospital cost for ear drops increased by as much as 478% when dispensed within the operating room rather than from the hospital's outpatient pharmacy.

Conclusions: Otolaryngologists should make an effort to become familiar with the cost of ototopical medications and the significant variability between inpatient and outpatient settings. Cost of ototopical agents should be shifted to the institution's outpatient pharmacy whenever possible especially for branded, higher cost combination drops. Patients should be treated based on the status of their ear disease at time of middle tube insertion.

1. Introduction

Tympanostomy tube placement is the most common surgical procedure in the pediatric population with important financial implications to our healthcare institutions. Nearly 700,000 cases are performed in the United States per year on patients under 15 years of age [1]. Otorrhea can occur after tube insertion and both intra- and post-operative instillation of antimicrobial otic drops is common practice. Prior research supports the benefits of various eardrops, including antibiotic-steroid combination formulations, in reducing the rate of otorrhea after tube insertion [2–5].

The costs to the healthcare system of eardrop therapy have not been previously elucidated. The purpose of this study is to apply various cost models in different clinical environments to determine the most cost effective way to prescribe eardrops after tympanostomy tube insertion. This information has potential to assist the otolaryngologist in making informed and cost-conscience decisions in treating patients at the time of tympanostomy tube insertion.

2. Methods

This study did not meet the definition of human subject's research according Federal Regulations 46.102, therefore, Institutional Review Board approval was not needed. In March 2017, the pharmacy at the University of North Carolina Hospital was queried as to the hospital cost of common eardrops in outpatient, hospital, and operating room environments. Referencing a de-identified operating room log at the University of North Carolina, 574 tympanostomy tube insertion cases were performed amongst 4 faculty pediatric otolaryngologist during the 12-month period of 2016. Two distinct practice models were designed: a Uniform Treatment Model and a Disease Specific Model. In order to estimate yearly costs at this hospital and for ease of calculations, the cost models used are based on a total of 500 tympanostomy tube cases. The following medications, listed alphabetically were utilized in this

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Table 1
Medication hospital costs in United States dollars.

Ototopical Drug(s)	Abbreviation	Hospital Costs per Patient[a]	Total Hospital Cost (n = 500)[a]
Intra-Operative			
Ciprofloxacin 0.3%-Fluocinolone acetonide 0.025% Otic	Cip-Flu	228.56	114,280
Ciprofloxacin 0.3%-Dexamethasone 0.1% Otic	Cip-Dex	182.00	91,000
Generic Ciprofloxacin Ophthalmic 0.3% + Generic Ophthalmic Prednisolone 1.0%	Oph-Cip + Oph-Pre	35.56	17,780
Generic Ofloxacin Otic 0.3%		22.03	11,015
Generic Ciprofloxacin Ophthalmic 0.3%	Oph-Cip	3.18	1590
Generic Oxymetazoline 0.05%		2.31	1,155
Outpatient			
Ciprofloxacin 0.3%-Fluocinolone acetonide 0.025% Otic	Cip-Flu	202.60	101,300
Ciprofloxacin 0.3%-Dexamethasone 0.1% Otic	Cip-Dex	37.91	18,955

[a] Costs assume medication quantity sufficient for 5 days of total therapy.

study:

1. Ciprofloxacin 0.3%-Dexamethasone 0.1% Otic (Ciprodex^{R}, Alcon, Fort Worth, TX), (Cip-Dex)
2. Ciprofloxacin 0.3%-Fluocinolone acetonide 0.025% Otic (Otovel^{R}, Arbor Pharmaceuticals, Atlanta, GA), (Cip-Flu)
3. Generic Ciprofloxacin Ophthalmic 0.3% (Rising Pharmaceuticals, Allendale, NG), (Oph-Cip)
4. Generic Ciprofloxacin Ophthalmic 0.3% (Oph-Cip), with Generic Ophthalmic Prednisolone 1.0% (Sandoz, Princeton, NJ), (Oph-Pre)
5. Generic Ofloxacin Otic 0.3%
6. Generic Oxymetazoline 0.05% (Major, Livonia, MI)

Table 1 lists the pharmacy acquisition cost of the medications based on the patient environment in which they are used. Based on cost, two categories of inpatient medications were seen. Cip-Flu, Cip-Dex, Oph-Cipro + Oph-Pre and Ofloxacin were relatively high cost at $228.56, $182.00, $35.56 and $22.03 respectively per patient when initiated in the operating room. Oph-Cip and Oxymetazoline were low cost medications at $3.18 and $2.31, respectively per patient for use in the operating room. Review of outpatient pharmacy costs also revealed medications had a different cost at the outpatient pharmacy. The hospital cost difference was most significant for Cip-Dex at $37.91 per bottle as an outpatient versus $182.00 when used within the operating room or inpatient status.

2.1. Uniform Treatment Model

In the Uniform Treatment Model the assumption is made that all 500 patients are treated with same eardrop regimen (Fig. 1). Within this model, different cost simulations were run based on which medication (s) was chosen for all 500 cases. Simulations using medications listed above were performed as these are the most commonly used in practice based on the authors' experience.

All patients were treated with a regimen that consisted of an intra-operative application by the surgeon followed by 5 days of post-operative drop use at home to both ears. In all simulations, it was assumed that the respective medication was opened in the operating room with the same bottle/package being transferred to the caregivers to complete 5 days of therapy. In simulations A through D, high cost drop medications were initiated in the operating room. In simulations E and F, low cost medications were used in the operating room. As an additional calculation in simulations E and F, the hospital cost of providing an optional outpatient prescription to transition to Cip-Dex post operatively was performed. This was done to capture the lower outpatient cost.

2.2. Disease Specific Model

In the Disease Specific Model, eardrops were used for all patients but were not administered uniformly to all 500 patients (Fig. 2). Instead, a treatment algorithm was used that was based on middle ear effusion findings at time of tube insertion. Based on previous published data, an assumption was made that 60% of patients (n = 300) will have

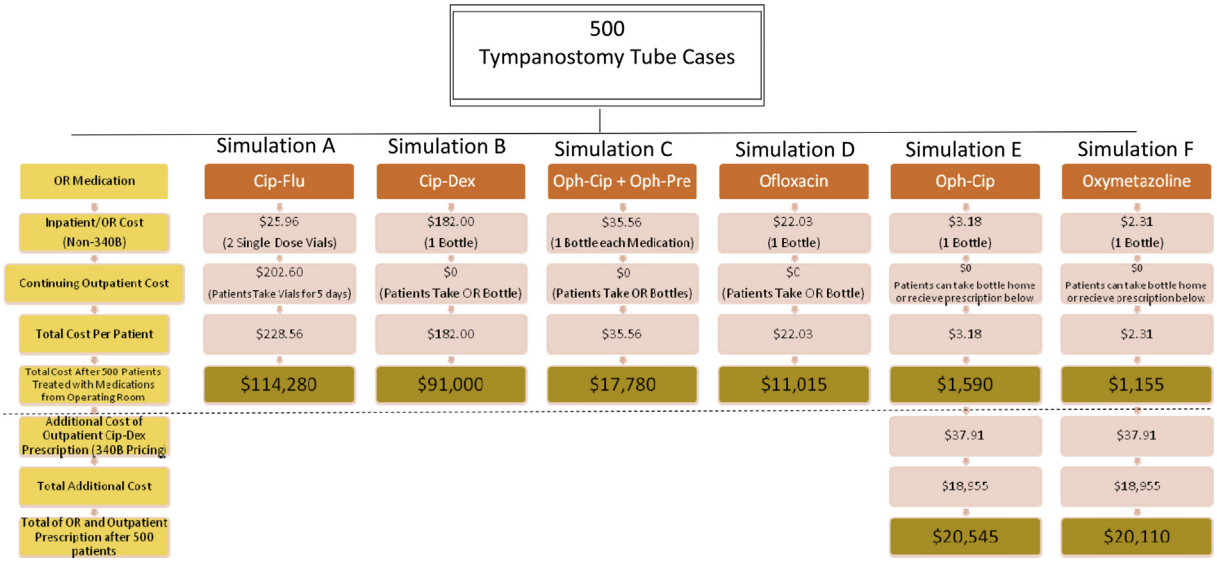

Fig. 1. Uniform treatment model.