



Factors influencing surgeon decision-making by measuring waiting time for pediatric ventilation tube insertions

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Abstract

Background: The surgeon and physician's decision-making may be influenced by many factors. The clinical practice guideline suggested that watchful waiting for 3 months should be the initial management for pediatric otitis media with effusion. The waiting time of ventilation tube insertion for pediatric patients is a proper measurement for physician decision-making. This study investigated factors influencing the waiting time for pediatric ventilation tube insertion and to explore factors influencing physician decision-making.

Methods: Information associated with all patients under 18 years of age who received ventilation tube insertions from July 1, 2000 to December 31, 2009 were retrieved and analyzed from a nationwide, population-based administrative database. The waiting time before ventilation tube insertions from the time of diagnosis of otitis media with effusion was recorded. Certain factors that would influence the waiting time were identified. At the same time, how these factors influenced clinical decision-making were also identified.

Results: The waiting time decreased as patient age increased ($p < 0.001$), and increased as the recent frequency of upper respiratory tract infection diagnosis increased ($p < 0.001$). Patients who received simultaneously bilateral ventilation tube insertions had shorter waiting time than those who had unilateral surgery ($p < 0.01$) and patients who had undergone ventilation tube insertions in a tertiary referral center generally had longer waiting times ($p < 0.001$).

Conclusion: The waiting time of ventilation tube insertions for pediatric otitis media with effusion can be influenced by many factors. Patients with older age and undergone simultaneously bilateral ventilation tube insertion had shorter waiting time. Patients who had more upper respiratory tract infection episodes and who received ventilation tube insertions in a tertiary referral center setting were subject to longer waiting times.

Keywords: Decision-making; Otitis media; Physician behavior; Ventilation tube

1. INTRODUCTION

In clinical practice, we can often recognize that different doctors may undertake diverging courses of management for a single patient, and one physician may manage patients with the same clinical condition differently. This indicates that the behaviors and clinical decision-making of physicians may be influenced by a variety of factors, including patient factors (age, sex, comorbidities, etc.),¹⁻⁴ policy factors (change of reimbursement,

regulations, etc.),⁵⁻⁸ surgeon or physician factors (subspecialty, training background, seniority, etc.),⁹⁻¹² and parent factors for pediatric patients (monthly income, education level, etc.).¹³⁻¹⁷

The year 2004 clinical practice guideline for managing pediatric otitis media with effusion (OME) and the year 2013 clinical practice guideline for tympanostomy tubes in children suggested that watchful waiting for 3 months should be chosen for initial medical management because 90% of pediatric OME are typically resolved spontaneously within 3 months.¹⁸⁻²³ If an Otolaryngologist did ventilation tube insertions for pediatric OME within 3 months, it may be an improper medical intervention for financial incentives. Thus, the waiting time of ventilation tube insertions for pediatric OME is a very good indicator to check the quality of clinical practice, and is also a proper measurement to investigate factors influencing physician behavior and clinical decision-making. This study investigated factors that would influence the waiting time of ventilation tube insertions for pediatric OME, and to explore the magnitude and direction of influences on physician behavior and clinical decision-making. This study also checked the quality of medical practices in Taiwan when practitioners treat pediatric OME.

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2. METHODS

2.1. Subjects

We used the national health insurance research database in Taiwan (a compilation of insurance claim data) from 2000 to 2009. We retrieved data of all patients who received ventilation tube insertions that were under 18 years of age on the date of surgery, extending from July 1, 2000 to December 31, 2009.

2.2. Waiting time definition

For all such patients, the waiting time from diagnosis of OME to ventilation tube insertions was recorded. We use the same definition of “waiting time” as we used in our previous study.²³ Therefore, “waiting time” was defined to be from the closest date of OME diagnosis 6 months before surgery to the date of surgery (Fig. 1).²⁴ The episode of OME 6 months before the date of surgery was considered as previous episode of OME for recurrence pediatric OME is very common. The ICD-9 codes we used were shown in the Supplementary Appendix, <http://links.lww.com/JCMA/A147>.

2.3. Factors analyzed

We classified the factors that may affect the waiting time into four categories, which were patient factors, policy factors, physician factors, and parent factors. Within those four categories, we can identify age, sex, and comorbidities of the patients as patient factors, seniority of the surgeon and hospital-level as physician factors, and monthly income of parents as parent factors. All of these factors can be clearly identified and defined in the National Health Insurance Research Database. The American Academy of Otolaryngology—Head and Neck Surgery Foundation released clinical practice guideline for otitis media with effusion in 2004, and the Taiwan national health insurance program increased the physician fee for ventilation tube insertions from USD \$63 to USD \$121 in July 2004. The payment was the same across all level of hospitals. There was an additional 60% payment for children under 6 months old, an additional 30% for children 6 months to 2 years old, and an additional 20% for children 2 to 6 years old. We used these two events as policy factors, and tried to identify certain factors that would influence the waiting time for ventilation tube insertions for pediatric OME. At the same time, we can also identify the direction of influence of these factors.

2.4. Statistical analysis

We used logistic regression to establish an association between patient waiting time and all the factors mentioned above to ascertain possible influencing factors. Then, we used multiple logistic regression for association between waiting time and possible factors to determine the factors influencing waiting time of ventilation tube insertions for pediatric OME.

3. RESULTS

A total of 9503 patients were included in this study. The mean clinic visits with diagnoses of OME that occurred before ventilation tube insertion was 6.4 ± 5.2 . The cutoff point of waiting time was set at 90 days for us to evaluate factors that may lead to short waiting time which is not suggested by the clinical practice guideline. The number of patients in each categorized section was shown in Table 1. The mean waiting time of all patients was 73.6 ± 57.2 days and the median waiting time was 60 days. About one-third of the patients had waiting time longer than 90 days and the other two-thirds had waiting time shorter than 90 days. The patient numbers in each group of possible influencing factors categorized by cutoff point of waiting time (90 days) were shown in Table 2. About 60% of the patients are male. Nearly 40% of the patient had adenoidectomy and patients with cleft palate accounted for 10 % of all patients. Nearly 60% of the patients underwent simultaneous bilateral ventilation tube insertion and the other 40% had unilateral surgery. Further, logistic regression for the association between waiting time and individual-level, policy-level, surgeon or physician-level, and parent-level characteristics by cutoff points of waiting time were shown in Table 3. Multiple logistic regression for association between waiting time and individual-level, policy-level, physician-level, and parent-level characteristics by cutoff points of waiting time were shown in Table 4. We found that the waiting time for ventilation tube insertion decreased as the age of the patient increased, adjusted odds ratio of 1.05 for each year increased ($p < 0.001$), and increased as the recent numbers of diagnosed upper respiratory tract infection (URI) increased, adjusted odds ratio of 0.96 for each time of diagnosis increased ($p < 0.001$). Patients with cleft palate may also have shorter waiting time, adjusted odds ratio of 1.19 ($p = 0.051$). Children who underwent unilateral ventilation tube insertion had longer waiting time than those who had tubes bilaterally, adjusted odds ratio of 1.19 ($p < 0.001$). Interestingly, the patients who had ventilation tube insertions procedure in tertiary referral center had longer waiting time, adjusted odds ratio of 0.78 in comparison to local hospitals ($p < 0.001$) (Table 4).

4. DISCUSSION

Watchful waiting should be the initial management for pediatric OME.^{18–23} Ventilation tubes for short duration of OME were inappropriate.^{25,26} There were studies that examined the appropriateness of ventilation tubes for children.^{25–27} However factors that may influence surgeons’ decision on pediatric ventilation tubes have never been studied. This is the first study that has tried to explore the factors that may influence waiting time for ventilation tube insertions for pediatric OME patients. We classified the factors that may affect the waiting time into four categories: patient factors, policy factors, physician factors, and parent factors. We identified certain factors that would influence

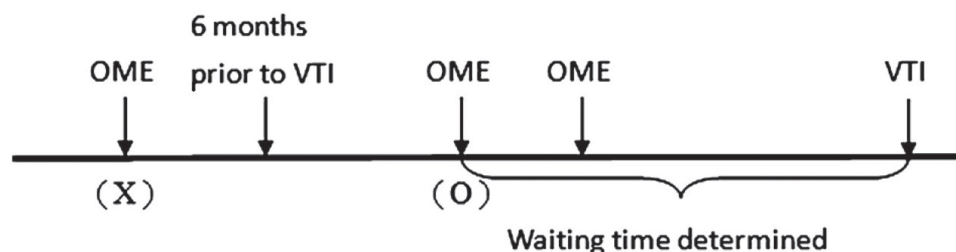


Fig. 1 The waiting time was determined by the time between the diagnosis of otitis media with effusion (OME) closest to 6 months before ventilation tube insertion (VTI) and the date of VTI performed.²² X = diagnosis not counted; O = diagnosis counted.

Table 1
Descriptive statistics of waiting time

	n (%)
Waiting time (d) ^a	
≥90 days	3520 (37.0)
<90 days	5983 (63.0)
Mean waiting time ^b	73.6 ± 57.2
Median waiting time ^c	60 (20-122)

^an = 9503.

^bMean ± SD.

^cInterquartile range was shown in the parenthesis.

the waiting time of ventilation tube insertions for pediatric OME. At the same time, we can also identify the direction of influence of these factors. In this study, we found that Patients of older age who underwent simultaneously bilateral ventilation tube insertion had shorter waiting time. Patients who had more URI episodes and who received ventilation tube insertions in a tertiary referral center setting were subject to longer waiting times.

The waiting time for ventilation tube insertion decreased as patient age increased. The incidence of OME decreased in older children.²⁰ These older children who had OME usually had other comorbidities leading to OME such as sinusitis, cleft

palate, Down syndrome, etc. This may lead surgeons to take action to ventilation tube insertions on older children because spontaneous resolution would not occur with those comorbidities. The waiting time increased as the recent number of URI diagnoses increased. Frequent URI episodes among young children were often complicated by AOM and/or OME. Surgeons may wait a little longer in the hope that spontaneous resolution would occur since these OME episodes may be independent and are the results of URIs. Patients with cleft palate had shorter waiting time. OME is a very common problem for children with cleft palate and chance of spontaneous resolution is low.^{28,29} Surgeons may resort to tubes earlier to restore hearing in this particular group of children. Children who underwent unilateral ventilation tube insertion had longer waiting time than those who had simultaneous tubes bilaterally. This is concordant with the suggestion of the clinical practice guideline.^{21,23} The patients who had ventilation tube insertions procedure in tertiary referral center had longer waiting times compared to other health care organizations. The adjusted odds ratio for tertiary referral center to perform ventilation tube insertions within 90 days was 0.78 (<0.001) in comparison to local hospitals. Surgeons in tertiary referral centers may be more aware of the suggestions of clinical practice guidelines and had better guideline adherence in comparison with surgeons in other organizations.

In this study, we found the average waiting time for ventilation tube insertions for pediatric OME was 73.6 ± 57.2

Table 2
Cross-tables for waiting time and individual-level, policy-level, physician-level, and parent-level characteristics

	≥90 d (n = 3520)	<90 d (n = 5983)	Total (n = 9503)
Age ^a	5.3 ± 2.7	5.9 ± 3.2	5.7 ± 3.1
Gender			
Female	1317 (37.4)	2390 (39.9)	3707 (39.1)
Male	2203 (62.6)	3593 (60.1)	5796 (60.9)
Adenoidectomy			
No	2101 (59.7)	3688 (61.6)	5789 (60.9)
Yes	1419 (40.3)	2295 (38.4)	3714 (39.1)
Cleft palate			
No	3162 (89.8)	5340 (89.3)	8502 (89.5)
Yes	358 (10.2)	643 (10.7)	1001 (10.5)
Down syndrome			
No	3500 (99.4)	5949 (99.4)	9449 (99.4)
Yes	20 (0.6)	34 (0.6)	54 (0.6)
Sleep apnea			
No	3354 (95.3)	5691 (95.1)	9045 (95.2)
Yes	166 (4.7)	292 (4.9)	458 (4.8)
Number of diagnoses of upper respiratory diseases ^a	14.6 ± 8.5	11.5 ± 7.6	12.6 ± 8.1
Laterality of VTI			
Unilateral	1482 (42.1)	2436 (40.7)	3918 (41.2)
Bilateral	2038 (57.9)	3547 (59.3)	5585 (58.8)
AAO guideline			
After	2239 (63.6)	3836 (64.1)	6075 (63.9)
Before	1281 (36.4)	2147 (35.9)	3428 (36.1)
NHI payment raise			
After	1454 (41.3)	2479 (41.4)	3933 (41.4)
Before	2066 (58.7)	3504 (58.6)	5570 (58.6)
Seniority of specialist, year ^a	9.6 ± 6.1	9.2 ± 6.4	9.4 ± 6.3
Hospital-level			
Non-medical center	1598 (45.4)	3090 (51.7)	4688 (49.3)
Medical center	1922 (54.6)	2893 (48.4)	4815 (50.7)
Parent income			
Low	1095 (31.1)	1862 (31.1)	2957 (31.1)
Medium	1168 (33.2)	2188 (36.6)	3356 (35.3)
High	1249 (35.5)	1902 (31.8)	3151 (33.2)

^aPresented as mean ± SD.

Table 3

Logistic regression for association between waiting time and individual-level, physician-level, and hospital-level characteristics, by cutoff point of waiting time

Variables	<90 d	
	OR (95% CI)	p
Age	1.07 (1.06-1.09)	<0.001
Gender		
Female	1.00	
Male	0.90 (0.83-0.98)	0.015
Adenoidectomy		
No	1.00	
Yes	0.92 (0.85-1.00)	0.059
Cleft palate		
No	1.00	
Yes	1.06 (0.93-1.22)	0.380
Down syndrome		
No	1.00	
Yes	1.00 (0.58-1.74)	1.00
Sleep apnea		
No	1.00	
Yes	1.04 (0.85-1.26)	0.719
Number of diagnosis of upper respiratory diseases	0.95 (0.95-0.96)	<0.001
Laterality of VTI		
Unilateral	1.00	
Bilateral	1.06 (0.97-1.15)	0.184
US guideline		
After	1.00	
Before	0.98 (0.90-1.07)	0.619
NHI amount		
After	1.00	
Before	1.00 (0.91-1.08)	0.903
Seniority of specialist (y)	0.99 (0.98-1.00)	0.001
Hospital-level		
Non-medical center	1.00	
Medical center	0.78 (0.72-0.85)	<0.001
Amount of insurance		
Low	1.00	
Medium	1.10 (0.99-1.22)	0.066
High	0.90 (0.81-0.99)	0.036

CI = confidence interval; OR = odds ratio.

days, which is quite close to the 3-month waiting time that the American Academy of Otolaryngology—Head and Neck Surgery Foundation guideline suggested if we take patient history into consideration. Patients may have OME for 1 or 2 weeks, or even longer before they seek medical attention. The influencing factors we found in this study were patient (age, cleft palate, laterality, and number of recent URI diagnoses) and physician factors (level of hospital). The increase in ventilation tube insertion payment and Academy of American Otolaryngology—Head Neck Surgery clinical practice guideline for otitis media with effusion²¹ were events that happened in the year 2004. Both events had no influence on the waiting time for ventilation tube insertions for pediatric OME. The effect of these two events in 2004 may be canceled for the effects of these two factors on the waiting time were in opposite direction. All of the above showed that ENT surgeons in Taiwan primarily adhere to the Academy of American Otolaryngology—Head Neck Surgery clinical practice guideline for otitis media with effusion,²¹ when conducting their practice, without apparent influence by financial incentives.

The primary strength of this study is that we utilized Taiwan's national health insurance claims database. Each visit and every medical procedure was recorded in this particular databank,

Table 4

Multiple logistic regression for association between waiting time and individual-level, physician-level, and hospital-level characteristics, by cutoff point of waiting time

Variables	<90 d	
	aOR (95% CI)	p
Age	1.05 (1.04-1.07)	<0.001
Gender		
Female	1.00	
Male	0.92 (0.85-1.01)	0.078
Adenoidectomy		
No	1.00	
Yes	0.97 (0.88-1.07)	0.534
Cleft palate		
No	1.00	
Yes	1.19 (0.99-1.41)	0.051
Number of diagnosis of upper respiratory diseases	0.96 (0.95-0.96)	<0.001
Laterality of VTI		
Unilateral	1.00	
Bilateral	1.19 (1.09-1.30)	<0.001
US guideline		
After	1.00	
Before	0.99 (0.91-1.10)	0.976
Seniority of specialist (y)	0.99 (0.98-1.00)	0.053
Hospital-level		
Non-medical center	1.00	
Medical center	0.78 (0.71-0.86)	<0.001
Amount of insurance		
Low	1.00	
Medium	1.13 (1.01-1.26)	0.027
High	0.99 (0.89-1.10)	0.863

CI = confidence interval; aOR = adjusted odds ratio.

without sampling. Using this databank for investigating physician behavior can better and more accurately establish how medical processes and procedures were conducted. Our findings were what really happened in a single country which may be considered as the limitation of this study. In contrast, we considered that the results of this study may have good external validity because we used ventilation tube insertions for pediatric OME to explore factors that may influence physician clinical decision-making. Ventilation tube insertions for pediatric OME are a very common and frequently performed procedure worldwide and there are well-established clinical practice guidelines for this procedure. The indication of this procedure is clear so the way of practice should be pretty similar worldwide, or at least in developed countries.

The limitations of this study were similar to other administrative claims data studies. We did not have access to the clinical data of the patients, such as history and physical examinations. We could miss some factors that may influence the decision-making of physicians, such as eardrum retraction or the duration of persistence of OME before the visit. The other limitation of administrative claims data studies is that the diagnostic codes that were coded by physicians in administrative claim data may not be so accurate. However, the procedure codes in administrative claims data are considerably more accurate. For this reason, we used a procedure code (the code for ventilation tube insertions) to define the study population to improve the internal validity of this study.

In conclusion, the waiting time of ventilation tube insertions for pediatric OME can be influenced by many factors, but primarily by patient-level factors including age, cleft palate, laterality, and number of recent URI diagnoses. Patients of older age

who underwent simultaneously bilateral ventilation tube insertion have shorter waiting time. Patients who had more URI episodes and who received ventilation tube insertions in a tertiary referral center setting were subject to longer waiting times.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <http://links.lww.com/JCMA/A147>.

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