Application of External Auditory Canal Model Training in the Operation Training of Ear Endoscopic Surgery

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Abstract

This paper aims to explore the application value of external auditory canal model training in the operation training of ear endoscopic surgery. 42 doctors from the Class 2018 further education in the First Affiliated Hospital of Sun Yat-sen University were randomly assigned into model training group and control group under traditional training. Clinical observation and assisted endoscopic surgery were conducted in both groups, while the external auditory canal model training using otic endoscope was additionally performed in the model training group. The practice and subjective evaluation of otic endoscope were compared and analyzed between two groups. As a result, the number of touching the external auditory canal, catheterization, and teacher assistance, as well as the finishing time were significantly lower in the model training group (P<0.05). At the same time, the student interest in learning, confidence in clinical operation of the otic endoscope, operation proficiency of the otic endoscope, and the evaluation of training method were significantly better than the traditional teaching group (P<0.05). In conclusion, the external auditory canal model training has obvious advantages and plays an important role in the operation training of the otic endoscope.

Keywords Otic endoscope; External auditory canal model; Training teaching

1.Introduction

Recently, with the development of ear endoscopic surgery, many otologists gradually learned and conducted ear endoscopic surgery. However, various ear complications have emerged as well, mainly resulting from the lack of standardized training of ear endoscopic surgery [1-2]. Every year, dozens of doctors from different levels of hospitals come for further education. Their operation of the otic endoscope are mostly poor without familiarization with the endoscopic surgery. According to years of clinical teaching practice in otic endoscope technique, although doctors for further education have watched video materials of otic endoscopic surgery and mastered some anatomical knowledge, their practical skills in otic endoscopic surgery is not optimistic. As the theory separates from the practice in clinical teaching, there is no international reports on the endoscopic surgery training research. In order to make up for the lack of practical operation opportunities and ethical risks in the clinical teaching of endoscopic surgery, our department designed a simple external auditory canal model for operation training. Through comparative study, the teaching experience of endoscopic surgery was summarized and reported as follows.

2. Materials and Methods

2.1 Students and groups

Forty two doctors from the Class 2018 further education between Jan – Dec, 2018 in the First Affiliated Hospital of Sun Yat-sen University were selected. They included 26 males and 16 females, with 55% of them from the second-senior class hospital, and 45% from the third-senior class hospital. None of selected students had any experience in endoscopic surgery. They were randomly assigned into a model training group (experimental group) and a traditional teaching group (control group), with 21 students in each group. There were 14 males and 7 females with an average age of 31.5±2.5 years in the experimental group. While in the control group, there were 12 males and 9 females with an average age of 30.9 ± 3.1 years. No significant difference in age and hospital-level source were observed between two groups.

2.2 Teaching materials and facility

Students in both groups were equipped with a STORZ endoscopic imaging system and associated microscopic instruments. The training of designed endoscopic external auditory canal simulator was also used in the experimental group training.

2.3 Teaching method

The training lasted for 3 months. Lectures on the basic theory and operation methods of ear endoscopy were given in both groups. Students observed the teacher's operation of ear endoscopic surgery to clarify their learning objectives. Subsequently, students from two groups entered the otology ward for patient management by assisting the teacher to complete the endoscopic surgery, and observing the teacher's operation of ear endoscopic surgery. During the operation training, the teacher explained in details, and gave the students opportunities to operate by themselves. Students in experimental group practiced additionally for ear endoscopic operation using the designed external auditory canal model. The model stimulated the shape of the adult external auditory canal using a flexible straw coated with color pigment. During the practice, students were asked to hold the endoscope and ear instruments to enter the external auditory canal model, and try to avoid touching the straw wall (it was stained after touching). After students were skilled, the teacher put a small piece of tape on the bottom of the external auditory canal model. Students separated and removed the tape using the ear instrument under the endoscope. Finally, the teacher sealed the bottom of the external auditory canal with plastic wrap to mimic the tympanic membrane morphology. Students performed tympanotomy and ventilator placement using the endoscope. Each student had approximately 120 minutes to practice every week.

2.4 Effect evaluation

(1) Operational assessment: The endoscopic tympanic membrane catheterization was completed once successfully and independently. The redness and bleeding caused by touching the external auditory canal, the number of requests for teacher's help, attempts of placement, and the time for final completion were recorded and analyzed statistically.
(2) Questionnaire survey: After the clinical operation, anonymous questionnaire survey was conducted in students regarding two training methods by assessing four items (visual analogue scale VAS, 0-10 points for each item). This was to understand students' understanding and evaluation of two teaching methods.

2.5 statistical methods

The measurement data were described as means ± standard deviation. The comparison for independent samples between groups was performed using t-test method. Significance was defined when P <0.05. SPSS 22.0 was used for statistical analysis.

3. Results

3.1 Assessment results of endoscopic operation

In the experimental group, the number of touching the external auditory canal, teacher assistance, catheterizations, and the finishing time were significantly lower in the model training group (P<0.05). No significance was observed in the number of catheterizations between the two groups, as shown in Table 1.

Table 1 Student assessments of endoscopic operation in two groups

Assessment type	Experimental group（n=21）	Control group（n=21）	t value	P value
1.Number of touching	2.02±0.46	3.71±0.61	-10.14	<0.01
2.Number of teacher assistance	1.35±0.60	2.62±0.54	-7.21	<0.01
3.Number of catheterizations	1.25±0.51	2.57±0.63	-7.46	<0.01
4.Finishing time (min)	15.54±0.44	25.15±0.56	-61.84	<0.01

3.2 Questionnaire results

After the endoscopic surgery, the questionnaire VAS scores of two groups were evaluated. The interest in learning, confidence in clinical operation of the otic endoscope, operation proficiency of the otic endoscope, and the satisfaction of the teaching methods were significantly better in the experimental group (P<0.05, Table 2).

Table 2 Student VAS scores (±s) of two teaching methods for endoscopic surgery

Assessment type	Experimental group（n=21）	Control group（n=21）	t	P
1. Interest in learning	6.02±0.65	4.21±0.67	8.89	0.01
2.Confidence in clinical operation of the otic endoscop	7.33±0.64	4.82±0.74	11.76	<0.01
3. Operation proficiency of the otic endoscope	8.05±0.56	3.87±0.63	22.73	<0.01
4. Satisfaction of the teaching methods	7.61±0.48	5.03±0.77	13.03	<0.01

4. Discussion

In recent years, endoscopic surgery is one of the fastest growing areas of otology in China. Since the popularity of the endoscopic surgery system is easier than that of the microscope, an urgent requirement of endoscopic surgery has occurred in a large number of grass-roots units. Although the current large amount of surgical video materials help beginners learn the endoscopic technique, the materials are mostly a two-dimensional view, and fail to present the fine structure of the ear. Once the beginners rashly carry out the operation of the endoscopic surgery, it may cause mild pain in the ear canal of the patient, or even severe complications such as facial paralysis and sensorineural hearing loss [1-3]. In the clinical teaching of endoscopic surgery, there are drawbacks such as limited practical operation opportunities and high ethical risks. Regarding the problem that the theory separates from the practice in clinical teaching, and in order to improve the training quality of endoscopic surgery for students in their further education, our department has tried a variety of clinical teaching methods, among which the external ear canal model training combined with traditional teaching methods has performed well.

As we all know, the development of any surgery is the summary of previous practices. No matter how solid the beginners' theoretical knowledge is, they always need to practice on patients. In fact, in order to reduce the surgery risk, the literature reports some methods for beginners to practice, such as using 3D printed skull [4], simulating endoscopic operation [5,6] and so on. These methods are effective, but high cost and requirement for special places made the daily practice inconvenient and popularization difficult. Therefore, our department designed a simple straw model to simulate the operation environment when using the ear endoscope. Those instruments assist students in their operation for better understanding, and allow them to master the operation skills of the endoscopic surgery. Our results showed that, in the first operation, students from the model training group showed significant improvement in the number of touching the external auditory canal, teacher assistance, and finishing time. The specific performance is as follows: students who have not undergone model training operated stiffly when they entered the external auditory canal, and touched the canal wall easily. Their operation was rusty when using endoscope and instruments, resulting in a long exposure of the surgical field. However, students from the model training group can properly avoid mentioned problems.

Some people may question: Is external auditory canal model training making the operation training a big deal? Actually not at all. In the clinical practice, the endoscope operation is mostly performed when the patient is awake. The skin of external auditory canal is quite sensitive to pain, which does not allow many mistakes during the operation. Through the external auditory canal model training, the teacher can immediately point out the wrong action of the beginner and correct them in time; the operator will also know whether his operation is standardized or not according to whether it is stained around the endoscope. The results show that the model training group performs better in operation familiarizing and teaching method evaluation, indicating that the model training method help students improve their self-confidence in clinical operation and better understand the surgical techniques.

Of course, our ear endoscopic model teaching is also not perfect. For example, (1) the structure of the middle and inner ear cannot be simulated, so that the complicated endoscopic surgery training cannot be performed. (2) There is still a difference comparing to the feeling of the actual patient during the operation. (3) External auditory canal bleeding and the position shift caused by cough in patients, as well as blur lens due to temperature differences need to be corrected in the clinical practice. We will continue to improve the design of teaching instruments, explore more effective teaching methods, and achieve high quality training in endoscopic surgery.

In summary, the application of external auditory canal model combined with traditional teaching methods in ear endoscopic surgery training only requires simple materials and is easy to operate. Those features can effectively solve the drawbacks of limited practice and high ethical risks in the practice of endoscopic surgery. It is good for beginners to cultivate the operation

feel, enhance the operation proficiency of the otic endoscope, and improve the training quality of the endoscopic surgery.

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Competing Financial Interests

The authors declare no competing financial interests.

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