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EDUCATION OF MICROSURGICAL TECHNIQUE FOR YOUNG SURGEONS BY INTERNATIONAL SOCIETY FOR EXPERIMENTAL MICROSURGERY WEST JAPAN AND FUTURE PROSPECTS

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The need for microscopic vascular anastomosis has increased in the field of gastrointestinal surgery. Herein we report the activities for microsurgical training by ISEM West Japan.

Since 2015, we have held the Hands-on seminar twice a year using artificial blood vessel. The participants sutured it with 9-0 polypropylene suture under bench microscopes. Competitions for microsurgical arterial anastomosis were held in the seminar, in which we evaluated the anastomosis regarding the leakage and patency.

Totally 208 participants attended the hands-on seminar. No relation was seen between the years of surgical experience and the score. However, there was a relation between the number of participation and the score.

Through our hands-on seminar, young surgeon could improve technique and motivation for the microsurgery.

Keywords: *Microsurgery, Surgical education, Hands-on seminars.*

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ОБУЧЕНИЕ МОЛОДЫХ ХИРУРГОВ МИКРОХИРУРГИЧЕСКОЙ ТЕХНИКЕ МЕЖДУНАРОДНЫМ ОБЩЕСТВОМ ЭКСПЕРИМЕНТАЛЬНОЙ МИКРОХИРУРГИИ (ЗАПАДНАЯ ЯПОНИЯ) И ПЕРСПЕКТИВЫ НА БУДУЩЕЕ

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Необходимость микроскопического сосудистого анастомоза в области хирургии желудочно-кишечного тракта не подлежит сомнению. Авторы сообщают о деятельности по обучению микрохирургии в ISEM West Japan.

Начиная с 2015 г., два раза в год, мы проводим практический семинар на тему применения искусственных кровеносных сосудов. Участники семинара тренируются шить их полипропиленовым швом 9-0 под настольными микроскопами. На семинаре проводятся соревнования по выполнению микрохирургических артериальных анастомозов, в ходе которых анастомоз оценивается на прочность и проходимость.

В практическом семинаре приняли участие 208 человек. Никакой связи между количеством лет хирургического опыта и полученной на соревновании оценкой не наблюдалось. Однако имелась связь между числом участников и количеством набранных ими баллов.

Благодаря практическому семинару молодые хирурги могут оттачивать технику и повысить мотивацию к занятиям микрохирургией.

Ключевые слова: *микрохирургия, хирургическое образование, практические семинары.*

Конфликт интересов: Эйдзи Кобаяши – медицинский консультант компании Sunarrow Ltd. Искусственный кровеносный сосуд из PVA был разработан компанией Sunarrow Ltd.

Прозрачность финансовой деятельности: никто из авторов не имеет финансовой заинтересованности в представленных материалах или методах.

Для цитирования: Рёсукэ Габата, Шинтаро Яги, Ёдзи Кобаяши. Обучение молодых хирургов микрохирургической технике Международным обществом экспериментальной микрохирургии (Западная Япония) и перспективы на будущее. *Вопросы реконструктивной и пластической хирургии*. 2021;24(1):56–60. doi: 10.52581/1814-1471/76/6

INTRODUCTION

Microsurgery is used in many clinical fields of surgery including neurosurgery, vascular surgery, plastic surgery, and reconstructive surgery [1], and there are many academic societies for each clinical field, but all of them are vertically divided into different fields [2].

In 1991, the International Society for Experimental Microsurgery (ISEM) (http://www.myisem.org/index.php) was founded by Sun Lee, who had developed many experimental organ transplantation models in rats and had been involved in the dissemination of microsurgery technology throughout the World [3].

The goal of ISEM is to promote the use of microsurgery not only in basic research but also in clinical practice worldwide, and it aims to be a cross-sectional organization involving various fields such as transplantation immunology, pharmacology, and veterinary medicine [4]. In addition, ISEM has been working with the European Society for Surgical Research (ESSR) to propose basic educational methods for experimental microsurgery [5].

On the other hand, in the treatment of liver - diseases, living donor liver transplantation, in which the liver can be regenerated in an appropriate condition after resection and the resected liver can be used as a donor graft, has become a common treatment, and many cases have been experienced [6]. Until now, surgeons dealing with hepatobiliary diseases have not needed microsurgery themselves, but the need for microsurgery has been increasing, especially for arterial reconstruction in living donor liver transplantation [7]. Furthermore, arterial reconstruction is sometimes required in the hilar cholangiocarcinoma and pancreatic cancer surgery. However, on-the-job training is the mainstream for the transmission of this technique, and young surgeons have very few opportunities to be involved, and there is less microsurgical training protocol in Japan.

Accordingly, we set up ISEM West Japan Chapter in order to lead young surgeons to experimental surgical research using microsurgery [4]. We have continuously conducted a microsurgery hands-on seminar organized by the ISEM West Japan Section. Herein we report the activities of the Hands-on seminars we have conducted so far, and then discuss advances in microscopy used in microsurgery and future educational strategies in the era of COVID-19.

HANDS-ON SEMINAR OF MICROSURGERY

In the hands-on seminar, based on the concept of "Not to use living-animals to acquire surgical techniques", we delivered a video of vascular anastomosis to the participants beforehand to give them image training, and then practiced anastomosis of artificial blood vessels using a desktop microscope. Since 2015, we have held the seminar once or twice a year in conjunction with several surgical conferences.

At the beginning of the seminar, the tips and pitfalls of vascular anastomosis under the microscope were explained. Then, assuming the reconstruction of the left hepatic artery in pediatric living-donor liver transplantation, we performed the suture practice of end-to-end anastomosis of a 2 mm artificial vessel (Sunarrow Limited, Niigata, Japan) (Fig. 1) with 9-0 polypropylene thread. Finally, in order to improve the participants' technique in a more scientific manner, we provided feedback on the technique evaluation [4]. And to lift the spirits of the participants, we conducted a contest to evaluate the anastomosis of a 2 mm artificial vessel with 9-0 polypropylene thread (Crownjun, Ichikawa, Japan) in 30 minutes.

Fig. 1. Artificial blood vessel made of PVA for training [4]

Рис. 1. Предназначенные для обучения искусственные кровеносные сосуды, изготовленные из поливинилового спирта [4]

The anastomosis was evaluated by two surgeons performing arterial anastomosis for liver transplantation in a blinded fashion. We evaluated the anastomosis regarding patency, leakage, and the knot from inside and outside. The evaluation methods were as follows: (1) water-proof / leak and patency test (5 points) using an infusion set with an 18G plastic needle connected to their artificial vessels (2). Observation of the anastomosis from the inside and outside (4 points) by making an incision in the long axis direction and pressing the anastomosis with acrylic plates. The total score (9 points in total) (Table 1) was used to award the prize for excellence.

Table 1. The total score used to award the prize for excellence

Таблица 1. Количество присуждаемых баллов за выполнение тестовых заданий

Water-proof test	Patency test	Anastomosis (inner)	Anastomosis (outer)
3 points: No leakage	2 points: Good Patency	2 points: Regular	2 points: Regular
2 points: Little leakage	1 point: Moderate Patency	1 point: Patially irregular	1 point: Patially irregular
1 point: Spout	0 point: No patency	0 point: Irregular	0 point: Irregular
0 point: Not connected	–	–	–

RESULTS

From 2015 to 2018, five hands-on seminars were held in conjunction with relevant conferences on transplantation and general surgery (Kumamoto in October 2015; Osaka in June 2016; Tokyo in November 2016; Kanazawa in July 2017; and Kyoto in December 2017). Of the 208 participants who attended the hands-on seminar, 91% (190 participants) were under 35 years old, including 5 medical and veterinary students. The competition in the Hands-on seminar was held with 77 participants. There was no correlation between the number of years of surgical practice and the scores, but participants who attended the hands-on seminar four or more times (11 participants, median 8 points) scored significantly higher than those who attended the hands-on seminar three or less times (66 participants, median 3 points) ($p = 0.0010$, Kruskal Wallis test). And the individual score of participants, who attended the hands-on seminar multiple times, increased in proportion to the number of times they attended. The participant who got the highest score was the surgeon who attended all our hands-on seminar.

DISCUSSION

Basic education in microsurgery recommends the effective use of non-biomaterials without using living-animals [2, 5] We have also performed hands-on education with artificial blood vessels made from polyvinyl alcohol (PVA) [4]. This PVA has been further improved and can be used for super microsurgery training [9].

We have provided hands-on education for young surgeons at conferences on general surgery, which are not directly related to microsurgery. Owing this biomaterial, we could provide education without contamination at hotel venues. In addition, that many young surgeons could participate in this seminar because the participation fee was reduced by subsidies from the public budget. The contests for the anastomosis of the artificial vessels have been held to motivate the young participants.

On the other hand, Surgical techniques have changed dramatically with the advancement of various medical surgical instruments. In the 1900s, the basis of surgery was “direct” technique, in which the surgeon looked directly with the eyes, but with the development of endoscopes, the technique has changed to “indirect” technique, in which the surgeon looks at the surgical field on an electronic screen and uses forceps to resect or suture the lesion. In other words, “head up surgery”, as represented by laparoscopic surgery and robotic surgery, is emerging in the field of digestive surgery, and young surgeons are adapting to “indirect surgery”, in which the “direction to look” is different from the “direction to work”.

The degree of proficiency is deeply related how soon surgeons start learning same as that of leaning sports. In other words, it is important to experience and practice “indirect” surgery from an

early stage. Although microsurgery is originally an "indirect surgery", the introduction of the video microscope has opened up the possibility of head-up surgery, in which the surgeon, assistant, and observer share the same high-quality screen as in laparoscopic surgery [9].

We have developed a 3D-4K video microscope as part of a medical-engineering collaboration project, and we succeeded in commercializing it under the product name "Hawk Sight".

This ultra-high-quality image can be transmitted remotely in high-definition such as 5G, eliminating the need for the field to instruct the hands-on and the young doctors participating in the hands-on to gather together.

In the era of COVID-19, it is important to provide education through hands-on webinars via the Internet using these ultra-high images. By using online, the education can be extended not only to Japan but also to the World.

CONCLUSION

Young surgeons in digestive surgery have few opportunities to learn vascular anastomosis techniques under the microscope, and it is difficult for them to master the techniques. However, the practical training in the microsurgery hands-on seminar using artificial vessels and the objective evaluation of anastomosis techniques through a contest improved the motivation and anastomosis skills of the participants.

Development and innovation of devices are also important to increase the number of young surgeons who are interested in microsurgery.

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