The past, present, and ideal future of cadaver surgical training in Japan

Journal:	*Surgery Today*
Manuscript ID	ST-2021-0364-SC
Manuscript Type:	Short Communication
Date Submitted by the Author:	21-Apr-2021
Complete List of Authors:	Shichinohe, Toshiaki; Department of Gastroenterological Surgery II, Hokkaido University Graduate School of Medicine Kobayashi, Eiji; The Jikei University School of Medicine, Department of Kidney Regenerative Medicine
Category:	Adrenal gland
Additional Categories:	
Abstract:	The framework for cadaver surgical training (CST) in Japan was established in 2012 based on the "Guidelines for Cadaver Dissection in Education and Research of Clinical Medicine" of the Japan Surgical Society (JSS) and the Japanese Association of Anatomists. Afterwards, Japan's Ministry of Health, Labour and Welfare allocated funding from its budget for CST. As of 2019, CST has been conducted in 33 medical schools and universities. Currently, the CST Promotion Committee of the JSS reviews each CST report submitted by medical schools and universities, and provides appropriate guidance based on professional autonomy. This paper outlines the history of CST in Japan. To sustain CST implementation, we propose the need for an operating organization that can oversee the implementation of CST and receive funds from stakeholders, such as government agencies, academic societies, and companies.

Article Type: Short Communication

The past, present, and ideal future of cadaver surgical training in Japan

Toshiaki Shichinohe[1], Eiji Kobayashi[2*]

[1] Department of Gastroenterological Surgery II, Hokkaido University. Sapporo, Hokkaido, Japan.

[2] Department of Kidney Regenerative Medicine, The Jikei University School of Medicine. Minato-ku, Tokyo, Japan.

*Corresponding author: Eiji Kobayashi, MD, Ph.D.

Department of Kidney Regenerative Medicine, The Jikei University School of Medicine.

3-25-8 Nishi-Shimbashi, Minato-ku, Tokyo, Japan 105-8461

TEL: +81-3-3433-1111 (Ext 3233) FAX: +81-3-5400-1290

Email: eijikoba@jikei.ac.jp

Keywords: cadaver surgical training, body donation, clinical anatomy

Abstract

The framework for cadaver surgical training (CST) in Japan was established in 2012 based on the “Guidelines for Cadaver Dissection in Education and Research of Clinical Medicine” of the Japan Surgical Society (JSS) and the Japanese Association of Anatomists. Afterwards, Japan’s Ministry of Health, Labour and Welfare allocated funding from its budget for CST. As of 2019, CST has been conducted in 33 medical schools and universities. Currently, the CST Promotion Committee of the JSS reviews each CST report submitted by medical schools and universities, and provides appropriate guidance based on professional autonomy. This paper outlines the history of CST in Japan. To sustain CST implementation, we propose the need for an operating organization that can oversee the implementation of CST and receive funds from stakeholders, such as government agencies, academic societies, and companies.

Main text

Cadaver dissection has been introduced to medical students as the basis of medical education in anatomy since the dawn of medicine and is still the norm worldwide. Meanwhile, cadaver surgical training (CST) is believed to be an effective educational method for surgeons to learn surgical techniques [1,2]. However, its circumstances differ by country because of religious and cultural differences in the treatment of cadavers, as well as differences in the medical education system after graduation [3]. Cadaver surgical training did not have clear implementation criteria in Japan until the publication of the “Guidelines for Cadaver Dissection in Education and Research of Clinical Medicine,” which was drafted by the Japan Surgical Society (JSS) and Japanese Association of Anatomists (JAA) in 2012 [4]. Owing to the publication of these guidelines and budgetary measures taken by the Ministry of Health, Labour and Welfare (MHLW), the number of medical schools and universities that implement CST has recently been increasing rapidly. In this paper, we look back on the history of cadaver dissection to date and describe the prospects of CST regarding its spread in Japan.

From the Past to the Present

History of anatomy: Records have shown that the first cadaver dissection was performed on an executed prisoner by Doctor Toyo Yamawaki during the Edo period of Japan in 1754. In 1859, Dutch army surgeon J. L. C. Pompe van Meerdervoort performed cadaver dissection as part of modern medical education in Japan. Since then, it has become one of the foundations of medical education in the country. After World War II, the body donation system was established in Japan. Modern cadaver dissection for anatomy education was conducted primarily on cadavers donated by the deceased and their families with their consent. However, the main educational method for the postgraduate education of surgeons was on-the-job training when CST had not yet been publicly discussed.

Eve of the spread of CST: Cadaver surgical training has mainly been used in North America in recent years for the purpose of introducing various implants and mastering new medical techniques (e.g., endoscopic surgery). Meanwhile, CST implementation remained stagnant in Japan until recently due to the sensational newspaper coverage of a company-sponsored seminar on dental implant procedures using imported cranial

cadavers in 1997. Following a series of sensationalistic reports, the Ministry of Health and Welfare at the time stated that improper CST implementation could lead to the crime of corpse damage, as defined by the Penal Code. Subsequently, the demand for CST implementation increased with the progress of surgical procedures and the introduction of advanced medical devices from overseas. However, CST in Japan was considered a legal "gray zone," and only a limited number of universities implemented it.

Current Status of CST

CST guidelines: Courses on CST for endoscopic surgery in each surgical field were actively conducted at the end of the 20th century, mainly in North America, while some Japanese doctors were taking these courses overseas. The increasing need for CST by Japanese surgeons has become a policy issue. Thus, an MHLW research, "Survey of Training Systems for Surgical Skills and Procedures," was conducted by the late professor, Satoshi Kondo, of Hokkaido University with members of the JSS, JAA, and other surgical societies in 2008. The research group surveyed the status of surgical training including CST in Japan and worldwide, coordinated the opinions of related

surgical societies, and proposed the “Draft of Guidelines for Cadaver Dissection in Education and Research of Clinical Medicine” in the third year of research.

In 2012, the JSS and the JAA jointly published the “Guidelines for Cadaver Dissection in Education and Research of Clinical Medicine” [4] based on the drafted guidelines, and with the approval of associated academic societies and the government (MHLW and the Ministry of Education, Culture, Sports, Science and Technology). These guidelines reinforce the Postmortem Examination and Corpse Preservation Act and the Body Donation Act, which forms the legal basis for CST. The guidelines allow the use of cadavers not only for CST, but also for clinical research and medical device development (Table 1). The key points of the rules of the established guidelines are listed in Table 2. Cadaver surgical training can only be implemented in medical and dental schools and universities. While still alive, the deceased should have consented to his or her corpse being used for medical university education and research, and the family of the deceased should have given their consent after the death of the individual. Furthermore, based on professional autonomy, the officers of each CST must report the details of the implementation and any conflicts of interest to the CST Promotion

Committee of the JSS. In response to the reporting system, the JSS organized a committee to review the reports and provide advice on the proper implementation of CST to each school and university.

Rapid spread: Immediately after the guidelines were published in 2013, only 6 out of 80 medical schools and universities in Japan reported the implementation of CST to the JSS. Meanwhile, the MHLW started to support 6 universities by investing approximately 45 million yen in competitive research funds per year as operating expenses for CST implementation from FY2013. Subsequently, presentations on CST have become more common, especially in surgical societies. The implementation of CST has been recognized as an effective method for post-graduate education and medical safety in Japan [5-9]. In FY2018, the MHLW increased the competitive research funds for CST to approximately 300 million yen per year, of which 200 million yen was to be used for the acquisition of equipment and 100 million yen for operating expenses. This support has continued until now (FY2021) thanks to the efforts of the stakeholders.

Growing government support has spurred the rapid spread of CST. A national report in 2019 indicated that 629 training sessions were held annually at 33 medical schools

and universities, with 5,042 doctors participating (Fig. 1). Furthermore, the total number of donated cadavers used for CST and clinical research in Japan reached 1,012. To implement CST, many facilities in Japan also use the Thiel fixation and other cadaver preservation methods for embalming cadavers rather than using fresh ones, which enable endoscopic surgery such as laparoscopy [10-12].

Diversification of needs: The spread of CST has not only caused an increase in the reported cases of CST to JSS, but also the diversification of its contents. When reports are categorized by purpose, programs for basic and standard surgical techniques are the most common, and those for advanced surgery are also conducted to the same extent, followed by clinical anatomy programs aimed at anatomical exploration for surgery (Table 1). These results show that CST is widely applied in the postgraduate education of doctors, from their basic training at the internship level to advanced medical research, as a safe method for learning invasive procedures without burdening patients. The implementation content in FY2019 categorized by clinical department showed that CST was conducted in a wide range of surgical fields, with the orthopedic field being the largest (28%), followed by general surgery (24%), otolaryngology (12%),

and brain surgery (10%) (Table 3). Meanwhile, fewer than 10 experiments for the research and development (R&D) of medical devices has been conducted throughout this period.

Challenges of CST

CST in the era of COVID-19: While the number of CST implementations has decreased in 2020 due to the impact of COVID-19, it is still useful even under pandemic conditions. Because on-the-job training should be avoided during the COVID-19 pandemic due to its risk of infection, CST has attracted attention as a recommended educational method. Its minimum risk of infection is due to its routine use of personal protective equipment in a facility with sufficient infection control and air ventilation. While manufacturers of Japanese medical devices have conducted verification tests of prototypes using cadavers through R&D at specialized facilities overseas, travel restrictions due to the pandemic have hampered the manufacturing process. This situation raises awareness on the need to establish R&D platforms in Japan.

Future of professional autonomy: To date, the spread of CST in Japan has been headed by the JSS, an organization based on general surgery, including thoracic, gastrointestinal, pediatric, breast, and endocrine surgery. The JSS has also imposed and reviewed professional autonomy-based reports of each CST in universities; however, the number of reports in surgical fields covered by the JSS accounts for only a quarter of recent reports (Table 3). Therefore, shifting the reviewing base to an inclusive organization that can supervise the activities of academic societies in the entire medical field, such as the Japanese Medical Science Federation, is desirable in the future.

Future of CST: Since the CST guideline was opened up in 2012, Japan's CST based on the body donation system has been implemented gradually but widely spreading. It is worthwhile saying that implementation of CST in Japan has been kept without monetary incentive during these 10 years, while several countries implement in a way that provide some benefits.

Prior to COVID-19 pandemic, doctors in some developed countries installing no such CST system attended a “luxury” CST seminar, if they could afford expensive tuition

fees, as well as airline tickets and accommodation fees. These seminars can be seen as having formed a so-called “business model” between doctors seeking skill improvement, patients seeking surgery by certified doctors, and seminar organizers and organizations that handle body donations. Meanwhile, Japan's CST has developed without such monetary incentives; the current situation of Japan's CST relies on surgeons who are passionate to educate surgeons who are eager to improve their skills. When considering that the objective of CST is to disseminate advanced medical techniques and improve medical safety, and that the wishes of body donors are also to “advance medicine”, it would be logical to develop some desirable and effective incentives for the implementation of CST for both the trainer and the trainee. Examples of such incentives have partially been applied in a specific clinical field as follows: to count CST participation as a credit for the board certifications of a certain surgical specialties, and to certificate a health insurance payment to high-difficulty surgery limited to a surgeon who has trained the operation by CST. In addition to the incentive for trainees, governmental and non-governmental support for clinicians, anatomists, and universities who organize CST is also important. Some universities overseas have

established that contribution to CST is equally evaluated to scientific publication in academic attainments (Professor Rene Tolba, RWTH Aachen University; personal communication).

To establish both CST and R&D infrastructure in future, broad discussion and building consensus not only within the medical societies but also to the public is necessary.

Acknowledgements

We would like to express our deepest gratitude to the late Professor Satoshi Kondo, who established the research group in 2008 for the establishment of the CST implementation platform in Japan. Furthermore, we would like to thank all members of the CST Promotion Committee of the JSS since the organization has been involved in various activities, such as the creation of guidelines, peer review implementation, and public relations activities since 2011. We would like to thank the Chairs Profs. Takashi Kondo and Hiroshi Date, as well as the following members (in alphabetical order by last name): Drs. Toyoshi Fujimoto, Naohito Hato, Masako Hiramatsu, Satoshi Hirano, Chizuka Ide, Toshihiko Iwanaga, Yoshimitsu Izawa, Hiroomi Kanayama, Tomoyasu Kato, Akio Kikuta, Eiji Kobayashi, Hiroshi Kurita, Mitsuhito Mase, Yoshiro Matsui, Yutaka Nohara, Takanori Shibata, Toshiaki Shichinohe, Yasuhiro Shirakawa, Takane Suzuki, Haruo Takahashi, Yoshimasa Takeda, Hiroshi Taneichi, Toshio Terashima, Toshiyuki Tsurumoto, Yasuo Uchiyama, Masahiko Watanabe, Hiroyuki Yaginuma, Kumiko Yamaguchi, and Kazunari Yoshida.

Regarding future plans, we received advice from the Japanese Association of Medical Sciences President Dr. Morito Monden and the Japan Surgical Society President Dr. Masaki Mori. Finally, we would like to mention that Mr. Takahiro Uesawa and Mr. Kentaro Kaneko (Japan Surgery Society Secretariat) have contributed as institutional contact points over the years.

Conflict of Interest:

The authors declare that there is no conflict of interest.

References

1. Gilbody J, Prasthofer AW, Ho K, Costa ML. The use and effectiveness of cadaveric workshops in higher surgical training: a systematic review. Ann R Coll Surg Engl. 2011;93(5):347-52. doi: 10.1308/147870811X582954.

2. James HK, Chapman AW, Pattison GTR, Griffin DR, Fisher JD. Systematic review of the current status of cadaveric simulation for surgical training. Br J Surg. 2019 ;106(13):1726-1734. doi: 10.1002/bjs.11325.

3. Kobayashi E, Nudeshima J. Current state of surgical training using cadavers in Japan compared with Western countries. Surg Today. 2018;48(9):891-893. doi: 10.1007/s00595-018-1673-4.

4. Japan Surgical Society and Japanese Association of Anatomists. Guidelines for cadaver dissection in education and research of clinical medicine; 2018. [cited April 2021]. https://www.jssoc.or.jp/journal/guideline/info20180406-01.pdf (in Japanese). Accessed April, 2021.

5. Homma H, Oda J, Yukioka T, Hayashi S, Suzuki T, Kawai K, et al. Effectiveness of cadaver-based educational seminar for trauma surgery: skills retention after half-year follow-up. Acute Med Surg. 2016;4(1):57-67. doi: 10.1002/ams2.230.

6. Homma H, Oda J, Sano H, Kawai K, Koizumi N, Uramoto H, et al. Advanced cadaver-based educational seminar for trauma surgery using saturated salt solution-embalmed cadavers. Acute Med Surg. 2019;6(2):123-130. doi: 10.1002/ams2.390.

7. Miyake S, Suenaga J, Miyazaki R, Sasame J, Akimoto T, Tanaka T, et al. Thiel's embalming method with additional intra-cerebral ventricular formalin injection (TEIF) for cadaver training of head and brain surgery. Anat Sci Int. 2020;95(4):564-570. doi: 10.1007/s12565-020-00545-z.

8. Watanabe M, Yoneyama Y, Hamada H, Kohno M, Hasegawa O, Takahashi H, et al. The Usefulness of Saturated Salt Solution Embalming Method for Oral Surgical Skills Training: A New Cadaveric Training Model for Bone Harvesting. Anat Sci Educ. 2020;13(5):628-635. doi: 10.1002/ase.1925.

9. Tokairin Y, Nakajima Y, Nagai K, Yamaguchi K, Akita K, Kinugasa Y. Aortic inflation with agar injection is a useful method of cadaveric preparation which creates a mediastinal anatomy that better mimics the living body for surgical training. Gen Thorac Cardiovasc Surg. 2020;68(6):652-654. doi: 10.1007/s11748-019-01258-5.

10. Thiel W. Die Konservierung ganzer Leichen in natürlichen Farben [The preservation of the whole corpse with natural color]. Ann Anat. 1992;174(3):185-95. German. PMID: 1503236.

11. Hayashi S, Naito M, Kawata S, Qu N, Hatayama N, Hirai S, et al. History and future of human cadaver preservation for surgical training: from formalin to saturated salt solution method. Anat Sci Int. 2016;91(1):1-7. doi: 10.1007/s12565-015-0299-5.

12. Nagase M, Kimoto Y, Sunami E, Matsumura G. A new human cadaver model for laparoscopic training using N-vinyl-2-pyrrolidone: a feasibility study. Anat Sci Int. 2020;95(1):156-164. doi: 10.1007/s12565-019-00494-2.

Table 1

Example of cadaver use in medical education and research [4]

(1) Acquisition of basic medical techniques - Use of cadavers by doctors-in-training with the objective of acquiring anatomical knowledge needed for safe medical techniques.
(2) Acquisition of basic surgical techniques and invasive techniques - Use of cadavers in clinical anatomy education for learning necessary surgical and invasive techniques that can serve as alternatives for on-the-job training (OnJT) or animal training.
(3) Acquisition of surgical techniques or invasive techniques that require advanced technology - Use of cadavers in clinical anatomy education and research for learning advanced surgical techniques with few OnJT opportunities or those that are difficult to learn using animals due to their anatomical differences with the human body.
(4) Research and development of new surgical techniques, invasive techniques, and medical devices - Use of cadavers with the objective of researching the preclinical verification of surgical techniques or developing new surgical devices.

Table 2

Implementation conditions of using cadavers in education and research for clinical medicine [4]

(1) The objective should be to improve medical safety through education and research for clinical medicine, and contribute to welfare.

(2) Implementation should be done within the scope of the Postmortem Examination and Corpse Preservation Act and the Body Donation Act in medical universities (dental universities, universities with medical departments, and dental departments) as part of medical education and research.

(3) The cadavers used should satisfy the following conditions:

- Registered body donors who are now deceased should have provided written intent for the corpse to be used in medical education and research, including dissection education conducted by students as well as clinical medicine, such as surgical training by doctors and dentists.

- When the family is present, understanding and approval are obtained from them as well.

(4) When implementing the training, approval and sufficient consultation and investigation should be obtained from the ethical committee of the university.

Table 3.

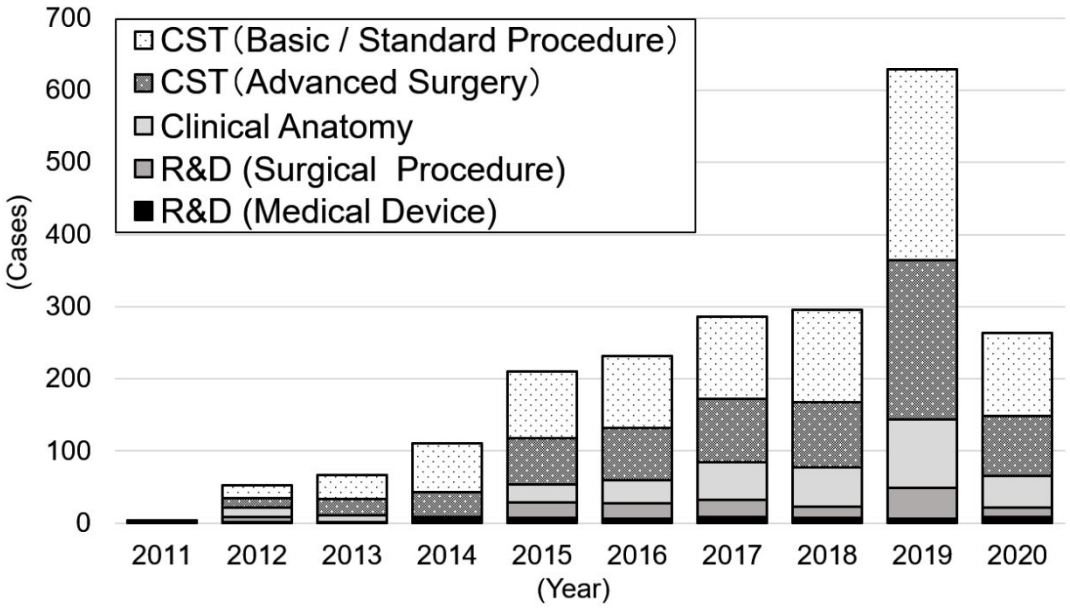
Status of use of cadavers for surgical education and research in Japan (2019)

Objectives and Fields		Cases	(%)	Details:	Cases (%)
Objectives	Education	125*	(91**)	Basic medical: technique:	33* (24**)
				Standard surgery:	86* (62**)
				Advanced surgery:	86* (62**)
	Research	48*	(35**)	Clinical anatomy:	42* (30**)
				Research and development of novel surgical procedures:	13* (9*)
				Research and development of medical devices:	1* (1**)
Fields	Orthopedic	39	(28)		
	General Surgery	33	(24)	Digestive:	15 (45)
				Hepato-Biliary-Pancreatic:	8 (24)
				Respiratory:	7 (21)
				Cardiovascular:	1 (3)
				Mammary & Endocrine:	2 (6)
	Otolaryngology	17	(12)		
	Brain surgery	14	(10)		
	Plastic surgery	12	(9)		
	Oral surgery	7	(5)		
	Emergency	6	(4)		
	Obstetrics	4	(3)		
	Urology	4	(3)		
	Anesthesiology	2	(2)		
	Total	138			

*Duplicates included, **Cases/total cases

Fig. 1.

Annual trends in surgical education and research cases using donated cadavers in Japan



Data from the annual reports of the Japan Surgical Society CST Promotion Committee

CST: Cadaver Surgical Training, R&D: Research and Development