

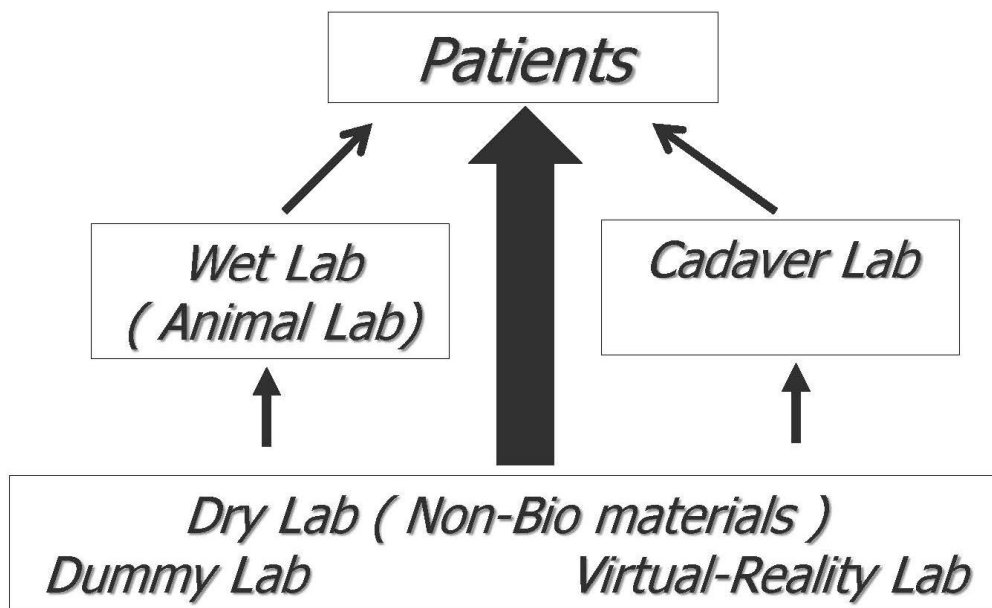
# The development of surgical training materials from sacrificed experimental pigs; The co-research project with Aizu Medical Center in Fukushima Prefecture

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## Background

There exist in our country following three methods for surgical technique training.

## How we develop medical techniques?



(E Kobayashi )

In the first place, there are three different methods how to provide autopsy training; 1. Make full use of dummies for simulation. 2. Cadaver training relying on body donation 3. Use of experimental animals such as pigs. The guideline for cadaver training by body donation has been summed up mainly by Japan Surgical Society and The Japanese Association of Anatomists and it has been spreading considerably nationwide under the supervision of the Ministry of Health, Labor and Welfare. There exists high cost issue of maintaining so-called Wet labs to deal with live animals which have been under construction in various medical universities in line with the development of advanced medical devices. The ideal is the simulation to dispense with cadaver or live animals. But it is more than clear that there is a limit for simulation training without the above.

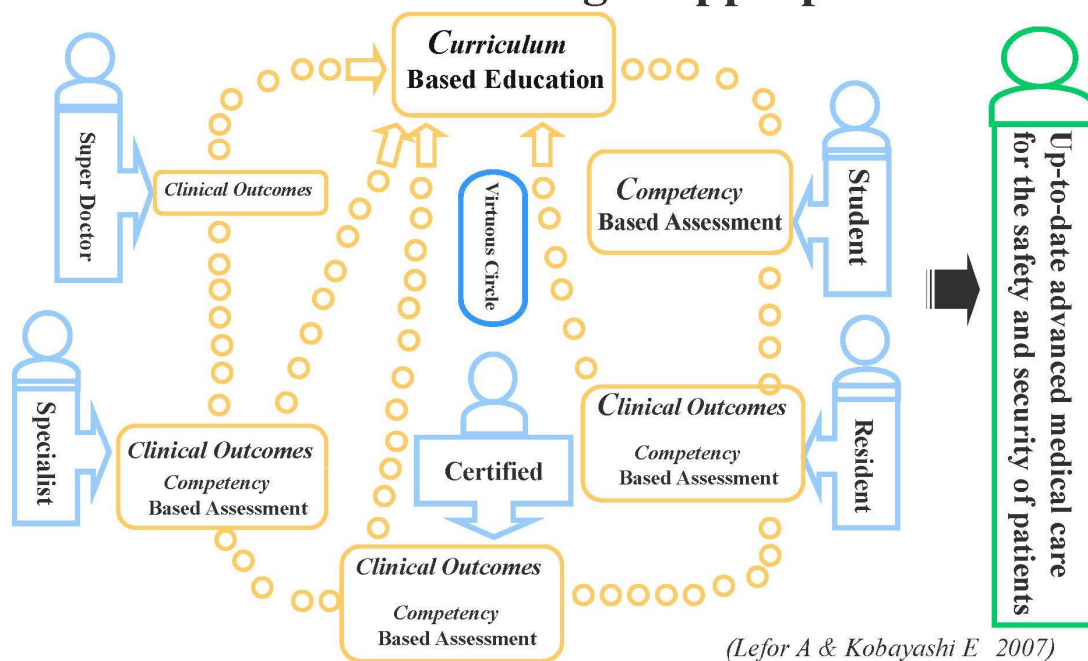
Taking the importance of surgical training through the usage of live animals into consideration, which is positioned above simulation training, I started to use pigs instead of homeless dogs 15 years ago for teaching practices towards students of surgery. More longer than 40 years ago, not only my long career as a medical student and doctor including learning period at Jichi Medical University but also overall researches and educations at schools of medicine have been deeply supported by the

homeless dogs for experiments.

The training practice was dedicated to 5<sup>th</sup> grade students of digestive surgery that last for 3 weeks entitled *ōShine the Scalpelō* to be translated into Japanese *ōMesu Yo Kagayakeō*. The content of the training was framed with abdominal opening, gastronomy and suturing with an entire pig under anesthesia by a team of 4 to 5 students. In the beginning of training program, I let them experience hand and machine suturing and generate merits and pitfalls of each method. The training covered not only operative procedures but postoperative management such as pain control and transfusion management applied to human operation (Category C- D experiment). In the first week after operation I let them enucleate the operated organ under sufficient anesthesia and observe sutured part with additional resuscitation training practice of cardiovascular system, which has been renewed year by year.

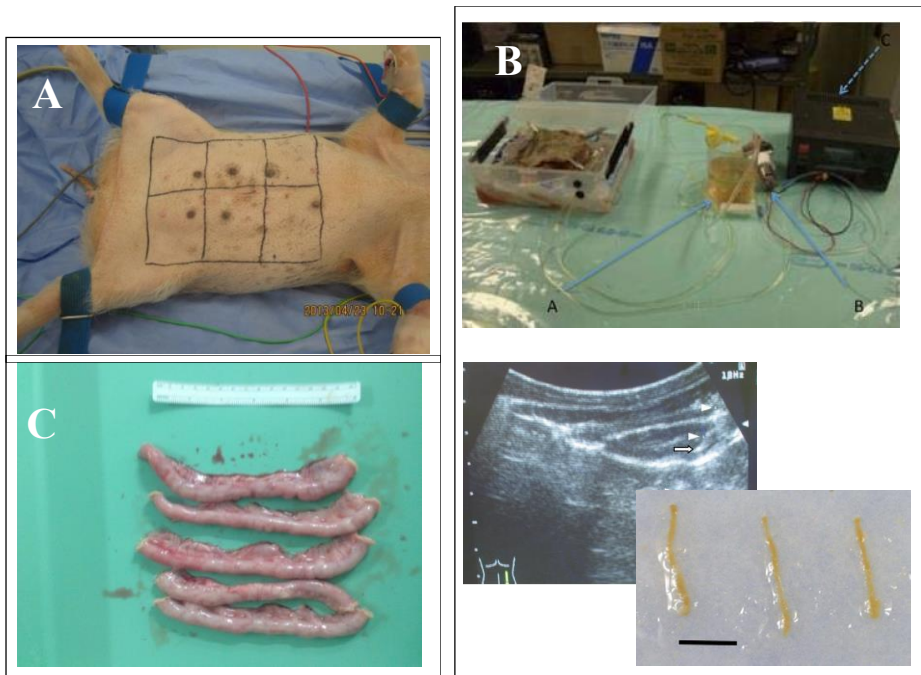
I have been putting forward the necessity of 3 Cs for this kind of training programs.

## Scientific assessment is always required to judge whether the training is appropriate



In the first place, we develop a said curriculum with pig training (Curriculum). Then we evaluate students participated by their competency (Competency). In the end, we check how they reflect the learnings such as skills and techniques in the actual treatments toward patients (Clinical outcome). By repeating these 3 Cs, I feel confident that we can establish a training program merely beneficial to patients and appreciable to the sacrificed animals.

Furthermore, we have been considering how we could develop extended *ōEx vivoō* training by enucleating training materials from the sacrificed pigs.



- A: Abdominal wall model with skins from the sacrificed pigs after euthanasia
- B: ōBento Kidneyō model with vascular functions from pigs
- C: Intestinal tract model kept in non-formalin liquid

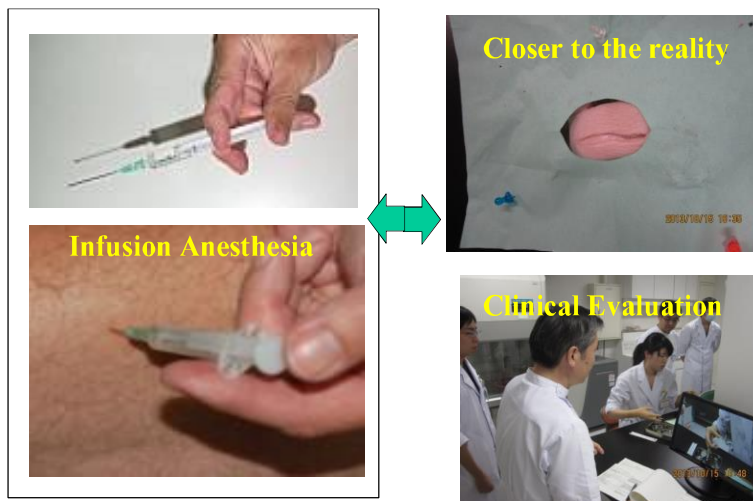
### The development of simulation training model for learning surgical techniques at Aizu Medical Center

It is extremely important to use *in vivo* simulation (Wet Lab) by experimental animals for those young doctors to learn surgical skills and techniques. However, it is utmost difficult to introduce it to community medicine fields on account of the limitation of venue and expenses. Prof. Takuro Saito of Aizu Medical Center in collaboration with Profs. Eiji Kobayashi, Alan Lefor and Shuji Hishikawa of Jichi Medical University have started to develop skin suturing simulation model by transferring frozen pig skin as a trial simulation model in community medicine fields.



(The co-research meeting between Jichi Medical University and Aizu Medical Center; From left, Profs. Lefor, Saito, Hishikawa and Kobayashi in April 2012)

And then, the abdominal wall with muscular layer frozen after resecting at Jichi Medical University were transferred to Aizu Medical Center where 40 students of 5<sup>th</sup> grade of BSL, Fukushima Prefectural University had been given a series of practical training for local anesthesia and suturing skills and techniques. The defrosted pig skins were evaluated by the students in 20 points as full scores by appearance, haptics, feeling and reality. A series of skills and techniques from local anesthesia to skin suturing were explained same as OSCE to be synchronized with that of patients by the medical instructors with evaluation(in 16 points as full scores) together with feedback by video shooting. The trainings took place twice a week divided into groups of 3 and the practicabilities had been evaluated in 5 points as full scores by the participating students.



The core value of the program is focused on the technique for invasive anesthesia that is not possible under Dry simulation.

The practicing time for technique has been effectively shortened from the first  $211 \pm 63$ pt to  $161 \pm 51$ pt ( $p < 0.05$ ). Evaluating points for the knowledge of extending explanation and consent for local anesthesia by medical instructor has successfully risen from  $2.9 \pm 1.1$ pt/4pt to  $3.5 \pm 1.0$ pt/4pt ( $p < 0.05$ ), also the evaluation by participating students by themselves has risen from  $9.2 \pm 1.6$ pt/15pt to  $10.7 \pm 1.2$ pt/15pt ( $p < 0.05$ ) in an affirmative manner. The overall evaluation for the training effectiveness has been fairly well at  $4.8 \pm 0.4$ pt/5pt.

The condition of frozen pig abdominal walls after the transport has been good enough and we could use them for skin suturing simulation training at community medicine premises. The practices taken place twice greatly contributed to the effective learning and we have come to a conclusion that it could be a surgical technique training model in community medicine hospitals.

### **The establishment of non-interruptive academia-academia organization**

In the meantime it has been proven that the tissues and organs enucleated from experimental pigs at Jichi Medical University are suitable for surgical training in distant places, there have been necessities to supply permanently these educational materials. In the fiscal year 2013 we considered other educational material development while we had been continuing academia-academia co-researches.



A: Train transfer point from Shikansen to local lines at Koriyama station

B: Local train to Aizu leaves every hour

C: 2<sup>nd</sup> floor Shinkansen to 1<sup>st</sup> floor Aizu line

D: The train body is decorated with NHK TV drama 〇Yae no sakura〇 (double cherry blossoms)



(The picture taken after the training with students on 15<sup>th</sup> of October 2013)

## The project to generate “Aizu Model” in line with academia-industry collaboration

The pig abdominal wall model is available for frozen preservation and less costly even considering the transfer cost by courier service. On the contrary, the internal organs actually are less-resistant against freezing and defrosting and greatly damaged to the extent that they are sometimes infected by viruses. Up until current days pathology specimen fixing in formalin is widely used. But the volatile odor creates big problem and is subject to legal regulations. There was a necessity to have developed new method of preserving and transferring surgical education materials easily to distant places.

In collaboration with Prof. Saito, I have been executing a pilot experiment with pig bowel and liver paying attention to non-formalin (Bilriton) that has been developed by Nippon Medical and Chemical Instruments Co., Ltd.



A: The experiment of pig liver fixing in Bilriton liquid provided by the slaughter house in Koriyama city (Oct. 14, 2014)

B: Recirculating system set outside the slaughter house in Koriyama

C: Recirculation of pig liver with Bilriton dyed liquid

## The outlook for the consistent development of surgical training materials

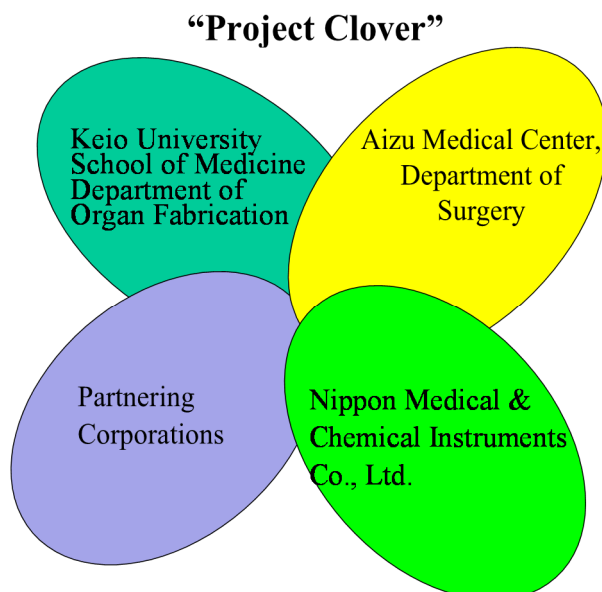
The below chart shows the outcome from the development of surgical training materials at Aizu Medical Center that are mainly divided into two categories; one is for freezing preservation and the other is fixed with non-formalin liquid, which we look into possibilities of marketing them as *ōAizu Modelō*

## The project to develop medical training materials by embracing sacrificed pigs

Project and Steps	Training materials	Storage method	Necessary tools and materials	
			Actual cost	(Providers)
Manuscript	Abdominal wall with skin	Freezing Common Refrigerator	Several hundred yen	3-0 Cutting needle (Ethicon)
Conference Presentation	Intestinal tract	Fixing Bilriton Liquid (Density not fixed)	Several thousand yen	Automatic Anastomosis Device (J&J and others) Fixing Liquid (Nippon Medical and Chemical Instruments Co., Ltd.)
Undisclosed	Liver	Fixing 25%Bilriton Liquid	About 10,000yen	Navigation Device (Olympus and others) Fixing Liquid (Nippon Medical and Chemical Instruments Co., Ltd.)

Currently some of each models have been in the process of manuscript editing, conference presentation as academia for respective availabilities. Furthermore, we have proven that the abdominal wall model is good enough for being preserved in frozen with some exceptions that there exist models recommended for being fixed in Bilriton liquid to prevent from infection. The development of training materials are ought to be covered partially by the public funds leaving the importance of organizing permanent supply system of sacrificed pigs involving the related industries collaboration

## The project for medical training material development at Aizu Medical Center



Further partnering corporations are considered to be pig-related and educational equipment manufacturers. Luckily there exist in Fukushima prefecture lots of corporations in the designated industry sectors. We started cooperation with Johnson & Johnson Family of Companies in Japan too.

As is explained on the above, I would propose an idea of developing surgical materials in general based in Aizu (Fukushima Prefecture) considering corporate participation such as Aizu Medical Center.

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