# A pilot study: feasibility of a sheep model for training in laparoscopic surgery without using any volatile anesthetics

## *Koyun laparoskopik eğitim modelinin inhalasyon anestezisi kullanmaksızın uygulanabilirliği üzerine bir pilot çalışma*

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Nowadays, laparoscopy is widely used in many fields of surgery. Many surgeons use a minimally invasive approach in the management of diseases requiring surgery. Laparoscopy has numerous advantages over a laparotomic approach, such as a smaller incision, better visualization, lower blood loss, and less postoperative adhesion formation. Smaller doses of pain killers, shorter hospital stay, and quick recovery are additional advantages.

Despite all of its advantages, there are some concerns about laparoscopic surgery: the steep learning curve is a major problem. Laparoscopic instruments have been designed for right-handed surgeons and this can create learning problems for left-handed surgeons. Performing surgery in a three-dimensional space but watching it in two dimensions can result in great difficulties at the beginning of the learning curve. Most trainees suffer from limited depth perception and lack of this sense can cause complications in laparoscopic surgery.

A successful curriculum for developing laparoscopic skills depends on many factors, including participant motivation, available resources, appropriate trainers, and faculty commitment. Advanced surgical skills such as laparoscopic suturing, handling unipolar and bipolar tools, and removing gross tissues from the abdominal cavity are difficult to learn under the conditions of an operating room. Acquisition of laparoscopic skills on simulators is becoming an essential part of surgical resident education. Surgical training outside the operating room is very popular (1). Video box trainers are best suited for this purpose. Practicing with simulators before surgery can reduce the complications and unintentional movements during the surgery. According to Karni et al, practice can set in motion neural processes that continue to evolve many hours after the practice has ended (2). Despite the progress and improvement of simulators and endo-trainers, they still do not provide a real surgical space for trainees.

However, advanced laparoscopic skills, such as dissection, cutting, coagulation, and stitching, require more sophisticated animal or human cadaver models. Like simulators and endo-trainers, using animal models is attractive for instructors and trainees. To reduce the learning curve in humans, several training models have been developed for teaching laparoscopic surgery: mouse (3, 4), rat (5), rabbit (6, 7), chicken (8), baboon (9), dog (10), sheep (11), and pig (12).

The use of a large animal model seems to be the best option for training. Close et al used sheep for their experimental study; however, they performed laparotomy and the sheep they used in their study were administered thiopentone and halothane (13). Kimber et al used a lamb model and they performed laparoscopy using volatile anesthesia (14). We carried out the first pilot study at Experimental Research Laboratory of Yeditepe University (YÜDETAM) using a 3-month-old sheep and we did not use volatile anesthetics for general anesthesia. The sheep was anesthetized with an intramuscular administration of 60 mg/kg ketamine hydrochloride (Ketalar; Eczacibasi Ilac Sanayi, Levent, Istanbul, Turkey) with 7 mg/kg xylazine hydrochloride (Rompun; Bayer Ilac Sanayi, Sisli, Istanbul, Turkey). The study was performed over 5 hours and every hour the need for additional anesthetics was observed and the same dosage of ketamine was given intramuscularly.

A 10 mm trocar was introduced into the abdomen. The layers of the abdominal wall of sheep are very thin. An open laparoscopic technique was used without any difficulty. Then pneumoperitoneum was created using $CO_2$ and intraabdominal pressure was set at 8 mmHg. Two axillary 5 mm trocars were introduced through the pelvic region (Figure 1 and 2).

The pelvis of sheep is narrow and its uterus has two long horns like in rats (Figure 3). The bladder and both ureters are intraperitoneal. These anatomical orientations give the trainee the opportunity to perform certain surgical manipulations. In our pilot study, the intraperitoneal bladder gave us the opportunity to perform cystectomy, to create a bladder injury and then, to repair it with intra-corporeal suturing. The uterus was removed using bi- and unipolar forceps. In this large animal model, the dissection of pelvic fatty and lymphatic tissues over the iliac vessels gives us the opportunity to improve the skills needed for radical pelvic operations. In our feasibility study, skeletonizing iliac vessels, controlling bleeding, and repairing the injury were successful, showing that the sheep pelvis can be used as an appropriate vessel dissection model.

It is obvious that the perfect training model should teach the skills required for laparoscopic surgery and should be inexpensive and universally available. Moreover, anatomically and

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**Figure 1.** Insertion of the trocars into the abdomen of a sheep

**Figure 2.** The tower, including a monitor, light source, and insufflators

physiologically, it should be almost identical to an anesthetized patient. The availability and relatively low price of the sheep model in comparison with "a pig model" show it to be the appropriate animal model for training in laparoscopic surgery in Istanbul.

**Figure 3.** Performing hysterectomy and cystectomy using both hands

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