Teaching Instrument: A Laparoscopic Training Model

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Abstract

A laparoscopic training model with female surface anatomy has been developed. This training model is made of a plastic boutique-showing model that is equivalent to normal-size female anatomy from the neck to the upper thigh. Four holes were made on the model's abdominal wall as puncture-sites to enter the cavity, the first is 80-mm diameter at the umbilical area, and the other three 38-mm diameter holes are located on both sides of the lower abdomen and suprapubic area. The umbilical hole can be covered with a simulated abdominal wall made from 6.5-mm insulation sheet, fixed to the model using a rubber band. The other three puncture-sites were plugged with a flexible rubber diaphragm as working ports. When used as video-laparoscopy, the auto-focus camcorder is used as a telescope and is connected to a regular television set as a monitor. This model can be used for training of abdominal entry by Veress needle or trocar, laparoscopic tubal ligation (LTL), and video–eye-hand co-ordination. This model has been a training medium in our Department for 1 year and was included in the OSCE for the Board Examination of the Royal Thai College of Obstetricians and Gynecologists in the year 2000 to assess the process of Veress needle insertion.

Key word : Training Model, Teaching Instrument, Laparoscopy

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Laparoscopic gynecologic surgery has become popular in Thailand. Short-course training has been conducted every year in many institutes. Mostly, the short-course training consists of three major parts including 1) Lectures, 2) Laparoscopic training model and, 3) Porcine model. The lectures are appropriate for the introduction of instruments, basic principles of safety, indication/contra-indica-

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tion, and how to prevent or correct complications. The trainees perform manipulative procedures using standard laparoscopic instruments with the laparoscopic training model. This useful introduction helps trainees to work with a two-dimensional image and to become familiar with laparoscopic instruments. However, its value is limited and most commercially available models fall short of representing normal anatomy and usually consist of just a flat plastic board. The porcine model is undoubtedly helpful to practice procedures on a life-like model where the problems of loss of pneumoperitoneum, bleeding, and mobilizing structures are all encountered. Although the porcine model is recommended, it requires a lot of instruments and personnel, which make it costly and not practical for beginners.

The ideal training for a laparoscopic procedure is, firstly, for trainees to watch a video and if they have no laparoscopic experience, they should spend time on a laparoscopic training model before attending a hands-on course[1]. After attending a short-course workshop, the trainees should improve and maintain their laparoscopic experience by practicing with a training model. This kind of inanimate training has a great advantage in that it provides no risk of complication to a patient. So the need for a multipurpose and more realistic female anatomic pelvic training model to approximate the operative model has become apparent. The purpose of this report is to describe how to construct and implement the use of a multipurpose video-laparoscopic training model with normal-size female surface anatomy.

Design and construction

A laparoscopic training model is a modification of a female plastic boutique-showing model. This model is equivalent to normal-size female surface anatomy from neck to upper thigh (Fig. 1). Four holes are made at the model's abdominal wall, the first is 80-mm diameter in the umbilical area, the other three are 38-mm diameter at the suprapubic area and both sides of the lower abdomen. Three 38-mm flexible rubber diaphragm are used to plug the holes defining laparoscopic instrument entry ports. A disposable simulated abdominal wall is made of 6.5-mm insulation sheet (Aeroflex, Eastern Polymer Industry Co., LTD, Thailand) 18x24 cm

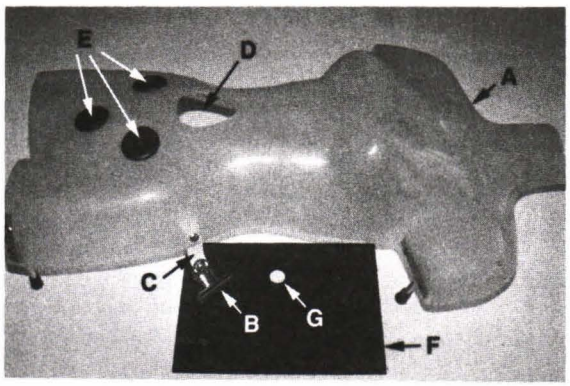

Fig. 1. Parts of the laparoscopic training model: Normal-size female plastic boutique-showing model (A), Paper clamps (B), Elastic rubber band (C), 80-mm umbilical port (D), Three 38-mm lower abdominal ports plugged with flexible rubber diaphragms (E), 6.5-mm insulation sheet 18x24 cm with umbilical mark (F), and 15-mm white sticker paper (G).

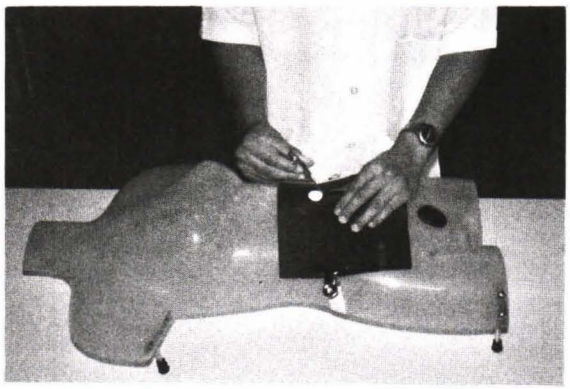

Fig. 2. The arrangement for Veress needle or primary trocar insertion training. The 6.5-mm insulation sheet 18x24 cm is used as the disposable simulated abdominal wall.

with 15-mm diameter of white sticker paper to represent the umbilicus. The disposable simulated abdominal wall covers the umbilical area of the model using two paper clamps connected to a rubber band fixed to both sides of the model. The rubber band allows the simulated abdominal wall to fold and can be held up by the trainee's hand or towel clips before Veress needle or trocar insertion (Fig. 2). The simulated abdominal wall can be changed quickly making it suitable for an OSCE. This training model can be used in three major applications. First, for training of abdominal entry technique including Veress needle and primary trocar insertion. Second, for laparoscopic tubal ligation (LTL) training, the auto-focus camcorder is fixed under the chest wall of the model directly into the pelvis where an artificial fallopian tube is located. The artificial fallopian tube is made from silicone thread 3-mm in diameter and 7-cm long. A regular television set will suffice as a video monitor. The trainee can look directly into the therapeutic laparoscope while the trainer can observe and record the performance *via* television (Fig. 3). Third, for working with a two-dimensional video-image and familiarization with laparoscopic instruments, the camcorder is fixed on the chest wall of the model and directed into the pelvis *via* the umbilical hole without the simulated abdominal wall. The television set is in a direct line of vision with the specimen in the pelvis (Fig. 4).

RESULTS

Since 1999, this model has been a training media for teaching basic laparoscopic techniques to obstetrics and gynecological residents in the Department of Obstetrics and Gynecology, Faculty of Medicine, Prince of Songkla University. The laparoscopic training model can be used for training various basic laparoscopic techniques, including: abdominal entry with Veress needle or trocar, laparoscopic tubal ligation (LTL), and video–eye-hand co-ordination. For abdominal entry training, the rubber band allows the disposable simulated abdominal wall to be lifted up by a trainee's hand or with a towel clips like a real abdominal wall. When used for LTL training, a new operative view can show how the trainee moves the tip and tongs of the laparoscope while performing ring application. The trainer can feedback and correct mistakes with video documentation from this view. For video–eye-hand co-ordination training, the trainee can practice various tasks and learn how to work with two-dimensional images

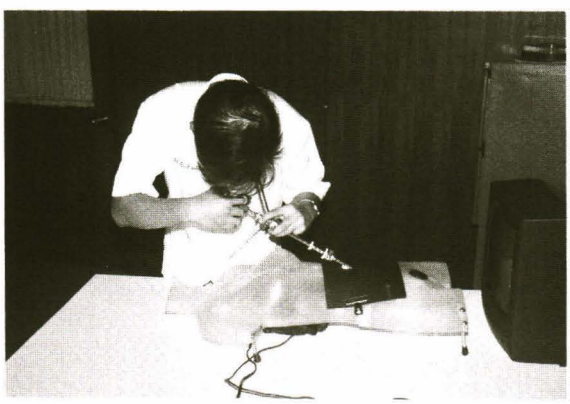

Fig. 3. The arrangement for laparoscopic tubal ligation training. The camcorder is put under the chest wall of the model and directed to the artificial fallopian tube in pelvis. The trainee looks directly *via* the therapeutic laparoscope while the trainer can observe and record *via* television set.

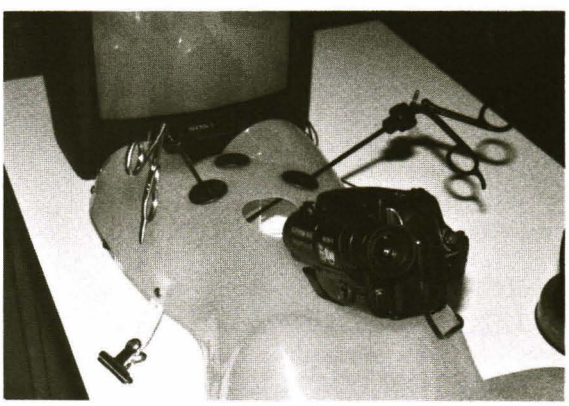

Fig. 4. An overhead view of the training model with the camcorder in the telescope position over the chest wall and two laparoscopic instruments in the lower abdominal ports.

via television. This training model was included in the OSCE for the Board Examination of the Royal Thai College Of Obstetricians and Gynecologists in the year 2000 to assess the process of Veress needle insertion. Quick changing of the disposable simulated abdominal wall make it suitable for OSCE.

DISCUSSION

The pelvic training model is one of the essential media for practicing laparoscopic techniques before application in the operating room[2, 3]. Most commercial or home-made training models consist of a flat or curved plastic board with many holes that are plugged with flexible rubber diaphragms representing the anterior abdominal walls with instrument ports, far removed from real female surface anatomy. The Borinquen ring[4] and the easily constructed laparoscopic simulator[5] can be used only for practice with two-dimensional video-eye-hand co-ordination. This reported laparoscopic training model has normal-size female surface anatomy and can be used as a multipurpose training model; first, for abdominal entry training; second, for LTL training and third, for practicing two-dimensional video-eye-hand co-ordination with basic laparoscopic instruments. Abdominal entry with a Veress needle or primary trocar is blind, so the risk of trauma to internal organs is high if the surgeon is not experienced. This step is essential for both diagnostic and operative laparoscopy. This simplified multipurpose laparoscopic training model can provide a more realistic abdominal wall with anatomical landmarks; it can be used for training and evaluation of proficiency in abdominal entry technique. The LTL with a Falope ring using the one puncture technique is popular in Thailand, most training institutes use video-laparoscope as a training media. Before trainees are allowed to perform LTL themselves, the trainer must hold the trainee's hands while performing the procedure on many cases to give them enough practical experience. The trainees have no opportunity to see how they performed and the trainer cannot feedback effectively regarding which steps must be improved, because video documentation *via* the conventional video-laparoscope cannot show movement of the tip of the laparoscope during ring application. The most common complications from LTL are tearing and bleeding due to the uterine tube being retracted into the lumen of the laparoscope without moving the laparoscope's tip closure to reduce tension. Further more, an injury to the uterine tube or mesosalpinx can occur if the laparoscope's tip is moved to the sides during ring application. When practicing LTL with this video-laparoscopic training model, the trainee can improve and rectify any mistakes from the video documentation *via* the camcorder behind the laparoscope's tip. This training model can be constructed using materials available locally at low cost, excluding the camcorder and television set.

SUMMARY

A laparoscopic training model with female surface anatomy has been developed. It can be used as teaching and examining media for basic laparoscopic skill. This low cost model can be easily constructed and is suitable for beginners.

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เครื่องมือช่วยสอน : หุ่นฝึกส่องช่องท้อง

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ได้ประดิษฐ์หุ่นฝึกส่องช่องท้องที่มีกายวิภาคของพื้นผิวคล้ายผนังหน้าท้องผู้หญิง หุ่นฝึกนี้สร้างจากหุ่นโชว์เสื้อพลาสติกขนาดเท่าผู้หญิงจริง ตั้งแต่ระดับคอถึงต้นขา เจาะรูกลม 4 รูบริเวณหน้าท้อง โดยรูบริเวณสะดือมีขนาดเส้นผ่าศูนย์กลาง 80 มม. อีก 3 รู ขนาดเส้นผ่าศูนย์กลาง 38 มม. บริเวณท้องน้อยทั้งสองข้างและบริเวณเหนือหัวเหน่า ปิดรูบริเวณสะดือด้วยผนังหน้าท้องเทียมซึ่งใช้แผ่นยางฉนวนกันความร้อนหนา 6.5 มม. ยึดติดกับหุ่นด้วยคลิปหนีบกระดาษและแถบยางยืด รูอื่น ๆ ปิดด้วยแผ่นยางนุ่มเพื่อเป็นช่องสอดเครื่องมือผ่าตัด เมื่อใช้ฝึกทำหัตถการผ่านกล้องวิดีทัศน์ จะใช้กล้องวิดีทัศน์มือถือแทนกล้องส่องช่องท้องและใช้โทรทัศน์ธรรมดาแทนจอแสดงภาพวิดีทัศน์ หุ่นฝึกนี้ใช้ฝึกเทคนิคการเจาะเข้าช่องท้องโดยเข็ม Veress หรือ trocar, ฝึกการทำหมันด้วยกล้องส่องช่องท้องด้วยวิธีรัดยาง และฝึกความสัมพันธ์ระหว่างตาและมือเมื่อทำหัตถการผ่านจอโทรทัศน์ ได้ทดลองใช้หุ่นฝึกนี้สำหรับฝึกแพทย์ประจำบ้านของภาควิชาสูติศาสตร์และนรีเวชวิทยา มหาวิทยาลัยสงขลา-นครินทร์เป็นเวลา 1 ปี และได้ใช้เป็นหุ่นสอบ OSCE เพื่อประเมินเทคนิคการแทงเข็ม Veress ในการสอบเพื่อวุฒิบัตรผู้เชี่ยวชาญทางสูติศาสตร์-นรีเวชวิทยา ของราชวิทยาลัยสูตินรีแพทย์แห่งประเทศไทยประจำปี พ.ศ. 2543

คำสำคัญ : หุ่นฝึกส่องช่องท้อง, เครื่องมือช่วยสอน, การส่องช่องท้อง

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