JOURNAL OF ENDOUROLOGY
Volume 22, Number 4, April 2008

DOI: 10.1089/end.2007.0380

A Novel Training Model for Laparoscopic Pyeloplasty Using Chicken Crop

ANIL RAMACHANDRAN, M.S., ABRAHAM KURIEN, M.S., PRADIP PATIL, M.V.Sc., STEPHANIE SYMONS, FRCS, ARVIND GANPULE, M.S., DNB, VEERAMANI MUTHU, M.Ch., and MAHESH DESAI, M.D.

ABSTRACT

***Purpose*: To create a model for laparoscopic pyeloplasty training using the crop and esophagus of a chicken. The model can be used to simulate the steps taken during laparoscopic pyeloplasty and to help trainees practice laparoscopic suturing skills.**

***Materials and Methods*: The chicken crop and esophagus were used to simulate the renal pelvis and ureter, respectively. These were exposed by reflecting the skin overlying the neck and thorax. The crop was thoroughly cleaned and filled with water via the esophageal end to simulate the dilated renal pelvis. The chicken was positioned within an indigenously made laparoscopic training box. Laparoscopic pyeloplasty was performed using the dismembered Anderson Hynes technique. The model was used over a period of 1 month by three urology trainees in their final year of training. They were assessed with respect to time needed to complete anastomosis and quality of anastomosis.**

***Results*: The mean operative time showed a marked reduction from the second to the fourth attempt. There was also a significant improvement in the quality of anastomosis from the first to the fourth attempt. At the end of four attempts, all trainees were able to satisfactorily complete a good quality ureteropelvic anastomosis in a mean time of 67.7 minutes (range 62–76 min).**

***Conclusion*: Laparoscopic suturing skills require effective training and constant practice to perfect the technique. Adequate practice on this chicken model shortens the learning curve, makes the trainee more confident of his or her skills, and improves his operative performance.**

INTRODUCTION

LAPAROSCOPY HAS REVOLUTIONIZED current urologic practice. The extension of laparoscopy into newer domains of urology has inevitably brought about a need for a change in training methodology. While early practitioners of the technique could afford to "learn on the job," urology trainees today have to ensure that they are sufficiently proficient in laparoscopic skills before they start practice. This translates into fewer complications and better technique.[1,2]

This scenario has brought about the need for simple yet realistic animal models to duplicate laparoscopic techniques in the training laboratory. Specialized training programs enable trainees not experienced in laparoscopy to increase reproducible performance in reconstructive laparoscopy.[3]

The training process should be systematic, progressing from dry to wet laboratories. Initial practice on inanimate models perfects hand-eye coordination. This is followed by practice on animal models in the wet laboratory, initially with simple ablative procedures such as nephrectomy and progressing to advanced techniques that involve intracorporeal suturing.

Although ablative procedures are generally practiced using the porcine model, there is a lack of effective animal models for reconstructive skill training, especially for laparoscopic pyeloplasty. We present a model for laparoscopic pyeloplasty training using the crop and esophagus of a chicken. The model was developed to simulate the steps taken during laparoscopic pyeloplasty and to help trainees to practice laparoscopic suturing skills.

Department of Urology, Muljibhai Patel Urological Hospital, Nadiad, India.

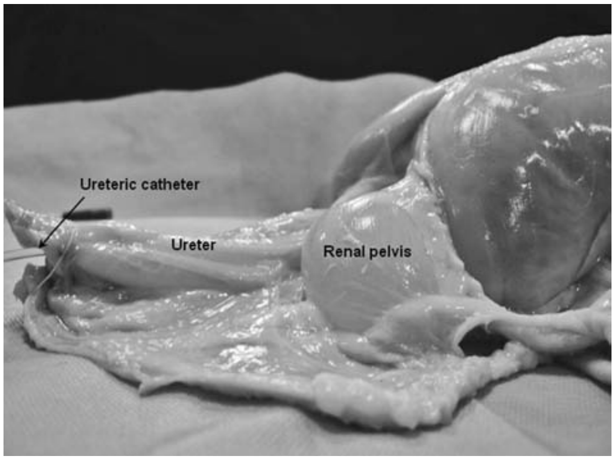


FIG. 1. Prepared chicken model simulating Ureteropelvic junction obstruction.

MATERIALS AND METHODS

The chicken crop (**ingluvies**) is an enlargement or outpouching of the esophagus proximal to the proventriculus (the glandular stomach) and functions primarily in a food storage role for avian species.[4] In this model, we used the chicken crop and esophagus to simulate the renal pelvis and ureter.

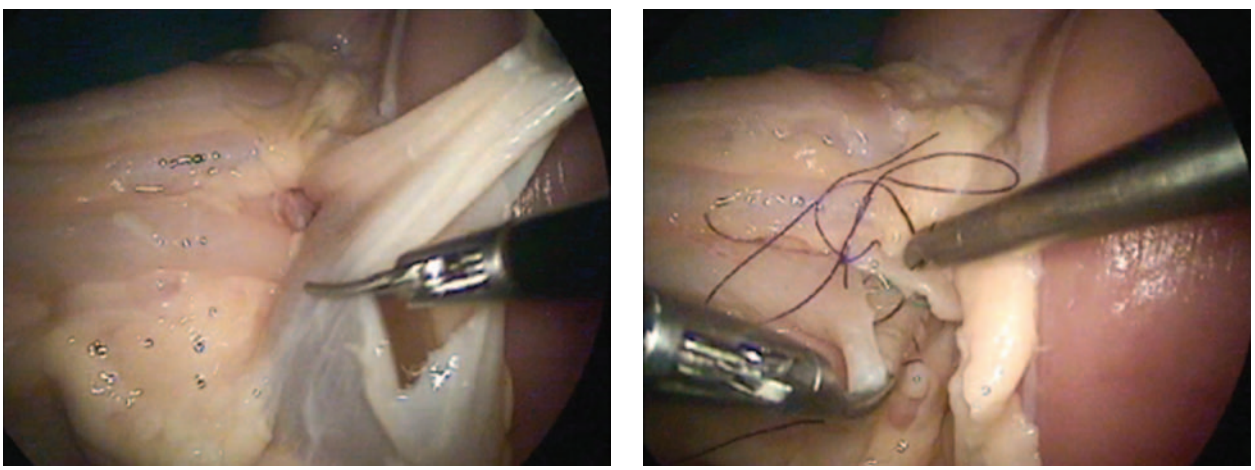
A whole, dead, plucked chicken was procured from a local poultry farm. The chicken esophagus and crop were exposed by reflecting the skin overlying the neck and thorax. The crop was thoroughly cleaned and filled with water via the esophageal end to simulate the dilated renal pelvis (Fig 1). An 8F infant feeding tube was inserted through the esophagus down to the crop and fixed *in situ* by ligating the esophagus with 2.0 silk. The whole chicken was then mounted on a thermocol base onto which the neck was fixed.

An indigenously manufactured laparoscopic training box was used. The chicken was positioned within the box to simulate a right-sided ureteropelvic junction (UPJ) with the proximal ureter and dilated pelvis.

A 30-degree laparoscope with camera (Richard Wolf Surgical instruments, Germany), two needle drivers, a forceps, and endoscissors (R.K. Medical Devices, Mumbai) were used for the simulation. The technique of laparoscopic pyeloplasty used was a dismembered Anderson Hynes pyeloplasty as is routinely performed in our institute (Figs. 2 A-C). Two 10-cm 4.0 polyglactin sutures were used for the procedure.

At the end of the procedure, the anastomosis was tested for water tightness by distending the crop with water via the infant feeding tube. The crop was then cut and taken out, and

A B



C

FIG. 2. (**A**)"Pyelotomy" in progress. (**B**) Simulated uretero-pelvic anastomosis. (**C**) Completed anastomosis.

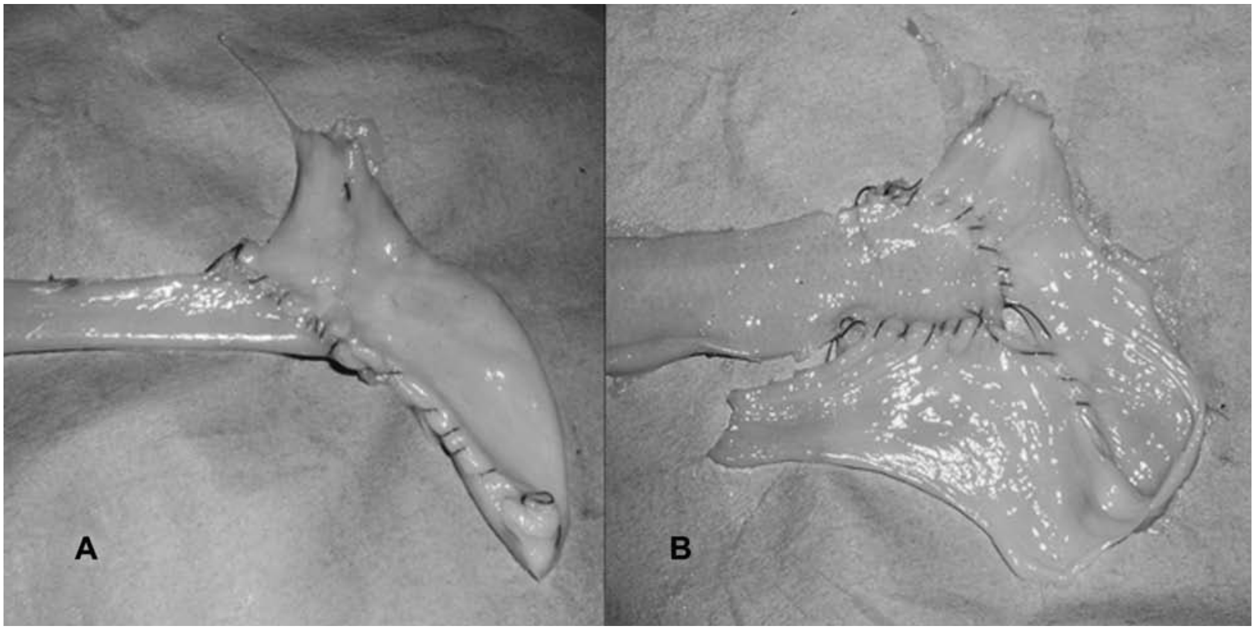


FIG. 3. Anastomosis cut and removed from model (**a**); anastomosis opened for assessment of suturing (**b**).

the anastomotic area opened to assess the quality of suturing (Fig. 3).

To evaluate the effectiveness of this model for training in laparoscopic suturing, the model was used over a period of 1 month by three urology trainees in their final year of training in our institute. The trainees were assessed with respect to time required to complete anastomosis and quality of anastomosis using a scoring sheet previously described for vesicourethral anastomosis in a chicken model.[5]

RESULTS

Each trainee made four attempts to complete the laparoscopic pyeloplasty over a 1-month period. The first attempt was completed by only one trainee; the other two trainees failed because of technical difficulties with laparoscopic suturing. The mean operative time showed a marked reduction from attempt two (130 min) to attempt three (93.3 min) and attempt four (67.7 min) (Table 1). The mean reductions in operative times were 36.7 min from attempt two to three, and 25.6 min from attempt three to four. There was also a significant improvement in quality of the anastomosis from the first to the fourth attempt (Table 2).

Factors that were seen to improve these parameters were adeptness in needle positioning on the driver, preplanning and changing needle position to adapt to the direction in which each suture was to be taken, rotational movement of the driver while taking the suture, and proper technique of intracorporeal knotting.

At the end of four attempts, all trainees were able to satisfactorily complete a good quality ureteropelvic anastomosis in a mean time of 67.7 minutes (range 62–76 min).

DISCUSSION

Laparoscopic pyeloplasty has rapidly advanced since its first description by Schuessler and associates in 1993.[6] It may soon become the standard operation for UPJ obstruction, replacing open pyeloplasty.[7,8] Of the laparoscopic procedures currently being performed, however, reconstructive procedures such as pyeloplasty are technically more challenging,[9] mainly because of the need for intracorporeal suturing and hence concern regarding increased risk of complications during the learning curve.[10]

The importance of sufficient skills training on various models before operating on patients cannot be over emphasized. Previous training using video trainers improves video-eye-hand

Table 1. Time Taken to Complete Task

	Attempt 1	*Attempt 2*	*Attempt 3*	*Attempt 4*
Trainee 1	142	140	86	62
Trainee 2	*	135	100	65
Trainee 3	*	115	94	76

(*—not completed)

Table 2. Quality Score as per Scoring System by Laguna et al[5]

	Attempt 1	*Attempt 2*	*Attempt 3*	*Attempt 4*
Trainee 1	5	5	3	1
Trainee 2	*	6	5	2
Trainee 3	*	6	4	2

(* not completed)

skills and translates into improved operative performance.1 Regular training in a standardized suturing technique can reduce surgery time by 50% and knot-tying time by as much as 75%, improving the efficiency and safety of reconstructive surgery.[11]

Training models can range from live animals to simulators and models created from synthetic material or animal tissue. The main limiting factor for the use of live animals would be ethical considerations as well as cost,[12] restricting use to a few well-equipped institutes. Similarly, use of expensive simulators and synthetic models is also not practical for all trainees. Hence, there is a need for low cost, easily available options for training models. The use of various body parts of dead animals for different procedures has been described.[12,13]

Although a number of models and studies have been reported for training in laparoscopic urethrovesical suturing using chickens,[5,14,15] there is a paucity of models for laparoscopic pyeloplasty. A low-cost model has earlier been described using reconfigured chicken skin for open and laparoscopic pyeloplasty training.[16]

During residents' laparoscopic training, the initial practice of suturing can be done on inanimate models or simple tissue models. This sequence tends to get repetitive, however, and there may be less compliance on the part of the trainee because there is no practically relevant objective to achieve. Having a definite end point that is clinically relevant (in this case, to complete a ureteropelvic anastomosis) keeps the trainee focused and increases his or her compliance. Because our model uses an anatomically similar structure to simulate the UPJ, it gives a more realistic feel to the tissue and anatomy.

Although we have attempted to reproduce the technique of pyeloplasty as is followed in our institute, the focus initially is not on the actual technique of the procedure but on learning laparoscopic suturing skills such as needle handling, positioning, needle transferring between drivers, and intracorporeal knotting.

There was a definite improvement in the speed and ease of technique seen with repeated use of the model. With each consecutive attempt, the reduction in operative time showed a decreasing trend, suggesting progress toward a plateau phase of the learning curve. Nadu and colleagues,[14] in a study using a chicken skin model for vesicourethral anastomosis, concluded that while the quality of the suturing improved after five exercises, a decrease in operative time was more gradual, requiring over 15 exercises. In our model, the number of attempts needed to achieve a satisfactory anastomosis in the minimum time will need to be quantified in future studies, so that the training schedule can be tailored accordingly.

The model also provides sufficient surrounding tissue for preliminary dissection and mobilization, adding to the realistic nature of the simulation. Postprocedure, having an immediate assessment of the anastomotic quality helps to instruct the trainee regarding areas that need improvement, thus helping the training process.

CONCLUSION

Laparoscopic suturing skills require effective training and constant practice to perfect the technique. We feel that adequate practice on this chicken model shortens the learning curve, makes the trainee more confident of his skills, and improves his operative performance.

REFERENCES

1. Scott DJ, Bergen PC, Rege RV, et al. Laparoscopic training on bench models: Better or more cost effective than operating room experience? J Am Coll Surg 2000;191:272–283.
2. Martin M, Vashisht B, Frezza E, Ferone T, Lopez B, Pahuja M, Spence RK. Competency-based instruction in critical invasive skills improves both resident performance and patient safety. Surgery 1998;124:313–317.
3. Teber D, Dekel Y, Frede T, Klein J, Rassweiler J. The Heilbronn laparoscopic training program for laparoscopic suturing: Concept and validation. J Endourol 2005;19:230–238.
4. Dyce KM, Sack WO, Wensing CJ. In: Textbook of Veterinary Anatomy. Philadelphia: WB Saunders, 1996, pp 813–837.
5. Laguna MP, Arce-Alcazar A, Mochtar CA, Van Velthoven R, Peltier A, de la Rosette JJ. Construct validity of the chicken model in the simulation of laparoscopic radical prostatectomy suture. J Endourol 2006;20:69–73.
6. Schuessler WW, Grune MT, Tecuanhuey LV, Preminger GM. Laparoscopic dismembered pyeloplasty. J Urol 1993;150:1795–1799.
7. Inagaki T, Rha KH, Ong AM, Kavoussi LR, Jarrett TW. Laparoscopic pyeloplasty: Current status. BJU Int 2005;95(suppl 2):102–105.
8. Moon DA, El-Shazly MA, Chang CM, Gianduzzo TR, Eden CG. Laparoscopic pyeloplasty: Evolution of a new gold standard. Urology 2006;67:932–936.
9. Munver R. Sosa RE, del Pizzo JJ. Laparoscopic pyeloplasty: History, evolution, and future. J Endourol 2004;18:748–755.
10. Parsons JK, Varkarakis I, Rha KH, Jarret TW, Pinto PA, Kavoussi LR. Complications of abdominal urologic laparoscopy: Longitudinal five-year analysis. Urology 2004;63:27–32.
11. Frede T, Stock C, Rassweiler JJ, Alken P. Retroperitoneoscopic and laparoscopic suturing: Tips and strategies for improving efficiency. J Endourol 2000;14:905–914.
12. Steffens K, Koob E, Hong G. Training in basic microsurgical techniques without experiments involving animals. Arch Orthop Trauma Surg 1992;111:198–203.
13. Kim DC, Hayward PG, Morrison WA. Training model for microvessel anastomosis. Microsurgery 1994;15:820–821.
14. Nadu A, Olsson LE, Abbou CC. Simple model for training in the laparoscopic vesicourethral running anastomosis. J Endourol 2003;17:481–484.
15. Yang RM, Bellman GC. Laparoscopic urethrovesical anastomosis: A model to assess surgical competency. J Endourol 2006;20: 679–682.
16. Ooi J, Lawrentschuk N, Murphy DL. Training model for open or laparoscopic pyeloplasty. J Endourol 2006;20:149–152.

Address reprint requests to:
Dr. Mahesh Desai
Muljibhai Patel Urological Hospital
Dr V.V. Desai Road
Nadiad—387001
Gujarat, India.

E-mail: mrdesai@mpuh.org

ABBREVIATIONS USED

UPJ = ureteropelvic junction.