Home-made Knot-pusher for Extracorporeal Knot-tying

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Abstract : *The Clarke ligator (knot-pusher) has proved to be useful for laparoscopic suturing. Recent rediscovery of the instrument and its application has markedly simplified laparoscopic suturing and extracorporeal knot-tying. A home-made knot-pusher was made from solid stainless steel rod 4.5 mm in diameter, 350 mm in length. The opened circular tip was made with ordinary tools. All edges of the tip were smoothed and polished to avoid trauma to suture material and pelvic organs. The home-made knotpusher was tested with more than 100 knots on a pelvictrainer. The knots were secured without trauma to suture material. Thereafter, extracorporeal knot-tying was successful in 14 pelviscopic surgical procedures. We have found that the home-made knot-pusher can be easily made at a much lower cost and is convenient to use. Since high cost and length of operation time are the major disadvantages of laparoscopic surgery, a home-made laparoscopic instrument can lower the cost of surgery, without increasing operation time. Tip configuration should be further modified to make it even more suitable for laparoscopic surgery. (Thai J Obstet Gynaecol 1994;6:33-36.)*

Key words : knot-pusher, extracorporeal knot-tying, laparoscopic suturing, laparoscopic instrument, laparoscopic surgery

Many gynaecologic and general surgical laparoscopic procedures can now be performed with the help of new techniques and new instruments. One of the necessary techniques is laparoscopic suturing and ligating. In 1972, Clarke[1] described the Clarke ligator (knot-pusher) and a technique for suturing and extracorporeal knot-tying that proved to be useful for laparoscopic procedures. These instruments were developed in the Department of Obstetrics Gynaecology at the State University of New York in Buffalo. In 1974, Leventhal[2] recognized that these instruments could be the basis for a new era of laparoscopic surgery. Recent rediscovery with minor modifications, and their application by Reich[3] in 1992, has markedly simplified laparoscopic suturing and ligating. In a

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developing country like Thailand, one of the many problems of laparoscopic surgery is the very high cost of imported disposable instruments. This report describes an easy way to make a knot-pusher at a much lower cost and demonstrates its use and application.

Materials and Methods

The home-made knot-pusher was made from a solid stainless steel rod 4.5 mm in diameter, 350 mm in length (Fig.1A). This stainless steel was supplied by a local metal store. First, the tip of the rod was flattened and rounded with a flat file (Fig.1B). The opened circular tip was made with a high-speed drill and hand saw (Fig.1C). All edges were smoothed with flat and round files and polished with muslin wheels, which were attached to a polishing motor (Fig.1D). After the final step, the tip was examined under X10 magnification, using magnifying glass. If any edges were not smooth the smoothing procedured were repeated. Extracorporeal knot-tying with the knot-pusher is easy. A simple loop is tied outside the peritoneal cavity and the knot pusher is applied to one strand (Fig. 2A). Holding both strands over the surgeon index finger, the knot is pushed through the trocar sleeve until it reaches the tissue to be ligated (Fig.2B). The second and third loops are then pushed down to secure the first, and the suture is divided with laparoscopic scissors (Fig.2C).

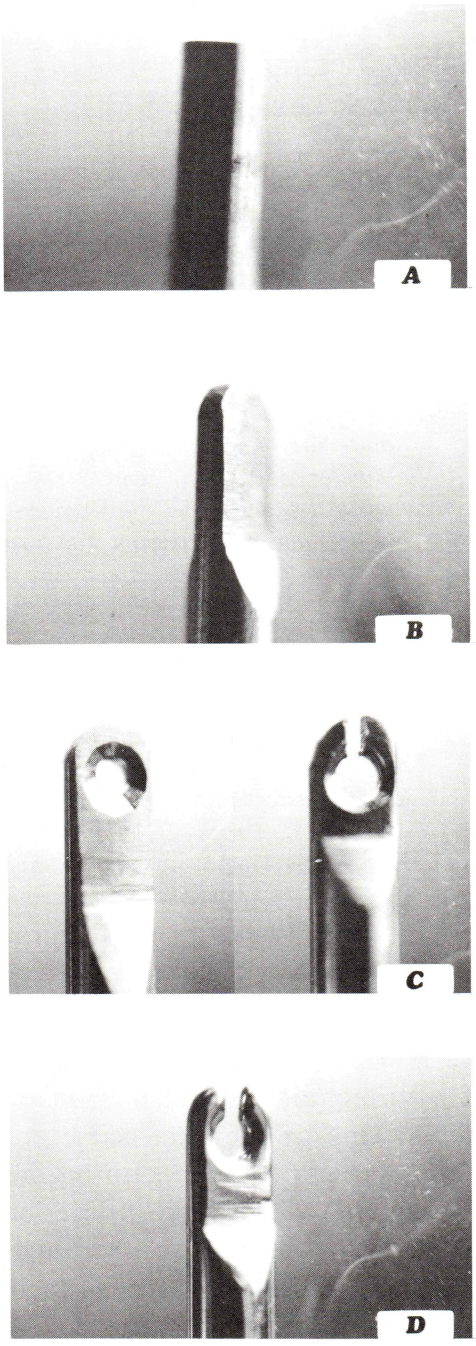


Fig. 1 Steps for making knot pusher.
A) Solid stainless steel rod 4.5 mm in diameter, 350 mm in length.
B) Tip is flattened and rounded.
C) The opened circular tip is made.
D) All edges are smoothened and polished.

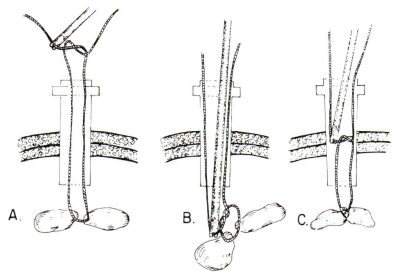


Fig. 2 Illustration of extracorporeal knot tying. A) Application of knot pusher to a simple loop. B) The knot is pushed through the trocar sleeve. C) The second and third loops are pushed down to secure the first.

Results

The home made knot-pusher was tested with a pelvictrainer. Various types of suture material were used, such as polydioxanone, polyglactin, polyglycolic or silk. It was tested with more than 100 knots without trauma to suture, and the knots were secured. Moreover, extracorporeal knot-tying was successful without complications in 14 procedures, as shown in Table 1. In this preliminary study, operative time, postoperative course and time in the hospital were similar to those of simple laparoscopic procedures. We have found that the home-made knot-pusher can be easily made at minimal cost and is convenient to use with the average time for each knot-tying less than 5 minutes. Moreover, its cost is only about 150 Baht (6US$) for a knot pusher. Instruments may be obtained by writing to the Department of Obstetrics and Gynecology, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkla, 90112.

Table 1 Procedures using extracorporeal knot tying

Procedure	Number
Suture repair of ovaries	4
Ligation of IP* ligaments	6
Laparoscopic culdotomy closure	4

*IP = infundibulopelvic

Discussion

The Clarke laparoscopic ligator with opened circular tip, and its surgical applications, were described originally in 1972[1]. Other surgeons have devised similar instruments and methods for these procedures[2,3]. Ligation with the Roeder loop[4,5] is restricted to areas suitable for placement of the loop and limits variation of suture. The intra-abdominal forceps tie[6], using two forceps, directs effective forceps peripherally out of view of the scope, resulting in the greatest risk of slippage of suture and breakage. The modified half hitch knot[7] is tied extracorporeally and slid to the tissue, being approximated by pulling on the loose end. Here, there is considerable pull on the transfixed tissue since the knot dose not always slide readily. This is because it must overcome suture friction and the combined resistance of suture passage

through the tissue and of the knot through the abdominal wall incision.

Using the knot pusher, we can apply different suture material prepared extracorporeally directly to the tissue being approximated. Suture type can be varied by the surgeon as desired. The instrument is reusable. There is no pull on tissue being ligated. Suture moves only once through tissue in the dirction of the suturing needle. There is good visibility and tactile sensitivity. This instrument is increasingly being recognized as an important part of many laparoscopic surgical procedures. Ease of laparoscopic suturing and ligating greatly enhance the confidence of the surgeon, help decrease operation time, and contribute to increase the indications for advanced laparoscopic surgery. Since high cost and length of operation time are the major disadvantages of laparoscopic surgery, our home-made laparoscopic instrument can lower the cost of surgery without increasing operation time. Tip configuration should be further modified to make it even more suitable for laparoscopic surgery.

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