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A new knot-supporting instrument and knot technique for laparoscopic surgery

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Background/aim: We report here an instrument designed by Dr Hasan Börekci that provides support to the knot to facilitate knot tying in laparoscopic procedures. We call the device the 'Börekci knot-supporting instrument' and the technique 'Börekci's knot technique'.

Materials and methods: To evaluate the efficacy of this instrument, 17 surgeons performing laparoscopic surgery tied 3 knots using the classical intracorporeal method and then using the intracorporeal knot-supporting instrument. The times required to tie each knot were recorded and compared statistically.

Results: Comparing the 2 knotting methods, the time spent tying the knots was shorter with the knot-supporting instrument in all 3 trials and the difference was significant (P = 0.026) in the third trial.

Conclusion: This alternative technique can be used for all knots in laparoscopic surgery when classical intracorporeal knotting is difficult.

Key words: Knot-supporting instrument, intracorporeal knot, laparoscopic surgery

1. Introduction

Laparoscopic surgery has improved markedly in recent years. Many procedures are now performed safely via laparoscopy, including those involving the gallbladder and bile duct, and vaginal prolapse surgery (1,2). Nevertheless, some procedures are difficult to perform via laparoscopy. It is especially difficult to tie a classical intracorporeal knot if the trocar entrance holes are in close proximity. To facilitate knot tying, we present the 'Börekci knot-supporting instrument' designed by Dr Hasan Börekci.

2. Materials and methods

The knot-supporting apparatus consists of a cylindrical pipe with 3 notches and bulges at the distal end, as shown in Figure 1. These bulges are for the suture needle. The threaded part behind the knot-supporting instrument allows the apparatus to fit a laparoscopic instrument. The classical steps in knotting are shown in Figures 2A, 2B, and 2C, while Figure 3 shows the steps using the knot-supporting instrument. With the knot-supporting instrument, suturing is performed with the needle holder in the right hand. With the knot-holding instrument in the left hand, the needle is fit into one of the bulges on the supporting instrument (Figures 3A and 3B). After the instrument in the right hand has been rotated once or twice (Figure 3C), the needle is moved away from the knot-supporting instrument using the end of the holding instrument, which is in the left hand (Figures 3D and 3E). Simultaneously, the needleless end of the needle-holding instrument in the right hand is used to hold the thread (Figure 3D) and is pulled back to make the knot (Figure 3F).

For this study, we used a laparoscopy training box. Seventeen surgeons who perform laparoscopic surgery but were not experienced in advanced laparoscopic techniques tied knots in the box and the time required was recorded. The surgeons were general surgeons, obstetricians and gynecologists, cardiovascular surgeons, and urologists from Kayseri Training and Research Hospital, Bozok University Faculty of Medicine, and Yozgat State Hospital. Each surgeon tied 3 knots using the classical intracorporeal method and then with the intracorporeal knot-supporting apparatus. The times required were recorded and compared statistically using the Mann–Whitney U test.

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Figure 1. The knot-supporting apparatus.

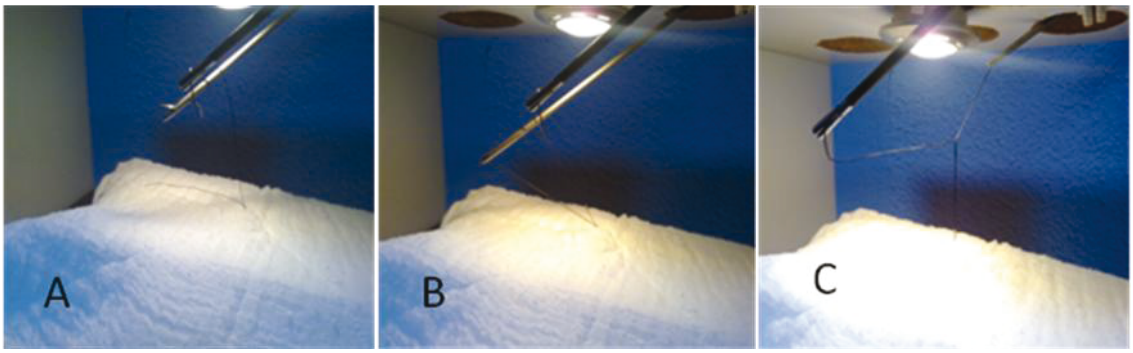

Figure 2. Steps involved in knot tying using the classical intracorporeal method.

3. Results

In comparing knots tied using the classical intracorporeal technique and our knot-supporting instrument, the differences in times required in the first and second trials were not significant (P = 0.205 and 0.986, respectively). However, in the third trial, the time required was significantly (P = 0.026) shorter using the knot-supporting instrument, as shown in the Table. The average times required to tie the classical knots by the 17 surgeons were 141.88 ± 93.76, 105.94 ± 91.82, and 128 ± 89.57 s in trials 1 to 3, respectively. In comparison, the respective times with the knot-supporting instrument averaged 91.41 ± 32.75, 91. 82 ± 67.45, and 61.23 ± 29.27 s, respectively. In all 3 trials, knot tying was more rapid using the knot-supporting instrument.

4. Discussion

The participating surgeons had little experience of advanced laparoscopic procedures. It is important that surgeons be trained in knotting before conducting laparoscopic surgery (3–6). We think that inexperienced laparoscopic surgeons can be trained to tie knots using our knot-supporting instrument in a training box. As indicated by our findings, with more practice the time required to tie knots is reduced. Dr Hasan Börekci noticed that when the trocar entrances are in close proximity, tying knots using the classical intracorporeal method is difficult. Use of this instrument ameliorates such difficulty. Use of the laparoscopic Endo Stitch instrument also enables suturing and tying of knots (1). Our knot-supporting instrument has no effect on suturing, except at the knotting stage. Therefore, we recorded only the time required to tie the knots.

Our findings suggest that this knotting technique and instrument is an alternative to the classical knotting technique. We have named this apparatus the Börekci knot instrument. While a laparoscopic needle holder can fit all instruments that can pass through a 5-mm trocar, such as a grasper, our instrument can only be used with a 10-mm trocar. In addition, our knotting instrument does not restrict the main purpose of the fitted equipment. The Börekci knot instrument has been certified to be beneficial by the Turkish Patent Institution (7).

In conclusion, the Börekci knot instrument and Börekci knotting technique are alternatives to the classical intracorporeal knot for all laparoscopic procedures. We think that use of this novel instrument will facilitate knot tying in procedures in which classical knotting is difficult.

Figure 3. Steps involved in knot tying using the knot-supporting apparatus.

Table. The times required to tie knots using the 2 methods.

Average time per trial (s)	Conventional knot (n = 17)	With knot apparatus (n = 17)	P-value
First trial	141.88 ± 93.76	91.41 ± 32.75	0.205
Second trial	105.94 ± 91.82	91.82 ± 67.45	0.986
Third trial	128 ± 89.57	61.23 ± 29.27	0.026

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