

LAPAROSCOPIC APPENDECTOMY, COST-EFFECTIVENESS OF THREE DIFFERENT TECHNIQUES USED TO CLOSE THE APPENDIX STUMP

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It is generally agreed that laparoscopic appendectomy is a valuable operative method.

The aim of the study was to evaluate cost-effectiveness of three different techniques used to close the appendix stump.

Material and methods. We conducted a retrospective study that compared three groups of patients who were operated on laparoscopically for acute appendicitis in 2013 at our institution. We used an endoscopic clip to close the appendix stump in the first group (n=20), endoscopic stapler was applied in the second group (n=20), and in the third group of patients the appendix base was closed with a laparoscopic suture (n=20). These groups were matched by age, sex and BMI.

Results. The average operative cost was the highest in the second group. Cost of the laparoscopic appendectomy with the application of the endoscopic clip was significantly lower (first group) and comparable to the third group. Observed differences in total hospitalization costs were associated only with the chosen appendix stump closure technique.

Conclusions. Clip closure of the appendix base is an easy and cost-effective procedure. The laparoscopic suture technique is the cheapest but technically demanding. According to our experience endoscopic stapler may be useful in some cases, although it is the most expensive method.

Key words: laparoscopic appendectomy, cost-effectiveness, results

Implementation and popularization of minimally invasive procedures is undoubtedly one of the major steps for development in surgery. Currently, laparoscopy has a solid, incontestable position in everyday surgical practice. This procedure is widely used not only during elective surgery but also in the surgical treatment of the acute abdomen (1, 2, 3). In case of acute conditions such as cholecystitis or perforated peptic ulcer laparoscopic surgery is commonly used. Laparoscopic surgery is less common in conditions such as e.g. perforated diverticular disease of the colon or adhesive small bowel obstruction. Laparoscopic appendectomy due to acute appendicitis is currently a well-established method with efficacy confirmed by a number of authors, including randomised clinical studies (4). This technique is as safe and effective as tradi-

tional surgery. The advantages of laparoscopy over traditional surgery include less perioperative complications, shorter hospital stay and shorter convalescence after surgery. Authors of some papers point out a higher cost of laparoscopic surgery comparing to traditional technique. The major factor determining the cost of the procedure is the technique used to close the appendix stump (5, 6, 7). The most common methods used for appendix stump closure include: endoscopic staplers, surgical titanium clips, endoloop ligatures or the reduction of the appendix base using traditional-type purse string sutures stitched laparoscopically (8-17).

This study compared three different methods of appendix stump closure in an attempt to assess the cost-effectiveness of appendectomy in the Polish financial reality.

MATERIAL AND METHODS

The study comprised 60 patients operated for acute appendicitis in the 2nd Department of General Surgery at the Jagiellonian University Medical College in Cracow in the years 2013-2014. A retrospective comparative analysis was performed in three groups of patients who received different types of surgical treatment for appendix stump closure. The first group comprised 20 patients in whom surgical titanium clips were used (20 men, mean age 26.9 ± 6.3 years, mean BMI = 23.9). The second group comprised patients in whom endoscopic staplers were used (20 men, mean age 27.3 ± 7.4 years, mean BMI = 23.7). The third group comprised patients in whom the appendix stump was closed using purse string sutures (20 men, mean age 33.3 ± 12.4 years, mean BMI = 24.1). The groups were matched by age, sex and BMI. A retrospective analysis was performed with the following parameters: mean duration of the procedure, hospitalisation period and hospitalisation cost. The use of materials was analysed based on protocols prepared by circulating nurses and served to calculate procedure costs.

Laparoscopic appendectomy was performed as described below. Patients were lying on their back, with the operating surgeon and assistant on their left hand side and the monitor on the right. The operating surgeons were either medical specialists or residents assisted by a surgical specialist. Pneumoperitoneum was achieved using the open technique or the Veress needle (closed) technique depending on the preferences of the surgeon. The laparoscope was inserted through the first trocar, 10 or 11 mm in diameter, placed in the navel. The second, 5 mm port was placed in the right mesogastrium and the third port, 13 mm in diameter, in the lower abdomen, slightly left of the central axis. Once the abdominal organs were inspected and the diagnosis of acute appendicitis confirmed, the appendix was mobilised and its mesentery resected using electrocoagulation. Next, the appendix base was closed: in group 1, surgical titanium clips (Aesculap) dedicated for appendectomy were used (fig. 1), in group 2, Endo-GIA staplers were used (fig. 2), and in group 3, the purse string suture was used (Vicryl 2.0) with a reduction of the appendix stump to the caecum, similarly to traditional

surgery (fig. 3). The resected appendix was removed in a latex casing through the trocar in the lower abdomen. Typically, a drain was placed through the 5 mm trocar to the pelvis via the area of the removed appendix.

RESULTS

The mean hospitalisation period after laparoscopic appendectomy was: 3.5 days (SD=1.4)

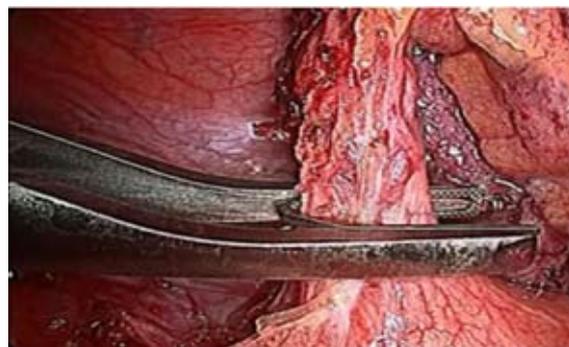


Fig. 1. Closure of the appendix stump using a surgical titanium clip



Fig. 2. Closure of the appendix stump using an endoscopic stapler



Fig. 3. Closure of the appendix stump using the purse string suture

in group 1, 3.8 days (SD=1.6) in group 2 and 3.6 days (SD=1.3) in group 3. The mean duration of the procedure in each group was: 60.9 minutes (SD=22.3) in group 1, 59.8 minutes (SD=11.2) in group 2 and 70.9 minutes (SD=15.1) in group 3.

The mean cost of the procedure was: PLN 2081.54 in group 1, PLN 2995.83 in group 2 and PLN 1808.97 in group 3 (tab. 1).

Two clips were used to close the appendix base in one patient as one clip proved insufficient due to the large width of the appendix stump.

No intraoperative or postoperative complications were observed in the analysed cohort of patients.

There was no need for conversion to open surgery in any of the analysed patients.

There were no perioperative deaths in the analysed groups of patients.

DISCUSSION

Treatment results from our Department are in line with data from most papers regarding the use of laparoscopy in the treatment of acute surgical conditions of the abdomen, including acute appendicitis (1, 3). The advantage of minimally invasive techniques over traditional surgery (hospitalisation period, number of infectious complications, the use of analgesics and antibiotics) is indisputable (5, 6, 7, 11, 13). The greatest advantage of laparoscopy is reduced surgical trauma and consequently, a shorter hospitalisation period. The cost of materials used during laparoscopic surgery is of course higher compared with those used in traditional surgery. However, due to the shorter hospitalisation period and reduced number of perioperative complications, the overall costs incurred by the medical facility are in fact lower. The closure of the appendix stump is a crucial element in laparoscopic surgery. The methods of stump closure analysed in this paper are safe and did not differ

significantly in terms of the number of complications. According to some authors, stump closure using the endoscopic stapler is the safest method; however, it is also the most expensive which plays an important role in the Polish reality. It is plausible that this method should only be used in specific perioperative conditions, such as necrosis or wide appendix base (7, 9). Although the cheapest, stump closure using the purse string suture is associated with a longer duration of the procedure (on average by more than 10 minutes in the analysed material) and more technically demanding (requires experience in laparoscopic suturing) which may prove burdensome in emergency room practice (12). With the current economic situation in Poland, appendectomy using a dedicated clip seems to be an intermediate solution, a logical compromise between the most expensive and cheapest method (8, 14, 16, 17).

The average duration of this procedure is similar to the duration of the procedure with an endoscopic stapler. The mean hospitalisation period did not differ significantly in any of the analysed groups. The use of metal clips for appendix stump closure is safe and associated with a low complication rate. It is also easy to learn and may serve as an introduction when residents are taught minimally invasive surgery. With the current advances in minimally invasive surgery and the Polish financial reality, laparoscopic appendectomy with appendix stump closure is a recommendable surgical procedure.

CONCLUSIONS

1. With the current valuation of medical procedures in Poland, laparoscopic appendectomy and appendix closure using a dedicated clip seems a reasonable solution that is both technically easy and cost-effective.

Table 1

Method of appendix stump closure	Mean hospitalisation period	Mean duration of the procedure	Mean cost of the procedure
Surgical titanium clip	3.5 days (SD=1.4)	60.9 minutes (SD=22.3)	2081,54 PLN
Endoscopic stapler	3.8 days (SD=1.6)	59.8 minutes (SD=11.2)	2995,83 PLN
Purse string suture	3.6 days (SD=1.3)	70.9 minutes (SD=15.1)	1808,97 PLN

2. Laparoscopic surgery using a stapler is associated with the highest cost but may be applied in patients in whom other methods of stump closure may prove ineffective, e.g. in the case of necrosis or excessive width of the stump base.
3. Laparoscopic appendectomy using the purse string suture may also be considered in everyday practice: this is the cheapest but most difficult method and is therefore associated with a longer duration of the procedure.

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