RESULTS OF LAPAROSCOPIC APPENDECTOMIES PERFORMED WITH THE USE OF TITANIUM CLIPS FOR CLOSURE OF THE APPENDICULAR STUMP

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Nowadays laparoscopy is used frequently not only in elective surgery but also in abdominal emergencies, including acute appendicitis. There are several techniques used to close the appendicular stump during laparoscopic appendectomy.

The aim of the study was to present the results of minimally invasive appendectomies performed with the use of titanium clips.

Material and methods. Patients operated on laparoscopically for acute appendicitis with the application of titanium clips between October 2012 and December 2013 were included in the study. We reviewed retrospectively patients’ data including: age, sex, duration of the surgical procedure and hospital stay, mortality, intraoperative and postoperative complication rates.

Results. There were 93 patients (mean age=33.8 years, SD=15.23) in the analyzed group, including 60 men (mean age=33.5 years, SD= 15.07) and 33 women (mean age=33.9 years SD=15.26). The average duration of the surgical procedure was 66 min (SD= 33.15). The average length of hospital stay was 3.38 days (SD=1.62). No intraoperative complications were observed in the analyzed group. Postoperative complication rate was low (6 cases, 6.5%). No mortality was observed.

Conclusions. Laparoscopic appendectomy with the application of titanium clips for closure of the appendicular stump is safe, associated with low complication rates and should be considered as a routine technique in everyday surgical practice.

Key words: laparoscopic appendectomy, titanium clips, results

Nowadays laparoscopy is used frequently not only in elective surgery but also in abdominal emergencies, including acute appendicitis (1, 2, 3). Laparoscopic appendectomy is currently a well-established and widely accepted method (3, 4). Its main advantages compared to the open surgery approach include less pain in the postoperative period, a faster return to normal activity and work, shorter hospital stay and a lower percentage of wound infection. Some authors point out, however at a slightly higher rate of intra-abdominal abscesses and higher cost of laparoscopic surgery compared with the classic one (5, 6). It seems that both of these factors unfavorable for laparoscopy are influenced by the applied method of closing the appendicular stump.

There are several techniques used to close the appendicular stump during laparoscopic appendectomy. The most commonly used surgical methods are associated with the use of endo-loop ligature, laparoscopic staplers, metal or polymer clips or application of purse string suture with the invagination of the base of the appendix into the cecum, as in the classic surgery (7-12). However, there is still controversy as to the optimal closure of the base of the appendix.

The aim of the study was to present the results of minimally invasive appendectomies performed with the use of titanium clips for closure of the appendicular stump.

MATERIAL AND METHODS

Patients operated on laparoscopically for acute appendicitis with the application of ti-
tanium clips between October 2012 and December 2013 in the 2nd Department of General Surgery of the Jagiellonian University Medical College in Cracow were included in the study. We reviewed retrospectively patients’ data including: age, sex, duration of the surgical procedure and hospital stay, mortality, intraoperative and postoperative complication rates.

Acute appendicitis laparoscopic surgery was performed using a classic technique. The patient was on the operating table lying on his back, the operating surgeon and the assistant were on his left side, and the monitor was placed on the right side. Either residents assisted by specialist surgeons or specialist themselves were the operators. Pneumoperitoneum was established using an open technique. The first trocar, through which a laparoscope was introduced, with a diameter of 10 or 11 mm was placed in the navel. The second 5 mm access was placed in the right mesogastrium, and a third access with a diameter of 13 mm in the lower abdomen just left of the center line. After viewing the abdominal organs and confirming the diagnosis of acute appendicitis, appendix was mobilized and skeletonised, by cutting its mesoappendix using a harmonic scalpel or electrosurgery. Then the clips were applied at the base of the appendix using a special, reusable clipper and after being cut off with the harmonic scalpel appendix was removed in the latex coating through a trocar in the lower abdomen (fig. 1-2). Aesculap titanium clips with a special closing mechanism at the end, protecting against slipping out of the clipped tissue were used. The tube was routinely passed through a 5 mm trocar descending into the pelvis.

Patients scheduled for laparoscopic appendectomy were administered antibiotics intravenously in the form of single-dose cefazolin, 30 minutes before the start of the procedure (1 g with patients weighing less than 80 kg, or 2 g weighing more than 80 kg) and metronidazole in a dose of 15 mg/kg body weight, 60 minutes before the start of the surgery. Depending on the severity of the inflammation found intraoperatively intravenous antibiotic therapy was used in the form of ceftriaxone and metronidazole or clindamycin.

RESULTS

There were 93 patients (mean age=33.8 years, SD=15.23) in the analyzed group, including 60 men (mean age=33.5 years, SD=15.07) and 33 women (mean age=33.9 years SD=15.26). The youngest patient operated was 18 years old and the oldest 86 years. The average duration of the surgical procedure was 66 min (SD=33.15). The average length of hospital stay in the analyzed group was 3.38 days (SD=1.62).

During the procedure phlegmonous appendicitis was most often observed (70 patients, 75.3%), less frequently gangrenous appendicitis (18 patients, 19.3% including 4 with perforated appendicitis and 3 with periappendicular abscess). In case of 5 patients the appendix was macroscopically unchanged (5.4%). Women of childbearing age prevailed in the latter group.

No intraoperative complications were observed in the analyzed group. Postoperative complication rate was 6.5% (6 cases) (tab. 1). One patient (1.1%) undergone laparoscopic reoperation due to adhesive bowel obstruction on the second day after appendectomy, which
In recent years, clips were suggested as an alternative method of closing stump appendicitis during laparoscopic operation. Several reports presented the results using non-absorbable polymeric clips Hem-o-lok, which proved to be safe, easy to use and relatively cheap (9, 10). However, their safe use is significantly reduced the maximum diameter of the closed appendix of 10 mm. Often an inflamed appendix is much thicker, which prevents their use.

In this study, we presented the results of using during laparoscopic appendectomy metal clips made of titanium double “jaws” and a special locking mechanism at the end of impeding the slipping off of the clipped tissue and coming off the clip. They allow for the closure of appendix with a diameter of 20 mm. Clipper to apply this type of clips requires the use of a trocar 12.5 or 13 mm, which was similar to the original endoscopic staplers, but slightly greater than that of the plastic clips permitting the use of the port diameter of 10 mm.

The average duration of the surgical procedure (66 min) achieved in this material is comparable to the literature data, especially considering that many procedures were performed by trainee residents assisted by a specialist. Also the average postoperative hospital stay (3.38 day) did not differ from data from other publications (3, 13).

Particular emphasis is given to no deaths and intraoperative complications and small percentage of postoperative complications in the analyzed group, which demonstrates the safety of this method of operating. 1 postoperative hematoma formation around cecum and 1 reoperation because of obstructive symptoms were not likely connected with the way of closing the base of the appendix with a metal clip.

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Presented results, as well as other reports indicate that the use of metal clips to close stump appendicitis is a safe method, associated with the low rate of complications (12, 13, 14), also in the case of complicated appendici-

**DISCUSSION**

The relevant closure of the appendicular stump during appendectomy is very important because it can prevent the occurrence of a number of serious postoperative complications. Widespread in the case of laparoscopic appendectomy is the use of the endo-loops or linear endoscopic staplers endoGIA type (7, 8). According to some authors, this last method is the safest option, but at the same time the most expensive, which especially in the Polish financial realities plays an important role (8). In turn, closing the appendicular stump with a purse string suture during minimally invasive surgery is much more difficult from a technical point of view and requires some experience in laparoscopic sewing.

| Table 1. Results of laparoscopic appendectomies with the application of titanium clips |
|-----------------------------------------|---------------------|
| Number of patients, including:         | 93                  |
| – mężczyźni / men                      | 60                  |
| – kobiety / women                      | 33                  |
| The mean age of the patients (SD = 15,23) | 33,8 roku / years   |
| The average duration of the surgical procedure (SD = 33,15) | 66 min              |
| The average length of a hospital stay, (SD= 1,62) | 3,38 dnia / days    |
| Diagnosis:                             |                     |
| – phlegmonous appendicitis             | 70 (75,3%)          |
| – gangrenous appendicitis              | 18 (19,3%)          |
| – lack of appendicitis                 | 5 (5,4%)            |
| Intraoperative complication rate        | 0 (0%)              |
| Postoperative complication rate         | 6 (6,5%)            |
tis (15). It is also relatively easy technique to learn, which is especially important in the case of departments training the residents. However, in cases of necrosis or very large thickening of the base of the appendix using an alternative method should be considered. In order to fully assess the surgical technique further studies are needed involving larger groups of patients undergoing surgery.

CONCLUSIONS

It seems that our results allow us to conclude that laparoscopic appendectomy with the application of titanium clips for closure of the appendicular stump is safe, associated with low complication rates and should be considered as a routine technique in everyday surgical practice.

REFERENCES