Laparoscopic Appendectomy in the Treatment of Acute Appendicitis

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ORIGINAL PAPER
SUMMARY
Background: Laparoscopic appendectomy (LA) has many advantages over the classic appendectomy (CA), but this method has not been accepted yet in Bosnia and Herzegovina. Therefore, we attempted controlled randomized study in order to compare classic appendectomy with laparoscopic appendectomy and confirm eventual advantages of caring base of appendix with hem-o-lok clips regarding ordinary accepted endoloop method during laparoscopic appendectomy. Methods: In this prospective study 120 patients were involved which are divided into two groups. In group I, 60 patients were operated with classical method, and group II was divided into two subgroups; 30 patients were operated with laparoscopic method in which the base of appendix was cared by double endo-loop method and 30 patients were operated by plastic non-resorptive hem-o-lok clip. During this study the time duration of operation was measured, the duration of application of hem-o-lok and endo-loop, postoperative analgesia, the length of hospitalization, intra-operative complications, anatomic position of appendix, appendicitis, and postoperative complications. Results: The results of the study showed that laparoscopic appendectomy is shorter in duration if compared to the classical appendectomy with statistical significance p<0.001 (CA 69.4 min; LAH 36.6 min; LAE 32.1 min); hospitalization is shorter p<0.0001 (CA 3.6 days; LAH 2.3 days; LAE 2.2 days). Quantity of given analgesics in LA is less than in CA without statistical significance between LAE and CA (p>0.340) and between LAH and LAE (p>0.148) while there is positive statistical significance between LAH and CA (p<0.015). Precise period of cicatrization of wound of patients operated by CA was 43 (71.6%) cases, with infection of wound in 35% cases, ileus in one (1.6%) patient. One patient had an infection of umbilical wound in LA and the other had cellulitis of front abdominal wall. Duration of application of hem-o-lok is shorter compared to endo-loop with statistical significance p<0.013 (LAH 68.2 s; LAE 176.9 s). Conclusion: Time of surgery is shorter and the duration of hospitalization, amount of given analgesics is smaller, less number of postoperative complications, better cosmetic effect and advantages of application of hem-o-lok over endo-loop laparoscopic appendectomy is preferred. Key words: laparoscopic appendectomy, acute appendix, classic appendectomy.

Also, some reports show the possibility of alternative care of appendix base during laparoscopic appendectomy other than the double endo-loop ligation (LA). This method shows that the double hem-o-lok clips (LAH) are easier to apply, and duration of surgery is shorter. Therefore, we attempted controlled randomized study in order to compare classic appendectomy with laparoscopic appendectomy and confirm eventual advantages of caring base of appendix with hem-o-lok clips regarding ordinary accepted endoloop method during laparoscopic appendectomy.

2. PATIENTS AND METHODS
In this prospective study 120 patients were involved, 60 of whom were operated by the classical method, while 30 patients were operated by laparoscopic method, in which the base of appendix was cared by double endoloop method and plastic non-resorptive hem-o-lok clip.

Criteria in this study were patients with acute appendicitis older than 14 years of age, and LA was operated by surgeon who has less than five procedures. Patients with secondary appendicitis caused by other clinic entity, and patients to who conversion from laparoscopic to classic method of appendectomy was done, were excluded from this study.

During this study the time of operation was measured, the length of application of hem-o-lok and endo-loop after skeleton mezoappendix, postoperative analgesia, the length of hospitalization (interval from the moment...
when the patient was admitted until he or she left the clinic), intra-operative complications, anatomic position of appendix, histological finding of appendix (hyperemic, phlegmatical, gangrenous or perforinare) and postoperative complications.

CA was performed through right iliac fossa, using alternative cut according to Springer. LA was performed in Trendelenburg position, patient is leant against surgeon 10-15 degrees. Surgeon and assistant are standing on the left side of patient. Before the operation begins, urinal kateter is injected. Pneumoperitoneum is performed using Veress syringe. Three ports are imported: 10 mm in supraumbilical area, with closed technique, then under control of camera two additional 5 mm ports: one in suprapubic area, some on the left and the other on the right in lower quadrant, levelled with the first 5 mm port, in order to get triangulation. Mesoaappendix is mobilized and dissected by ultrasonic coagulating shears (Ultrasonic coagulating shears, Ethicon, Endosurgery, Cincinnati, OH). Then three endo-loop ligature are placed (LA) 1/0 Vicryl (Ethicon) around appendicular base or two hem-o-lok clips (LAH). Then 5 mm camera is imported through left 5 mm suprapubic port and endo-bag is imported through suprambili
cal 10 mm port (Endosurgery, Cincinnati, OH, Ethicon) in order to remove appendix and avoid contamination of wound. Abdominal toalet of right paracolic groove and pelvic is performed by using irrigation. If there were exudates, drain is placed in Douglass area. Then, trocar is being pulled out, letting out CO2 from abdominal hollow and closing incise wounds by skin stitches.

3. RESULTS

From entire number of operated patients by classic method, 37 (61,66%) were females average 26,05 years old between 15 and 55 years of age and 23 (38, 33%) were males, average 38 years old between 15 and 70 years of age. There were 30 (50%) females and 30 (50%) males in the group of patients operated by LA.

The most common approach in CA is bevel cut through McBurny’s point in 48 (80%) examined patients, laparotomia totalis and laparotomia infraumbilicalis in 2 (3,3%) patients. Bevel cut in combination with drainage is performed on 7 patients (11,6%), and the total number of drainage in CA was on 11 patients (18,33%). In LAE the total number of drainage was on 27 patients (90%), while in LAH 25 patients (83,3%).

3.1. THE LENGTH OF HOSPITALISATION

The average time of hospitalization of patients operated by CA was 3,65 days, in comparison to LAH it is 2,3 and LAE 2,2. The maximum length of hospitalization in CA amounted to10 days, LAH 4 days, while LAE 3 days. There is a statistically significant difference in duration of hospitalization of patients operated by CA and both group of patients operated by LAH and LAE (p<0,0001, p<0,001), while there is not statistically significant difference in duration of hospitalization between LAH and LAE (p<0,13).

3.2. THE LENGTH OF OPERATION

The length of operation in both groups of examined patients is showed in Table 1. There is statistically significant difference in duration of operation between both laparoscopic method and classic method of appendectomy (LAH p<0,01, LAE p<0,001). There is no statistically significant difference in duration of operation between LAE i LAH (p>0,451).

3.3. ANALGESIA

Control of pain after operation in both groups of patients was performed with parenteral analgesia. The average amount of given analgetic in CA was 7,1 ampoules, while in LAH 4,8 ampoules and in LAE 5,2 ampoules. There is no statistically significant difference in amount of given analgetic between LAE and CA (p>0,340), and between LAE and LAH (p>0,148), while there is significant difference between LAH and CA (p<0,015).

3.4. THE TIME OF APPLICATION OF HEM-O-LOK AND ENDO-LOOP DURING LA

During operation the time needed for application hem-o-lok and endo-loop was measured, and immediate after importing a working instrument (applier) (an instrument is imported after finished skeletoning and the clearance of base of appendix) until application is finished, in other words immediate intersection base of appendix. There is statistically significant difference considering duration of application hem-o-lok and endo-loop (p<0,013) (Table 2).

3.5. PATHOHISTOLOGICAL ANALYSIS

In CA the largest number of operated patients had phlegmatically altered appendix 31 (51,66%), while gangrenous altered appendix had 16 patients (53,3) in LAH, and 17 patients (56,6%) in LAE.

3.6. COMORBIDITY, OPERATIVE AND POSTOPERATIVE COMPLICATIONS

The following diseases are noticed in LA: umbilical hernia, myomatose uterus, and woman in fourth month of pregnancy, condition after cholecystectomy. Operative complications in LA are showed in Table 3. Regular cicatrization of wound in patients operated by CA was 43 (71,66%), while the other patients had an infection of wound 3 (5%) patients, phlegm of wound 2 (3,3%) patients, healing of wound per secundam 9 (15%) patients and ileus 1 (1,6%) pa-

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### Table 1. Operative time in classic and laparoscopic appendectomy

<table>
<thead>
<tr>
<th>Appendectomy technique</th>
<th>Average time of operation</th>
<th>Maximum time</th>
<th>Minimum time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classic</td>
<td>69,41 min</td>
<td>150 min</td>
<td>30 min</td>
</tr>
<tr>
<td>Hem-o-lok</td>
<td>36,60 min</td>
<td>60 min</td>
<td>20 min</td>
</tr>
<tr>
<td>Endo-loop</td>
<td>37,16 min</td>
<td>50 min</td>
<td>25 min</td>
</tr>
</tbody>
</table>

### Table 2. Time of application hem-o-lok and endo-loop

<table>
<thead>
<tr>
<th>Complications of hem-o-lok</th>
<th>Treatment</th>
<th>Complications of endo-loop</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open cecum 2-3 cm</td>
<td>Laparoscopically sutured</td>
<td>Cut tenia laparoscopically sutured</td>
<td>Suture</td>
</tr>
<tr>
<td>Bleeding from branch a. appendicularis</td>
<td>Cared with 5 and 10 mm clips and surgical</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Intraoperative complications of patients operated by laparoscopic method

<table>
<thead>
<tr>
<th>Complication</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative complications</td>
<td></td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>1 (1,6%)</td>
</tr>
<tr>
<td>Perforation</td>
<td>1 (1,6%)</td>
</tr>
<tr>
<td>Anastomotic leakage</td>
<td>1 (1,6%)</td>
</tr>
<tr>
<td>Septic complication</td>
<td>1 (1,6%)</td>
</tr>
<tr>
<td>Postoperative complications</td>
<td></td>
</tr>
<tr>
<td>Wound infection</td>
<td>3 (5%)</td>
</tr>
<tr>
<td>Wound phlegm</td>
<td>2 (3,3%)</td>
</tr>
<tr>
<td>Wound healing</td>
<td>9 (15%)</td>
</tr>
<tr>
<td>Wound ileus</td>
<td>1 (1,6%)</td>
</tr>
<tr>
<td>Wound infection</td>
<td>3 (5%)</td>
</tr>
</tbody>
</table>
tient. One patient had an infection of umbilical wound in LA and the other cellulitis of front abdominal wall infraumbilically.

4. DISCUSSION

Because of its advantages over open appendectomy – there is less postoperative pain, the period of hospitalization is shorter and better cosmetic results, laparoscopic appendectomy is becoming more accepted method considering the treatment of acute appendicitis (1, 2, 3, 4, 5, 6, 7, 8, 9, 10). However, the time of operative procedure is decreasing with the number of performed appendectomy, and better cosmetic effect and patients were returning faster to daily activities also gives advantages to this method.

Laparoscopic appendectomy has lately become everyday method in treatment of acute appendicitis (6, 11). One of the important reasons for this is that the classic appendectomy (CA) is simple, effective procedure that can be done by most surgeons. Laparoscopic appendectomy, on the other hand, requires a degree of knowledge of laparoscopic surgery and more expensive surgical equipment.

The most reports indicate shorter period of hospitalization of patients operated by laparoscopic method compared to classic method (1, 12, 13), faster return to everyday activities and shorter period of sick leave and return to work. In CA patients had longer time of hospitalization (34,8 hours) compared with LAH and 32,4 hours compared with LAE.

During classic appendectomy there is bigger manipulation of tissue, which represents one of the reasons of longer application of analgesics, wound infection as a result of irrigation and cleaning of Douglas’ area and skeletonizing mesoappendix through incise cut. Duration of hospitalization depends on many factors, including degree of pain, possibilities to visit ambulance, additional help at home, and abilities of hospital (2).

During our study time duration of operation was measured from cut to skin stitches. The average length of operation in classic appendectomy was 69,42 minutes, but in laparoscopic appendectomy for application of hem-o-lok was 36,60 minutes and endo-loop was 37,16 minutes. Cueto with associates’ states positive correlation of gangrenous alternated appendix with diffuse peritonitis, intra-abdominal abscess, length of operation and appearance of postoperative complications (1).

Changes on front abdominal wall, repeated operations with earlier pathological intra-abdominal condition, especially older and obese patients, are making difficulties or exclude performance of laparoscopic procedure. Impossibility of safe creation of pneumoperitoneum represents contraindication for applying laparoscopic method of operation, and approach to classic method of appendectomy.

In group of patients operated by laparoscopic method, time needed for application of hem-o-lok and endo-loop was measured after skeletonizing mesoappendix. Endo-loop ligature was applied longer (108,7 seconds). Length of application of hem-o-lok depends on simplicity of application clips in comparison to endo-loop ligature (7), which is difficult to set, especially when appendix is bigger than normal. Impossibility of application XL clips appears when there is disparity of size of hem-o-lok and capacity of appendix. Caring a base of appendix with endo-loop is priority when we have this sort of finding. These intra-operative findings lead to longer time of operation and exposure to negative influence of anaesthesia. There are no reports of combination of caring base of appendix by hem-o-lok clips and endo-loop ligature.

Control of pain after operation in both groups of patients was performed by parenteral analgesia. In both groups of our patients endotracheal anesthesia was performed and there was no conversion into classic method of appendectomy. Maximum number of ampoules of analgesics in LAH was 10 ampoules in one patient who had gangrenous perforated appendix with diffuse fibrinopurulent peritonitis, while the maximum number of ampoules analgesics in LAE applied at patients with gangrenous alternated appendix.

Many authors claim that LA is safe and efficient method without deaths recorded (4, 8, 9). During our study there were no death cases recorded in both groups of patients. Beside specific intra-operative and postoperative complications during LA, death of patients, depends on associative diseases. Mortality grows with rupture of acute appendicitis in younger and it is 3%, while in older it is 15%. There are reports of mortality from 0,5% in patients operated by LA older than 65 years, while in CA it is 2,4%. In the same report there is positive correlation between mortality of LA with cardiovascular complications. Several different reports say that LA is safe method (1, 11), in LAH intra-operative complications were in two cases: bleeding from the branches of artery appendicularis which was cared with 5 and 10 mm clips and surgical and open cecum in a base of appendix length 2-3 cm which was laparoscopically sutured.

Bleeding as intra-operative complication was in LAE and cut tenia coecum which was laparoscopically cared. All intra-operative complications were cared without any influence during healing. We can assume that with greater number of performed appendectomy the number of intra-operate complications could be reduced to minimum.

5. CONCLUSION

Laparoscopic appendectomy has proved advantages in comparison to open method. The risk for wound infection is lower, there is less postoperative pain, and period of staying in hospital is shorter.

In the cases of generalized peritonitis, laparoscopic method enables complete cleaning of abdominal hollow. Characteristic of laparoscopic is a smaller traumatized tissue and less irritation of bowels. Less postoperative pain and shorter period of staying in hospital, faster recovery and return to normal activities. This study showed many advantages of LA compared to CA, and advantages of LAH compared to LAE. Of course, there are some open questions such as histological reaction of tissue to endo-loop and hem-o-lok, as much as economic implications which prefer endoscopic procedure.

REFERENCES


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