

LAPAROSCOPIC VERSUS LAPAROTOMIC APPENDECTOMY FOR GENERALISED PERITONITIS IN CHILDREN

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KEY WORDS

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ABSTRACT

The aim of our study was to compare the results obtained with traditional versus laparoscopic appendectomy in generalised peritonitis. All patients treated for generalised peritonitis at the Department of Paediatric Surgery, Orthopaedics and Traumatology (DPSOT) were monitored, with focus on differences occurring in the postoperative period following laparoscopic or open surgeries.

Our set of patients was established using medical records of patients treated at DPSOT between 2002 and 2008. The selection criteria included the basic diagnosis (*peritonitis diffusa*) and complex diagnostics, treatment, and follow-up care at DPSOT. In terms of the postoperative period, we observed the length of treatment at ICU, the total length of hospitalisation, leukocyte and CRP level patterns, and both early and subsequent complications. Group A consisted of 140 children who underwent open surgery. Group B consisted of 70 patients in whom laparoscopic surgery without conversion was performed.

The average length of intensive care after traditional open surgery for generalised peritonitis due to acute appendicitis was 6.3 days and the length of hospitalisation was 9.5 days. The average length of intensive care in patients who underwent laparoscopic surgery was 5.8 days and the length of hospitalisation was 8.9 days. The mean C-reactive protein levels on day 6 after appendectomy were 20.1 in group A and 22.0 in group B. The levels of circulating leukocytes on the same day were 5.3 in group A and 7.1 in group B.

Laparoscopic appendectomy for appendicitis in its late stage with advanced generalised peritonitis does not show increased occurrence of early or late complications compared to traditional laparotomic appendectomy. Traditional open appendectomy exhibits more late complications.

ABBREVIATIONS USED

DPSOT – Department of Paediatric Surgery, Orthopaedics and Traumatology, Faculty Hospital Brno
ICU – Intensive care unit



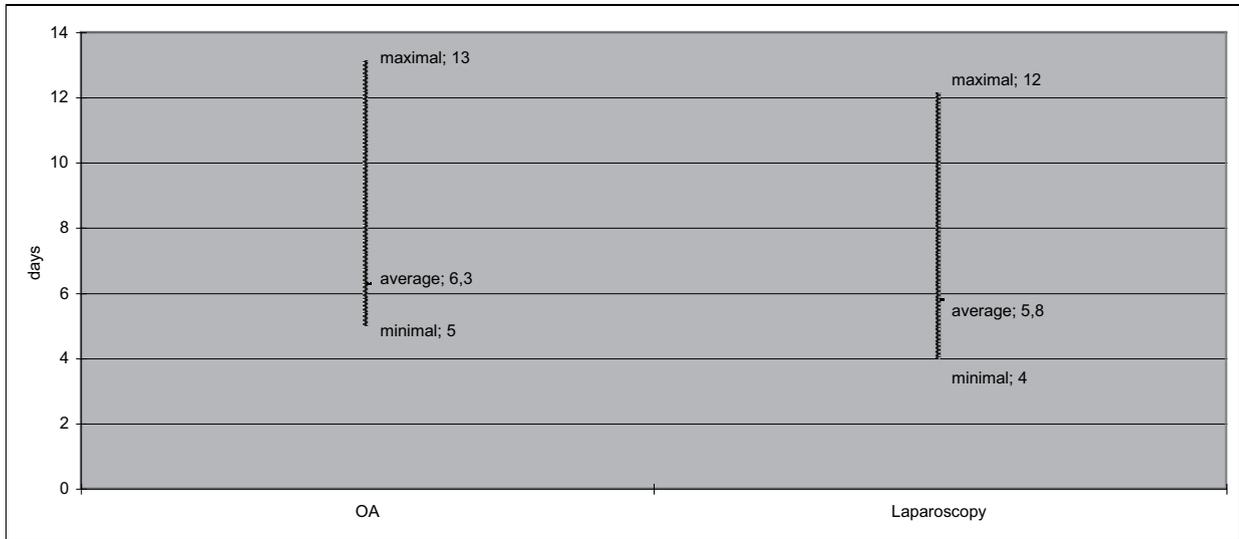
Figure 1
Transabdominal inserted laparoscope (archive of DPSOT)

INTRODUCTION

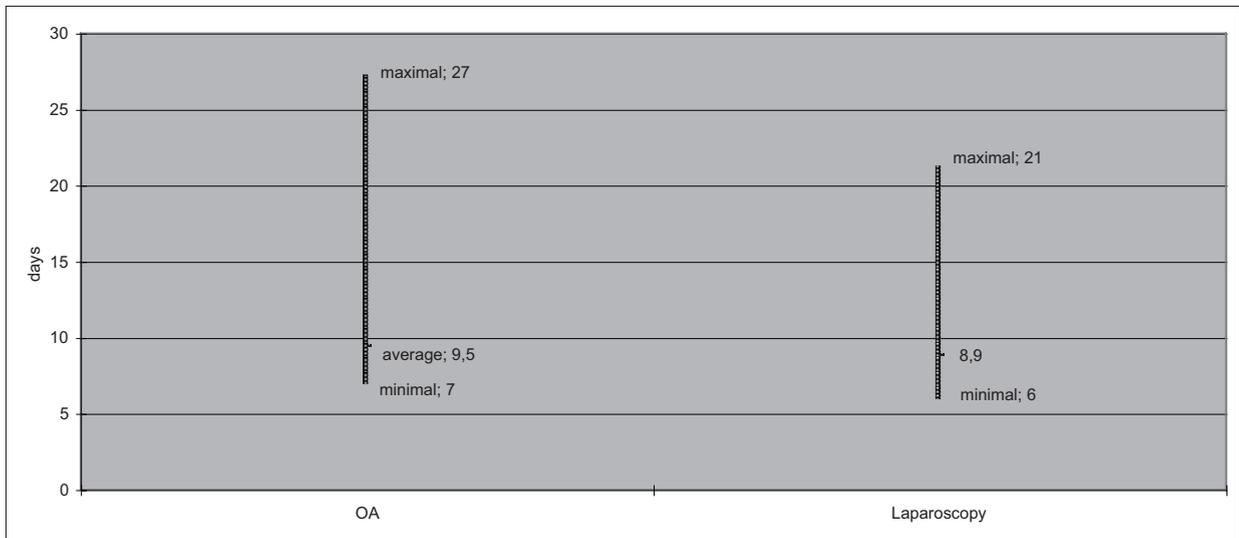
Inflammation of the appendix of the caecum is one of the most common surgical emergencies of the abdomen treated at paediatric surgery departments. At the Department of Paediatric Surgery, Orthopaedics and Traumatology about 600 children (0–19 years) are admitted every year with suspected appendicitis, and in more than a half of the cases the diagnosis is confirmed by clinical examination and additional laboratory tests. The only causal treatment is early surgery performed by means of the classic, i.e. open, procedure or laparoscopically, a technique which has now been more commonly used. The choice of the surgical procedure is largely based on standard practice of the hospital. A large number of contradictory studies are available [1, 2], confirming or refuting the advantages of the mini-invasive laparoscopic procedure. As a result, the method is either widely accepted or classic laparotomy is preferred. Access to necessary equipment and experienced staff also play an important role [3]. A definite guide as to indication criteria for laparoscopic surgery

cannot be determined and the two methods will therefore be still considered as the basic and adequate surgical procedures for acute appendicitis.

The aim of our study was to compare the results obtained with classic versus laparoscopic appendectomy in generalised peritonitis. Generalised peritonitis is in most cases associated with advanced inflammatory changes of the appendix in the form of gangrenous appendicitis, often perforated, and an appendix empyema or a periappendicular infiltrate frequently occur. Generalised peritonitis may also be accompanied by a smaller pelvic or bowel loop abscess. In all these cases, not only appendectomy, but also the abdominal cavity lavage is required. In terms of laparoscopy, the latter is more difficult to perform as extensively as with the open procedure. We observed all patients treated for generalised peritonitis at DPSOT and focused on differences occurring in the postoperative period following laparoscopic versus open surgeries. Initially, we formulated a null hypothesis, expecting no differences in the postoperative period after laparoscopic or laparotomic surgery.



Graph 1
Data distribution of hospitalisation length on ICU



Graph 2
Data distribution of hospitalisation length on surgery department

MATERIALS AND METHODS

Our set of patients was established using medical records of patients treated for generalised peritonitis at DPSOT between 2002 and 2008. Since 2002 we have been using a fully functional electronic hospital information system enabling us to search conveniently for all necessary in-

formation about these patients. The selection criteria included the basic diagnosis (K560 – *Peritonitis diffusa*) and complex diagnostics, treatment, and follow-up care at DP-SOT. Within the analysed period, i.e. the last 7 years, 210 patients were selected based on these basic criteria. In the next phase of retrospective data collection we considered the choice of the surgical procedure and the postoperative

period. Concerning the latter, the following parameters were defined [4]:

- length of stay at ICU
- total length of hospitalisation
- patterns and stabilisation of leukocyte levels
- patterns and stabilisation of C-reactive protein levels
- early re-operation due to abscess
- occurrence of subsequent complications (adhesion – ileus)

The set of patients was divided into 2 groups. Group A consisted of 140 children who underwent open surgery. We did not distinguish between different laparotomy types (transverse incision, pararectal incision). In this group, we also included children who underwent laparotomic surgery after conversion from the originally selected procedure, i.e. laparoscopy. Group B consisted of 70 patients in whom laparoscopic surgery without necessary conversion was performed.

After compiling data tables, statistical evaluation was carried out for all defined parameters and the results of our retrospective study were determined.

RESULTS

The average length of intensive care after traditional open surgery for generalised peritonitis due to acute appendicitis was 6.3 days, whereas the average length of intensive care in patients who underwent laparoscopic surgery was 5.8 days. The total length of hospitalisation also shows no significant differences between the two methods: in group A it was 9.5 days and in group B 8.9 days. The mean C-reactive protein levels on day 6 after appendectomy were 20.1 in group A and 22.0 in group B. The levels of circulating leukocytes on the same day were 5.3 in group A and 7.1 in group B. No patients, whether treated with classic laparotomy or laparoscopy, exhibited early complications, such as an abdominal abscess or early bowel adhesions. In group A, we observed late complications in 8 cases, including clinical manifestations of bowel adhesions in the form of acute ileus in six of them (on day 78 after surgery on average). The remaining 2 cases exhibited late formation of an abscess focus (on day 40 after surgery on average). In children treated with laparoscopic surgery, ileus did not occur even during the minimum observation period of 1 year after surgery. Within the whole set of 70 patients, we recorded only one late complication and that was inflammatory penetration with subsequent cicatricial fibrosis and pain in *musculus psoas l. dx*.

In terms of statistical significance, our initially formulated null hypothesis was confirmed for all objective parameters defined for the evaluation of results achieved in acute appendicitis treatment. The total length of both intensive care and

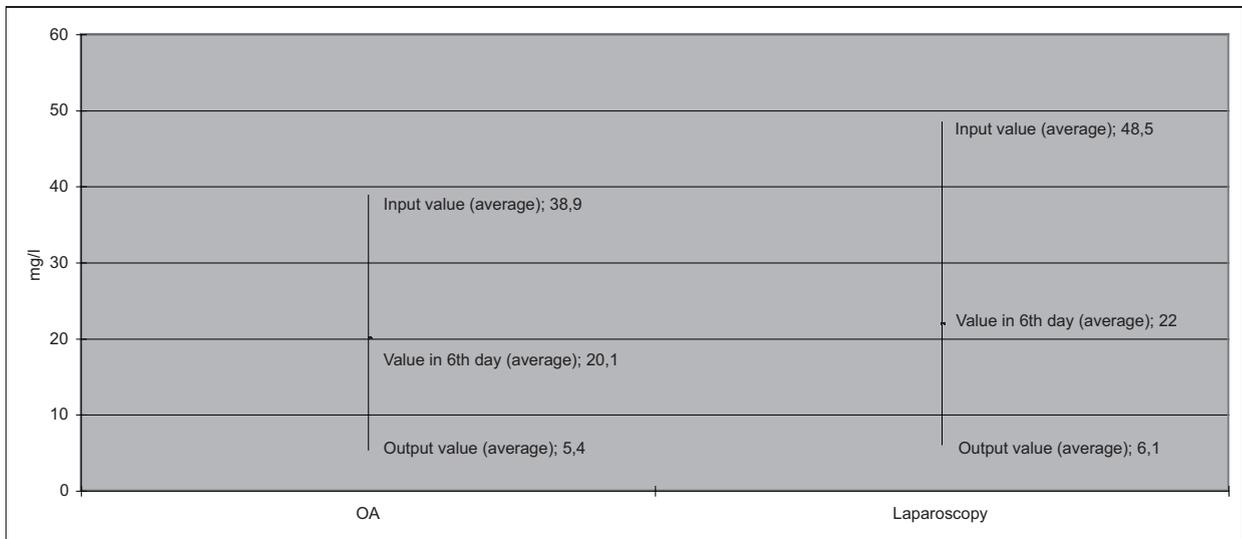


Figure 2
Laparoscopic set for paediatric endosurgery (archive of DPSOT)

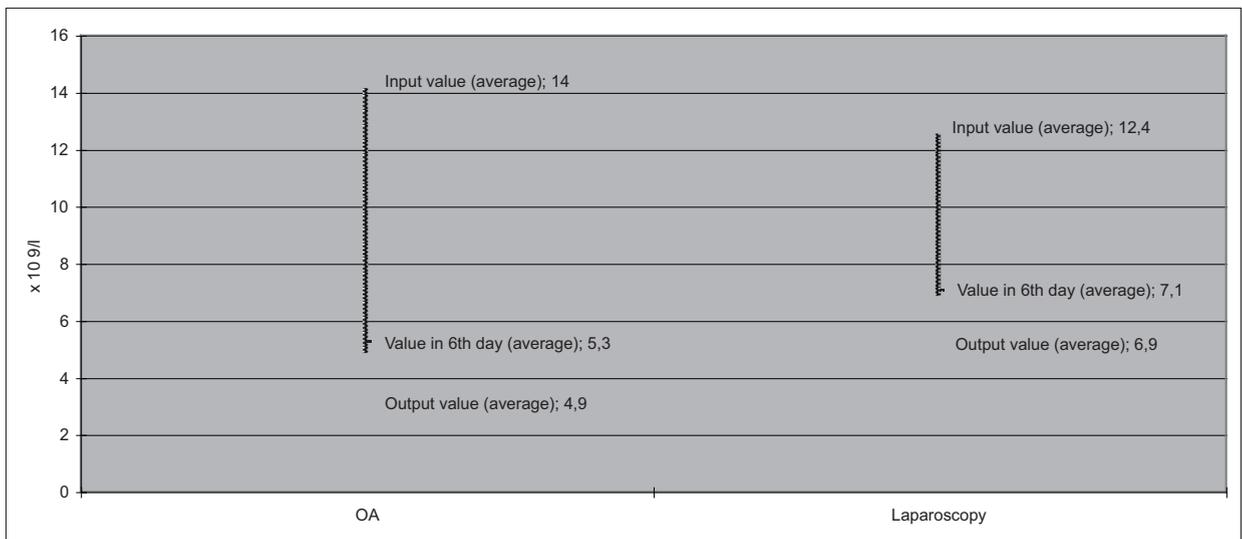
hospitalisation shows no differences between the two methods using a 5% significance level ($p_1 = 0.0018$, $p_2 = 0.0018$). The same situation occurred in case of C-reactive protein levels and leukocyte levels where both surgical procedures provided a statistically confirmed similarity of findings ($p_3 = 0.0018$, $p_4 = 0.0018$). Open laparotomy followed by appendectomy shows a higher incidence of subsequent complications and, in terms of statistical evaluation, it refutes our null hypothesis that had been initially formulated ($p_5 = 0.145$). Within the whole set, we recorded zero mortality due to acute appendicitis and generalised peritonitis. In 4 patients included in group A, open surgery was required as a result of conversion from laparoscopy.

DISCUSSION

The question of choosing the surgical procedure, i.e. whether to use laparoscopy or the traditional method, for inflammation of the vermiform appendage of the caecum has been under discussion ever since the introduction of the laparoscopic technique. Though the number of departments that



Graph 3
Data distribution of CRP level (6th day after operation)

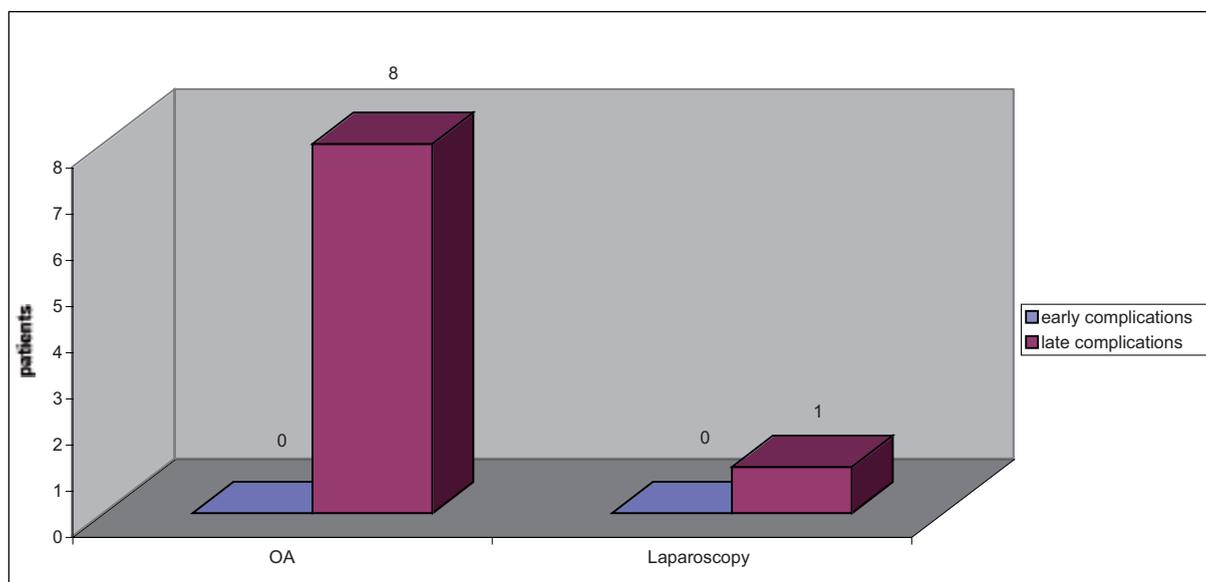


Graph 4
Data distribution of WBC (6th day after operation)

prefer the mini-invasive laparoscopic procedure is growing, a final recommendation cannot be provided. In the end, it is always the responsibility of the surgeon. The day when one of the methods would be excluded from lege artis procedures is not likely to come.

As for laparoscopic surgeries, there is a large number of sceptics who regard the technical limitations of the performance during surgery as its disadvantage. However, gradual

advances in surgical instruments and improving skills clearly show that human capability does not know any limits even in this area. One of the major practical limitations is time [4]: in laparoscopic appendectomy the operating time may be significantly longer than in laparotomic appendectomy. From this perspective, to prefer the latter seems essential and rational. By contrast, the atypical appendical position (retro-caecal, subhepatic) or a limited movement of the caecum



Graph 5
Frequency of early and late complications depending on surgical method

(subserous or sleeved) makes the open appendectomy quite difficult. With laparoscopy the operation procedure can be quicker and more comfortable for both the patient and the surgeon.

Another disadvantage associated with the laparoscopic method is a limited possibility of performing proper lavage of the inflamed peritoneal cavity [5]. Not only our study, but also several other studies provide valid information to disprove this assertion [4, 6]. Although the abdominal cavity is not widely opened and mechanically cleaned, compared to the classic procedure, we are able to perform revision of the peripheral areas of the abdominal cavity and individual organs more accurately. If we use adequate disinfection solutions, antibacterial measures can be regarded as sufficient. Moreover, in case of laparoscopy we can thoroughly suck out the remaining lavage liquid together with the remains of the fibrin clots, coagula, and tissue remains which are often found after surgery of generalised peritonitis.

The risks of laparoscopic surgeries, i.e. laparoscopic appendectomy, show a gradually decreasing tendency. This does not result only from the development of safer and more modern instruments, but it is also closely related to the adoption of safe surgical procedures. The insertion of the first port following Veress needle insertion has become less common and direct preparation of the abdominal cavity or monitored penetration by means of a transparent port with a camera are now preferred. The other ports are then inserted strictly under monitoring by a laparoscopic camera, and

the incidence of injuries to organs in the abdominal cavity is comparable with the open procedure. In our set of patients, we did not record any iatrogenic injuries to organs in the abdominal cavity induced by the inserted port or a laparoscopic instrument. The percentage of this type of complications is usually about 1%. The most commonly injured organ is the small intestine followed by the stomach, the inferior vena cava, and exceptionally some other organs (the aorta, the pancreas, etc.).

The question of safe preparation when using the electric field has also been widely discussed. Mostly Western countries and the USA intensively appeal for the safety of surgical procedures and the use of alternative means for early surface treatment. Within Western Europe the use of the harmonic scalpel has been promoted and in the USA the ENDO GIA stapler has been definitely recommended. Since they all represent stable economic systems of health care financing, it is only logical that their recommendations are not influenced by financial limitations. Retrospective studies provide numerous recommendations, suggesting an increased occurrence of complications after using monopolar electrocoagulation. Based on our experience, a large group of 210 patients treated for acute appendicitis did not exhibit any such complications. Even in the set of all patients treated laparoscopically at our department in the course of the last 7 years this problem could not be referred to as frequent. Patients who suffered an injury caused by monopolar electrocoagulation during laparoscopic surgery would

not exceed a few cases. The differences in effect between monopolar and bipolar coagulation are another subject for discussion. Our group of patients demonstrates the benefits of a bipolar machine, particularly in terms of reducing the number of perioperative complications with a tendency to bleed, which can lead to infection of haematoma remains at the appendectomy site. The risks of monopolar coagulation are indeed higher than in the case of bipolar forceps. However, we do not have statistical evidence for a higher incidence of injuries caused by electric current. The trend has obviously been set and all hospitals applying the laparoscopic procedure will probably aim at using disposable staplers, the harmonic scalpel, or new and more sophisticated methods.

CONCLUSION

Laparoscopic appendectomy for appendicitis in its late stage with advanced generalised peritonitis does not show increased occurrence of early or late postoperative complications compared to classic laparotomic appendectomy. A null hypothesis expecting no differences was successfully confirmed using a statistical significance level. On the contrary, traditional open appendectomy is accompanied by more late complications, such as bowel adhesions. Based on this study, we can recommend laparoscopy as adequate for appendectomy also in its late stage with inflammation extending into the peritoneum [7, 8].

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