Comparison of standard and fast track rehabilitation in patients with acute appendicitis. Intermediate results of multicenter prospective randomized trial


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Aim. To analyze outcomes of fast track rehabilitation in patients with acute appendicitis.

Material and methods. Prospective, randomized multi-center trial including 86 patients was conducted. There were 38 patients in the main group and 48 in the control group. All patients underwent laparoscopic appendectomy under endotracheal anesthesia. Protocol included informing, no premedication, glucose infusion prior to surgery, antibiotics administration, mesoappendix excision, limited deployment of drainage tubes, intraabdominal prolonged anesthesia, minimal pneumoperitoneum, limited irrigation, minimum power monopolar electrocautery, antiemetics, early activation and eating (2 and 6 hours after surgery). Pain was evaluated by visual-analogue scale. Auscultative peristalsis was considered every 2 hours after surgery. Cortisol level was assessed preoperatively, in 6 and 12—24 hours after surgery in 11 (29%) and 15 (31%) patients of the main and control groups respectively. Discharge criteria: no leukocytosis, fever and pain syndrome requiring anesthesia, no signs of complications and patient’s consent.

Results. Terms of disease, gender, age and comorbidities were similar in all patients. Duration of surgery under minimal pneumoperitoneum and standard pressure was also similar: 69.2±3.96 and 70.9±3.89 min (p=0.762). Pain syndrome grade and need for analgesics were significantly lower in the main group within entire follow-up. Pain syndrome was absent at the 1st postoperative day in 16 (42%) and 2 (4.1%) patients of both groups, respectively (score 0—1). Phrenic nerve syndrome was observed in 36.8% of the main group and 60.4% of the control group (p=0.05). Incidence of dyspepsia and terms of peristalsis onset were similar. Length of hospital-stay was 1.45 days in the main group and 3.15 days in the control group (p=0.002). In the main group 18 (47%) patients were discharged on the first day after surgery. There were only 4 (8.3%) patients with similar hospital-stay in the control group (p<0.001). There were no repeated hospitalizations. Postoperative cortisol concentration was similar in both groups as well as in complicated and uneventful postoperative period. In the main group postoperative intestinal paresis (Clavien—Dindo grade 2) occurred in 1 patient. In the control group 7 patients had postoperative infiltrate and 1 patient — intestinal paresis (Clavien—Dindo grade 2). Postoperative drainage tube was deployed in 3 out of 7 patients with postoperative infiltrates and 6 of them received antibiotic therapy. Medication was successfully applied in all patients with complications.

Conclusion. There are some advantages of FTR for AA including reduced pain syndrome, morbidity and less length of hospital-stay. Issue of cortisol concentration requires further trials.

Keywords: standard and fast track rehabilitation, acute appendicitis, multicenter randomized trial.

Introduction

Acute appendicitis (AA) is one of the most common surgical diseases and accounts about 30% in emergency pathology [1, 2]. Minimally invasive technologies are able to improve outcomes in patients with AA and to reduce length of hospital-stay. At the same time, incidence of complications after appendectomy is still relatively high — 10% [3, 4]. Pain syndrome and dyspepsia also affect rehabilitation besides complications. Regarding severity of dyspepsia and pain syndrome length of hospital-stay may be 1—3 days in uncomplicated inflammation and 7—10 days in perforated AA and appendicular peritonitis [5]. As a consequence, overall duration of disability may be up to 3 weeks after appendectomy.

Thus, professional societies for emergency surgery recommend to reconsider certain practical approaches in AA patients in recent years [6]. Fast track rehabilitation (FTR) is one of the ways to improve quality of rehabilitation and to reduce complications rate in emergency surgery [7, 8]. The last have revolutionary changed elective surgery together with minimally invasive technologies [8, 9]. There are few investigations of FTR in emergency surgery. Review of M. Paduraru (2017) consisted of only 5 trials analyzing certain components of FTR in emergency surgery of large bowel and perforated ulcers repair. The authors preliminary concluded that «enhanced recovery in emergency surgery is applicable, safe and followed by improved outcomes» [10]. Few studies of FTR have demonstrated reduced time and cost of treatment with equal number of repeated hospitalizations and complications rate [11, 12], as well as possibility of outpatient laparoscopic appendectomy (LAE) for uncomplicated and complicated AA [13, 14]. Hamill (2016) in review of clinical trials of «evidence-
based interventions which can improve outcomes of AA. It was concluded that there is no FTR algorithm for AA, as well as evidence-based trials of its efficacy [5].

The purpose of this study is analysis of FTR efficacy in patients with AA.

Objective — to study the outcomes of FTR in patients with acute appendicitis.

Materials and methods

Prospective randomized multicenter trial included AA patients who were hospitalized in Moscow Clinical Hospitals No. 4 and 29 for the period 01.2016—06.2017. Randomization was performed at admission to surgical department by medical records numbers: even — FTR group (main), uneven — standard rehabilitation group (control).

Inclusion criteria were any form of inflammation (intraoperative macroscopic assessment); absent, local, widespread peritonitis (assessment during laparoscopy); absent or loose infiltrate; age over 18 years; MSA risk grade II—IV.

Exclusion criteria: patient’s refusal; language barrier; transfer to intensive care unit after surgery; MSA risk grade V; access conversion; dense appendicular infiltration; peritonization of appendage stump; no signs of AA in diagnostic laparoscopy.

102 patients were randomized for this period; 16 of them were excluded. Overall sample consisted of 86 patients aged 18—73 years (mean 31.8 years), there were 37 women and 49 men. FTR protocol was applied in 38 patients (main group), standard approach — in 48 cases (control group). All patients underwent laparoscopic appendectomy (LAE) under endotracheal anesthesia.

The protocol included: 1) informing (patient’s brochure); 2) no sedatives in premedication; 3) 10% glucose 200 ml infusion prior to surgery; 3) antibiotics administration 30 min prior to surgery; 4) mesoappendix excision in macroscopic signs of inflammation; 5) limited deployment of drainage tubes; 6) infiltrative administration of local prolonged anesthetic agents in trocar wounds, subdiaphragmatic irrigation and intraperitoneal administration of anesthetics. Mesoappendix infiltration with anesthetics if it was preserved; 7) minimal pneumoperitoneum (8—9 mm Hg); 8) limited irrigation in abdominal cavity sanation; 9) minimum power monopolar electrocautery to reduce thermal trauma (30 W coagulation/cutting in main group, 60 W coagulation/cutting in control group). No coagulation of appendiceal stump mucosa; 10) antiemetics (metoclopramide 2 ml intraoperatively) in ≥1 risk factors: female, non-smokers, age ≤50 years, postoperative vomiting in anamnesis; 11) getting up and fluid per os 2 hours after surgery (except night); 12) feeding in 6 hours after surgery (liquid food) if nausea is absent (except night).

Prolonged anesthesia of anterior abdominal wall was achieved via injection of anesthetics into preperitoneal space and transversus abdominis plane block. It was used laparoscopy-assisted preperitoneal injection of anesthetics at the level of iliac crest drug along anterior axillary line. Therefore, anesthetic was administered between abdominal internal oblique and transverse muscles (ilioinguinal and ilio-hypogastric block) after external dislocation of needle for about several millimeters. Abdominal wall was managed with 15—20 ml of anesthetic, subdiaphragmatic abdominal cavity — 5 ml, trocar wounds infiltration — 10 ml. Ropivacaine and Bupivacaine 0.25% were used.

Pain syndrome was assessed by visual analogue scale (VAS) in cm immediately after surgery, after 2, 6 hours and within 12—24 hours after intervention.

Peristalsis was auscultatively evaluated every 2 hours after surgery.

Plasma cortisol was analyzed by using of chemiluminescent immune method in 11 (29%) and 15 (31%) patients of the main and control groups in order to objectively perioperative stress. It was carried out within 3 intervals: 1 hour before surgery, 6 and 12—24 hours after surgery.

Complicated forms of AA consisted of gangrenous appendicitis, advanced peritonitis and infiltrate.

Clavien—Dindo classification was used to assess complications.

Primary endpoint was incidence of postoperative complications, secondary endpoints — length of hospital stay and number of repeated hospitalizations.

Discharge criteria were absent leukocytosis, fever and pain syndrome requiring anesthetics administration, no ultrasonic signs of early wound and intraabdominal complications and patient’s consent.

Telephone interviewing was performed in 2 and 30 days after discharge. Pain syndrome, episodes of fever, dyspepsia, wound complications, repeated need for medical help were considered.

Statistical analysis was carried out in BioStatistica program.

Student’s p-criterion and Fisher’s exact test were used to analyze differences between groups. Differences were significant at $p \leq 0.05$. Data are presented as mean ± standard error.

Results

Anamnestic of disease, time between admission and surgery onset and time after the last meal were similar in both groups (table 1).

There were 10 patients with complicated course of AA in every group (26.3% in the main group, 20.8% in the control group). Groups were similar by this variable ($p=0.612$). Antibiotics were administered in 4 patients with gangrenous AA followed by perforation and advanced peritonitis in the main group (for 2 days). In the control group antibiotics were prescribed in 24 patients (for 2 days in gangrenous appendicitis and/or local peritonitis, for 5 days in advanced peritonitis). Terms of active movements and liquid food intake were significantly less in main group compared with control group (table 2).
Pain and postoperative analgesia. Additional anesthesia was associated with reduced pain syndrome in the main group within all terms (table 3). No pain syndrome (<1 cm by VAS) in the first postoperative day was noted by 16 (42%) patients of the main group and 2 (4.1%) patients of the control group. Need for postoperative analgesia was lower in the main group compared with the control group (Ketorolac 13.8±3.91 mg vs. 28.8±5.05 mg, \( p = 0.029 \)).

Phrenic nerve syndrome. This syndrome was observed in 36.8% of the main group and in 60.4% of the control group (\( p = 0.05 \)). Severity of brachial and cervical pain was 3.5 and 5 cm in main and control groups, respectively (VAS).

Activation time. Mild-to-moderate pain syndrome was followed by earlier patients’ activation (3.9 vs. 6.7 hours) and enteric nutrition in main group (3.9 vs. 6.8 hours).

Dyspepsia. There were no differences in both groups; postoperative nausea and vomiting requiring additional antiemetics occurred in 7 patients from the main group and 8 patients from the control group.

Time of surgery. Time of surgery was similar in both groups (\( p = 0.762 \)). In our opinion, it means similar clinical forms of AA in both groups on the one hand and sufficient exposure of operating field under adequate myorrelaxation even in minimal pneumoperitoneum on the other hand.

Peristalsis. Peristalsis onset and terms of the first stool were similar in both groups.

Length of hospital-stay. There was significantly lower postoperative hospital-stay in the main group (1.45 vs. 3.15 days, \( p = 0.002 \)). In FTR group 18 (47%) patients were discharged within the first postoperative day, in the control group — only 4 (8.3%) patients (\( p < 0.001 \)).

Hospital-stay was separately analyzed in patients with complicated forms of AA. In the main group this value was 2.66±0.36 days, in the control group — 5.32±0.61 days.

### Table 1. Patients’ characteristics in both groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Main (n=38)</th>
<th>Control (n=48)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, years</td>
<td>33.2±2.01</td>
<td>30.7±1.46</td>
<td>0.305</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>9 (23.6%)</td>
<td>4 (8.3%)</td>
<td>0.069</td>
</tr>
<tr>
<td>Previous abdominal surgery</td>
<td>6 (15.8%)</td>
<td>3 (6.3%)</td>
<td>0.175</td>
</tr>
<tr>
<td>Advanced peritonitis</td>
<td>6 (15.8%)</td>
<td>4 (8.3%)</td>
<td>0.326</td>
</tr>
<tr>
<td>Infiltrate</td>
<td>6 (15.8%)</td>
<td>3 (6.3%)</td>
<td>0.175</td>
</tr>
<tr>
<td>Gangrenous appendicitis</td>
<td>4 (10.5%)</td>
<td>7 (14.6%)</td>
<td>0.748</td>
</tr>
<tr>
<td>Time from disease onset, h</td>
<td>23.4±2.68</td>
<td>24.1±3.41</td>
<td>0.894</td>
</tr>
<tr>
<td>Time from the meal, h</td>
<td>13.9±1.04</td>
<td>16.5±2.18</td>
<td>0.351</td>
</tr>
</tbody>
</table>

### Table 2. Intra- and postoperative management in both groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Main (n=38)</th>
<th>Control (n=48)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage tubes</td>
<td>4* (10.5%)</td>
<td>19** (39.6%)</td>
<td>0.003</td>
</tr>
<tr>
<td>Antimicrobial therapy</td>
<td>4 (10.5%)</td>
<td>24 (50%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mesoappendix excision</td>
<td>26 (68%)</td>
<td>2 (4%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Abdominal pressure, mm Hg (mean)</td>
<td>10.5±0.23</td>
<td>12.9±0.19</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Terms of active movements, h</td>
<td>3.9±0.49</td>
<td>6.8±0.61</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>The first meal, h</td>
<td>3.9±0.41</td>
<td>6.8±0.56</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Time of surgery, min</td>
<td>69.2±3.98</td>
<td>70.9±3.89</td>
<td>0.762</td>
</tr>
</tbody>
</table>

* — gangrenous appendicitis followed by perforation + advanced peritonitis; ** — gangrenous ± perforated appendicitis ± any peritonitis ± infiltrate.

### Table 3. Outcomes in both groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Main (n=38)</th>
<th>Control (n=48)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS after surgery</td>
<td>2.43±0.37</td>
<td>4.3±0.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>VAS 2 h after surgery</td>
<td>2.1±0.28</td>
<td>4.1±0.29</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>VAS 6 h after surgery</td>
<td>2.1±0.29</td>
<td>3.7±0.23</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>VAS 12—24 h after surgery</td>
<td>1.9±0.26</td>
<td>3.4±0.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Phrenic nerve syndrome</td>
<td>14 (36.8%)</td>
<td>29 (60.4%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Analgesia after surgery*</td>
<td>13.8±3.91</td>
<td>28.8±5.05</td>
<td>0.029</td>
</tr>
<tr>
<td>Peristalsis terms, h</td>
<td>9.4±1.2</td>
<td>11.9±0.89</td>
<td>0.148</td>
</tr>
<tr>
<td>Hospital-stay, days</td>
<td>1.45±0.24</td>
<td>3.15±0.42</td>
<td>0.002</td>
</tr>
<tr>
<td>Complications after surgery</td>
<td>1 (2.6%)</td>
<td>8 (16.7%)</td>
<td>0.071</td>
</tr>
</tbody>
</table>

* — for 1 and 2 days in recalculation on Ketorolac, mg.
spite the tendency differences were not reliable ($p = 0.099$). Outcomes are presented in table 3.

**Postoperative follow-up**

According to telephone interviewing redo hospitalizations, fever, pain syndrome, complications and deaths were absent in both groups.

**Biochemical markers of surgical stress**

*Effect of perioperative management protocol.* Fast track recovery protocol did not affect postoperative cortisol level — concentration was similar in both groups.

*Patients of complicated and uncomplicated groups.* Pre-operative cortisol concentration was not correlated with type of inflammation, presence of infiltrate or peritonitis (table 4).

*Cortisol as a biochemical marker of postoperative complications.* Cortisol concentration was similar in 6 patients with postoperative complications and 20 patients with event-free postoperative period (table 5).

**Antibiotic prophylaxis and antibiotic therapy**

*Main group.* Antibiotics were prescribed only in patients with gangrenous-perforated appendicitis followed by advanced peritonitis. Infectious complications were not observed. *Control group.* Antibiotics were administered in patients with gangrenous-perforated and nonperforated appendicitis and any form of peritonitis. Postoperative infiltrates occurred in 3 patients of complicated group and 4 patients of uncomplicated group. These data force us to look for other reasons of postoperative infiltrates in different approaches and effective measures for their prevention.

**Complications**

*Main group.* Postoperative intestinal paresis within 1 day after surgery occurred in 1 patient with acute gangrenous appendicitis followed by diffuse peritonitis and infiltrate. Activation of patient was performed in 3 hours after surgery, fluid intake — after 2 hours, liquid food intake — after 14 hours. Dyspepsia was not prevented in this patient, postoperative nausea and vomiting were absent. Medication was effective for intestinal paresis. Patient was discharged in 7 days after surgery. Severity of complication Clavien—Dindo 2 (deviation from normal postoperative period followed by additional medication).

*Control group.* Postoperative complications were noticed in 8 patients. 7 patients had postoperative infiltrate associated with pain syndrome and fever since the first postoperative day. Infiltrates were confirmed by sonography or CT-data. Another patient had intestinal paresis. Among 7 patients with postoperative infiltrates there were 2 cases of initial complicated inflammation, preventive postoperative drainage was deployed in 3 patients. It is noteworthy that 6 out of 7 patients received antibiotics after surgery. NSAIDs were administered in all patients with infiltrates, drugs were prescribed in 1 patient who did not receive antibiotics after surgery. All complications in control group were also referred to Clavien—Dindo grade 2 (medication).

All patients with complications of both groups were discharged within 2—11 days.

**Discussion**

Postoperative pain syndrome may be effectively reduced or eliminated with local anesthetics [17—19] as well as laparoscopic approach which has proved its effectiveness and safety [15, 16]. Prolonged combined retroperitoneal and intraperitoneal anesthesia was effective and safe in our work.

Intra-abdominal pressure was also analyzed. It was found that minimal pneumoperitoneum reduces postoperative pain and need for analgesics, as well as incidence and severity of phrenic nerve syndrome without advanced time of surgery (in case of experienced surgeon) [20, 21]. There was less frequency of phrenic nerve syndrome after appendectomy under low intra-abdominal pressure in our study. Duration of procedure under minimal pneumop-

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**Table 4. Cortisol concentration in both groups**

<table>
<thead>
<tr>
<th>Cortisol concentration</th>
<th>Main</th>
<th>Control</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to surgery</td>
<td>140.9±20.1</td>
<td>214.1±17.9</td>
<td>0.182</td>
</tr>
<tr>
<td>6 hours postoperatively</td>
<td>180.1±24.4</td>
<td>215.9±20.2</td>
<td>0.552</td>
</tr>
<tr>
<td>12—24 hours postoperatively</td>
<td>112.9±12.72</td>
<td>157.9±15.8</td>
<td>0.317</td>
</tr>
<tr>
<td>Complicated group prior to surgery</td>
<td>185.7±22</td>
<td></td>
<td>0.980</td>
</tr>
<tr>
<td>Uncomplicated group prior to surgery</td>
<td>184.2±16.48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* — here and below in μg/l.

**Table 5. Analysis of cortisol concentration in groups of complicated and uncomplicated postoperative period**

<table>
<thead>
<tr>
<th>Cortisol concentration</th>
<th>Uncomplicated</th>
<th>Complicated</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 hours postoperatively</td>
<td>199.9±33.02</td>
<td>238.8±66.5</td>
<td>0.639</td>
</tr>
<tr>
<td>12—24 hours postoperatively</td>
<td>122.3±25.44</td>
<td>168.5±40.29</td>
<td>0.379</td>
</tr>
</tbody>
</table>
Abdominal drainage after appendectomy for uncomplicated AA increases incidence of intra-abdominal and wound complications (IA) according to meta-analysis of H. Petrowsky (2004) [22]. Rather (2013) analyzed the role of preventive drainage for complicated AA. Drainage was followed by prolonged hospital-stay, advanced incidence of intestinal paresis and need for anesthesia with the same number of wound and intra-abdominal complications. The authors concluded there is no benefit from preventive drainage for complicated AA if broad-spectrum antibiotics are administered after surgery [23]. In Wisely’s report drainage tubes were deployed in 43% of patients in FTR group and in 60% of patients managed with standard perioperative protocols after emergency colon resection. There was significantly lower number of complications and need for analgesia in the main group [24].

In our study intra-abdominal complications were absent in both groups without preventive drainage tube. Postoperative infiltrates occurred in the control group despite drainage.

Incidence of postoperative nausea and vomiting was similar in intraoperative prevention with antiemetics and without it. Further analysis of postoperative dyspepsia prevention is necessary for clear recommendations. In our study early feeding and activation of patients were followed by similar terms of peristalsis recovery. Absent objective method to assess peristalsis should be emphasized in our study, while time of the first stool could not be a reference point in this issue due to short hospital-stay. It is also possible that uncomplicated AA and short laparoscopic appendectomy are not accompanied by significant inhibition of peristalsis.

Perhaps, advanced normalization of peristalsis may be effective in patients with complicated forms of inflammation and prolonged surgery. However, terms of peristaltic sounds and the first stool were similar in both groups of our study.

Length of hospital-stay was different in both groups (1.45 vs. 3.15 days, p=0.002). Almost in half of patients in the main group (47%) postoperative hospital-stay was several hours. There were no repeated hospitalizations and need for medical care in both groups. Most of authors report FTR is followed by reduced length of hospital-stay and economic efficiency [11]. Short hospital-stay (sometimes several hours) may be disturbing for many surgeons regarding potential complications which may be missed in early discharge from the hospital. On the one hand, this is justified by no reliable criteria to predict postoperative complications. However, «preventive hospitalization until potential complications» also looks unwarranted. We used some postoperative criteria (pain, temperature, leukocytosis, dyspepsia) to select patients for early discharge without advanced incidence of repeated hospitalizations. In all cases patient received a memo about conditions which should be followed by immediate medical care and attending physician’s contacts. In our opinion, early discharge is not the main goal of FTR per se. Less surgical stress including reduced pain, dyspepsia and stress-associated complications is more important. Early discharge of patient is a result of FTR protocol rather its goal. Causeless discharge can provoke increase of repeated hospitalizations rate. Frazee et al. (2017) reported FTR in 55 patients with perforated appendicitis and reduced length of hospital-stay up to 2.67 days. Postoperative complications occurred in 20% of patients and only 5 (9%) patients required repeated hospitalization [25]. Outcomes were recognized as «acceptable» in view of no control group.

Search for objective criteria to assess surgical stress and predict postoperative complications is actual goal in surgery and pathophysiology. One of these markers may be cortisol as anabolic glucocorticoid hormone synthesized in adrenal cortex under the influence of adrenocorticotropic hormone. The main biological role of cortisol is stress-mediated increase of glucose level in tissues via gluconeogenesis and skeletal muscles breakdown. Finnerty (2013) found that long-term postoperative hypercortisolemia is associated with impaired wound healing, advanced incidence of infectious complications and risk of death [26]. In contrast, Taylor (2013) did not find correlation of serum cortisol concentration with type of surgery [27]. Krikri (2013) experimentally confirmed similar cortisol concentration in open and laparoscopic cholecystectomy, whereas open and laparoscopic adrenalectomy was followed by significantly different values [28]. Veenhof (2012) analyzed immune status and stress response during open and laparoscopic colectomy with and without FTR protocol. Correlation of cortisol level with type of surgery and postoperative management protocol was absent [29]. In contrast, another trial demonstrated reduced level of cortisol after intraabdominal anesthesia in appendectomy [19].

We did not find correlation of cortisol level with pain syndrome as well as different concentrations of the hormone in patients with complicated and uncomplicated inflammation. It was not confirmed prognostic role of cortisol concentration after surgery to predict postoperative complications. Reduced abdominal pressure was not followed by decrease of cortisolemia. These data may be explained by insufficient sample size or sensitivity of the method. Cortisol’s role may be finally determined after completion of the trial.

According to meta-analysis of American Society for Surgical Infection, uncomplicated forms of AA do not require postoperative antibacterial therapy (evidence level A) [30]. Miu (2005) in RCT assessed 3 modes of antibacterial therapy for appendicitis: antibiotic prophylaxis, short course (2 days) and standard course (5 days). There were no differences in postoperative infectious complications rate and length of hospital-stay [31]. In our study antibacterial prevention alone was not accompanied by advanced incidence of infectious complications. The question of optimal duration of therapy is still actual. Surgery for com-
Complicated appendicitis should be followed by antibacterial therapy during «3 — 5 days regarding clinical and laboratory criteria» [32].

Postoperative infiltrates (7 patients) in the control group despite antibiotic therapy (6 out of 7 patients) justified the need to look for other reasons of their development. Current assumptions about these causes (thermal trauma of cecum, abandonment of infected tissues in abdominal cavity) require further experimental and clinical study.

**Limitations of the study**

Possible limitation of the trial is evaluation of FTR protocol as a whole. At the same time, assessment of certain components’ effect on postoperative period is limited. Trials of FTR in emergency surgery analyzed various number of components because all elements of fast recovery may be not always used. Only 8—18 out of 22 elements recommended for routine surgery were used in different researches. Interestingly, Padurarutu in systematic review did not find correlation between advanced number of protocol elements and improvement of the outcomes. In authors’ opinion, further studies are necessary to determine whether certain components or their number affect results [10]. Emergency surgery is followed by less number of patients undergoing complete protocol compared with elective procedures. According to Roulin et al. (2014) entire FTR protocol for colectomy is applied in 57% of cases in urgent surgery compared with 77% in elective surgery [33]. In our study, drainage tube was postoperatively deployed in 4 (10.5%) patients of the main group with complicated forms of inflammation. Trial was not aimed at assessment of algorithm’s certain components. The purpose of the work was evaluation of effectiveness and safety of FTR as a single algorithm similarly to researches in elective surgery.

In our opinion, primary results are accompanied by some optimism regarding prospects of FTR in AA surgery.

**Conclusions**

FTR protocol for AA has advantages including reduced pain syndrome, postoperative morbidity and hospital-stay. Cortisol level has not predictable value for postoperative complications. The purpose of the study was evaluation of effectiveness and safety of FTR as a single algorithm similarly to researches in elective surgery.

In our opinion, primary results are accompanied by some optimism regarding prospects of FTR in AA surgery.

**REFERENCES**


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