The aim of the study was to determine whether patients treated with anticoagulants in the peri-operative period are at higher risk of developing bleeding complications.

Material and methods. Medical records of patients operated for abdominal hernia were analysed. Data concerning demographic characteristic of a group, type of hernia, comorbidities, preoperative anticoagulation therapy and complications were collected. Association of applied anticoagulation therapy with the time of drainage, the amount of drained discharge and the length of hospitalisation was evaluated.

Results. Analysed group consisted of 186 patients. Thirty seven patients were treated with different schemes of anticoagulant therapy before the the surgery. Patients treated with triple anticoagulation therapy (acetylsalicylic acid, low-molecular weight heparin, vitamin K antagonists) had significantly longer time of drainage in comparison to patients treated according to other schemes (p<0.05). The amount of drained discharge and time of hospitalisation did not differ significantly. Neither comorbidities nor the administration of low-molecular weight heparin did not affect the analysed parameters.

Conclusions. Patients operated on abdominal hernia, who were treated with triple anticoagulation therapy in peri-operative period, require significantly longer drainage of the wound what can result in prolonged hospitalisation.

Key words: abdominal hernia, anticoagulants, acetylsalicylic acid, low-molecular-weight heparin, vitamin K antagonists, haemorrhagic complications

Each year, around 5,400 surgical interventions are performed in Poland for umbilical hernia, around 2,600 for linea alba hernia and around 5,300 for postoperative scar hernia, accounting for a total of over 13 thousand interventions annually (1).

The risk of developing postoperative scar hernia varies from 2 to 20% depending, among others, on the type of surgery, method of abdominal wall closure, collagen synthesis disorders, postoperative wound infections (2, 3, 4).

Hernias are more common in obese patients, patients with concomitant diabetes and other metabolic disorders (5).

Despite the development of surgical techniques, the management of hernia remains a great challenge for surgeons. Currently, abdominal hernia is usually repaired with tension-free hernioplasty using a synthetic mesh. The application of this method has reduced the rate of hernia recurrence to 12-24% (6) compared to standard surgical procedures where the recurrence rate was 20 to 50% (2).
Hernia occurs significantly more frequently in elderly patients (4). This is due to the reduced durability of abdominal walls and reduced muscle strength. In this group of patients, chronic diseases such as diabetes, hypertension, ischaemic heart disease or atherosclerosis are common and caused coronary incidents or cerebral stroke in many individuals. Consequently, these patients receive anticoagulant medication, such as low-molecular-weight heparin (LMWH), vitamin K antagonists (VKA) and acetylsalicylic acid (ASA). Factor X inhibitors, such as rivaroxaban, have also been introduced recently.

Patients chronically receiving anticoagulants are typically given low-molecular-weight heparin or bridging therapy (7). The goal is to reduce the frequency of postoperative haemorrhagic complications which are among the most common complications following surgical management of abdominal hernia.

Another factor that influences coagulation in the postoperative period is the prophylactic use of low-molecular-weight heparin (7).

This study analyses the risk factors for haemorrhagic complications in patients receiving anticoagulants who were operated for abdominal hernia.

MATERIAL AND METHODS

This study consists of a retrospective analysis of the medical documentation of patients operated on for abdominal hernia in the years 2010–2013 at the Clinic of General and Transplantological Surgery of the Norbert Barlicki University Hospital No 1 in Łódź.

The analysis includes:
1. Demographic data.
2. Hernia profile (type of hernia; in the case of postoperative scar hernia: type of primary surgery, timespan between surgery and occurrence of hernia).
3. Concomitant diseases (hypertension, diabetes, history of acute coronary syndrome).
4. The use of anticoagulant medication in the postoperative period (use of acetylsalicylic acid (ASA); low-molecular-weight heparin [LMWH]; vitamin K antagonists (VKA]).
5. Postoperative course (drainage duration, drainage volume, postoperative complications, hospitalisation period).

In the statistical analysis, p < 0.05 was considered statistically significant. The Shapiro-Wilk test was used to test distribution normality. The Kruskal-Wallis test (with appropriate post-hoc tests) was used to compare drainage duration, drainage volume and the hospitalisation period among patients receiving different schemes of anticoagulant therapy and suffering from different comorbidities. The same test was used to compare the timespan between hernia occurrence and surgical management among different types of hernia.

RESULTS

The analysed group comprised 186 patients: 97 women (mean age 54.3 years; SD 14.6) and 89 men (mean age 52.7 years; SD 13.9). The on-lay method was used to operate hernia in 182 patients and the sub-lay method in four patients. The mean hospitalisation period was 7.7 days (2-91 days).

The types of hernia operated on and time of their occurrence following surgery are shown in tab. 1.

The timespan between surgery and hernia occurrence did not differ significantly among patients with different types of hernia (p ≥ 0.05). Four patients (2.2%) developed respiratory insufficiency following surgery and were transferred to the Intensive Medical Care Unit as a result. Three of these were operated on for giant hernia. One of these patients died due to respiratory insufficiency while the remaining patients returned to the Department of Surgery for further treatment as soon as their general condition improved.

One of the factors that influence the number of postoperative complications, including haemorrhagic complications is the size of the operated hernia. More than half of patients (94 patients) were operated on for postoperative scar hernia. Most of the described complications were observed in this group. All remaining factors with the potential to influence the occurrence of haemorrhagic complications in these patients were also analysed.

With regard to concomitant diseases, 90 patients (48.4%) suffered from hypertension, 22 (11.8%) from type 2 diabetes while 28 (15.1%) had a history of acute coronary syndrome. The occurrence of HA in patients who
Anticoagulants as a risk factor in patients operated on for abdominal hernia

had suffered from acute respiratory syndrome was associated with longer drainage duration compared with patients with no concomitant diseases (p < 0.05). The remaining disorders did not influence any of the analysed parameters of the perioperative period (tab. 2).

Thirty-seven patients received chronic anticoagulant therapy in the preoperative period. Thirteen patients received ASA, 9 received ASA and LMWH, 8 were treated with VKA and LMWH, and 7 patients received all three medications. In every one of these patients, anticoagulant therapy was changed 7 days prior to surgery to prophylactic doses of LMWH only.

Postoperatively, patients were given prophylactic doses of LMWH for 10 days as a precautionary measure to avoid coagulation.

For the purposes of the analyses, we divided the patients into several groups: those who did not receive anticoagulants, patients receiving single-drug therapy (ASA or VKA chronically prior to the intervention which were discontinued in the perioperative period and substituted by prophylactic doses of LMWH) and patients with triple-drug therapy (ASA and VKA chronically prior to the intervention which were discontinued in the perioperative period and substituted by prophylactic doses of LMWH).

Patients receiving triple-drug anticoagulant therapy required a significantly longer drainage period (p < 0.05). In this subgroup, a trend of larger drainage volume and a longer hospitalisation period was observed (p < 0.05 but with no significant differences between groups in post-hoc tests).

DISCUSSION

None of the surgical wound closure techniques currently applied gives full protection from complications such as postoperative scar hernia. The use of a polypropylene mesh as a

Table 1. Time from occurrence of hernia to the surgery

<table>
<thead>
<tr>
<th>Type of hernia</th>
<th>Number of patients</th>
<th>Mean time (months)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>182</td>
<td>33.5</td>
<td>60.2</td>
</tr>
<tr>
<td>In the postoperative wound</td>
<td>94</td>
<td>25.3</td>
<td>23.4</td>
</tr>
<tr>
<td>Umbilical and in the linea alba</td>
<td>5</td>
<td>16.5</td>
<td>9.0</td>
</tr>
<tr>
<td>Umbilical</td>
<td>61</td>
<td>52.1</td>
<td>102.0</td>
</tr>
<tr>
<td>Paraumbilical</td>
<td>2</td>
<td>18</td>
<td>8.5</td>
</tr>
<tr>
<td>In the linea alba</td>
<td>18</td>
<td>30.5</td>
<td>17.4</td>
</tr>
<tr>
<td>Umbilical and in the postoperative wound (patients after cholecystectomy)</td>
<td>1</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>In the postoperative wound (following appendectomy) and in the linea alba</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Differences in time of drainage, amount of rained discharge and time of hospitalisation between patients treated with associated comorbidities

<table>
<thead>
<tr>
<th>Concomitant disease</th>
<th>Number of patients</th>
<th>Drainage duration (SD) [days]</th>
<th>Drainage volume (SD) [ml]</th>
<th>Hospitalisation period (SD) [days]</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>90</td>
<td>2.4 (1.2)</td>
<td>54.9 (168.1)</td>
<td>5.5 (2.9)</td>
</tr>
<tr>
<td>DM</td>
<td>5</td>
<td>5.1 (2.4)</td>
<td>392.5 (500.2)</td>
<td>12.8 (5.6)</td>
</tr>
<tr>
<td>HA</td>
<td>55</td>
<td>2.7 (1.5)</td>
<td>95.9 (206.8)</td>
<td>6.9 (5.8)</td>
</tr>
<tr>
<td>ACS</td>
<td>3</td>
<td>3.0 (1)</td>
<td>253.3 (340.2)</td>
<td>6.7 (1.5)</td>
</tr>
<tr>
<td>DM + HA</td>
<td>11</td>
<td>3.3 (2.4)</td>
<td>340 (888.9)</td>
<td>7.3 (4.1)</td>
</tr>
<tr>
<td>HA + ACS</td>
<td>18</td>
<td>5.3 (6)</td>
<td>502.2 (874.7)</td>
<td>14.3 (21.5)</td>
</tr>
<tr>
<td>DM + HA + ACS</td>
<td>7</td>
<td>6.6 (7.5)</td>
<td>1320 (2621.5)</td>
<td>22.1 (31.8)</td>
</tr>
</tbody>
</table>

DM – diabetes mellitus, HA – hypertensio arterialis, ACS – acute coronary syndromes
prophylactic measure during the primary surgery yields best results (5).

Surgical interventions to treat abdominal hernia are among those most commonly performed by general surgeons worldwide. The use of laparoscopy and synthetic meshes has allowed improvement of surgical techniques (8); however, the patient’s condition and concomitant diseases may significantly increase the risk of complications following surgical interventions for abdominal hernia. Factors that predispose to the development of hernia can be split into several groups.

The first group of factors are those associated with the patient. Flaccid abdominal walls create the conditions for the development of hernia and are more common in women (due to pregnancies), the elderly, cachectic patients, e.g. with cancer, who additionally receive radio- and chemotherapy, and in obese individuals. According to some studies (9), the level of abdominal muscle development and durability of the abdominal cavity wall, debilitated by previous surgical interventions, play an important role. One risk factor for abdominal hernia commonly reported in literature is advanced age (10). In our study, the mean age of patients operated on for abdominal hernia was 54.3 for women and 52.7 for men, respectively. Sex was not shown to influence the occurrence rate of abdominal hernia in this study.

Concomitant diseases and anticoagulant therapy prior to surgery were the second group of factors. We have shown that the drainage period in patients with hypertension, with a history of acute coronary syndrome, was significantly longer than in patients with no co-morbidities. The long-term use of oral anticoagulants increased the risk of prolonged healing of the postoperative wound. Type 2 diabetes can disrupt postoperative wound healing due to the process of microangiopathy (11); however, this study has shown no link between diabetes and an increased risk of complications.

Haematoma and bleeding are one of the most common complications following surgical interventions in hernia management. The surgical procedure itself can influence the occurrence of these complications; therefore, it is important to perform the procedure carefully, beginning with tissue incision and preparation, through setting the stage for mesh sewing, to controlling haemostasis during the intervention. At the same time, it is worth remembering that every additional intervention, such as e.g. haematoma puncture or repair due to bleeding increases the risk of other complications (e.g. infections), resulting in a prolonged period of hospitalisation, recovery and return to normal functioning.

Furthermore, improperly managed hernia can lead to recurrence and, consequently, the need for surgical reintervention. Therefore, it is important to carefully collect the patient’s medical history, especially in relation to prior anticoagulant therapy. Anticoagulant therapy itself may significantly increase drainage volume; moreover, if the drain is improperly placed, it can result in another complication: haematoma in the abdominal wall.

The results of this study show that the use of anticoagulant medication is associated with prolonged drainage duration; however, this prolongation is most pronounced in patients receiving three medications at once: mean time extended from 2.6 days to as many as 8.7 days. At the same time, triple-drug therapy and treatment with ASA alone increased the mean drainage volume (73.4 in patients not receiving any anticoagulant medication to 826.7 in patients receiving ASA and 924.3 in patients receiving ASA + LMWH + VKA, respectively). The hospitalisation period was also prolonged in both groups: 15.7 for ASA and 24.1 for triple-

<table>
<thead>
<tr>
<th>Anticoagulant therapy scheme</th>
<th>Number of patients</th>
<th>Drainage duration (SD) [days]</th>
<th>Drainage volume (SD) [ml]</th>
<th>Hospitalisation period (SD) [days]</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>149</td>
<td>2.6 (1.4)</td>
<td>73.4 (191)</td>
<td>6.2 (4.4)</td>
</tr>
<tr>
<td>ASA</td>
<td>12</td>
<td>4.7 (5.3)</td>
<td>826.7 (1833.9)</td>
<td>15.7 (23.8)</td>
</tr>
<tr>
<td>ASA+LMWH</td>
<td>9</td>
<td>3.2 (2)</td>
<td>260 (414)</td>
<td>8.3 (5.9)</td>
</tr>
<tr>
<td>LMWH+VKA</td>
<td>7</td>
<td>3.9 (1.7)</td>
<td>301.4 (366.6)</td>
<td>7.1 (2)</td>
</tr>
<tr>
<td>ASA+LMWH+VKA</td>
<td>7</td>
<td>8.7 (8.5)</td>
<td>924.3 (1249.7)</td>
<td>24.1 (32.8)</td>
</tr>
</tbody>
</table>

Table 3. Differences in time of drainage, amount of rained discharge and time of hospitalisation between patients treated with different anticoagulants.
drug therapy compared to a mean time of 6.2 in patients not receiving medication. These data suggest that both acetylsalicylic acid and therapy with three anticoagulant drugs may increase the risk of haemorrhagic complications (12).

Haemorrhagic complications may also be influenced by postoperative anticoagulation prophylaxis. Patients also received standard doses of low-molecular-weight heparin for 10 days. This is a routine medical procedure worldwide (13) aimed at preventing complications of embolism. As shown in this study, this is not associated with an increased risk of complications in the postoperative period.

CONCLUSIONS

In patients chronically receiving anticoagulant medication, surgical interventions for abdominal hernia may be associated with an increased risk of haemorrhagic complications.

Bearing in mind the results of this study and relevant literature, the appropriate preparation of the surgical intervention and postoperative care for patients chronically receiving anticoagulant medication gain utmost importance. The implementation of algorithms of the appropriate steps to be taken should reduce the occurrence of haemorrhagic complications in these patients.

REFERENCES