Mesh biomaterials have become the standard in the treatment of hernias, regardless the location. In addition to the obvious advantages of the methods based on implantable biomaterials, one should be aware of the possible complications, such as their migration to the abdominal organs.

**Material and methods.** The study group comprised patients operated at the Department of General, Gastroenterological Oncology, and Plastic Surgery during the period between 2008 and 2011, due to hernia surgery with mesh implantation. We also analysed the number of patients operated, due to complications of mesh migration during the same period.

**Results.** 368 patients were subject to mesh implantation, due to hernias during the period between 2008 and 2011. Three patients underwent surgery because of symptomatic migration of the mesh (ileus, fistula).

**Conclusions.** The frequency of mesh migration is difficult to determine because of the different criteria of migration, observation period, and other factors. In patients after mesh implantation the potential migration of the biomaterial should be considered in case of unclear or acute abdominal symptoms.

**Key words:** mesh implantation, hernia, migration

The use of biomaterials in surgery, especially in the treatment of hernias, dates back to the XIX century. Billroth was the first who concluded that the secret to successful hernia treatment is associated with the use of an artificial tissue with properties of a fascia. Over the years, persistent attempts using various materials were undertaken, which were to replace the patient’s own tissue (silver wire mesh, tantalum and nylon mesh, as well as stainless steel and polyvinyl). None of these materials met the test of time. All, after the initial interest and enthusiasm, were of little use in clinical practice. In 1959, Usher was the first who used polypropylene in the treatment of hernias, and since that time to this day, one may observe the new era in the use of biomaterials considering patients subject to hernia surgery. But even today’s biomaterials do not meet the criteria for an ideal mesh, which were formulated in the fifties of the past century by Cumberland and Scales. According to the above-mentioned authors the ideal biomaterial should possess the following characteristics: (1) – it should not react chemically with surrounding tissues, (2) – it should not be allergenic nor cause inflammation, (3) – it should be resistant to mechanical factors, and be reused after sterilization, (4) – it should not be carcinogenic, (5) – its structure and consistency must allow for clinical use, (6) – it should not change with time.

The use of biomaterials has created a number of completely new clinical problems, such as the stimulation of the inflammatory reaction „surrounding the foreign body” with subsequent seroma development. Mesh infections resulted in the change of antibiotic prophylaxis and extension of the definition of surgical site infection. Another issue is the research
concerning the development of the bacterial biofilm located on the surface of the mesh.

Each of these subjects lived to see detailed discussions and numerous references, and became the theme of a number of scientific meetings. Much less space is devoted to yet another issue, the migration of implanted biomaterials. To see how important is the above-mentioned issue, one must realize that the majority of recurrent hernias after Lichtenstein’s operation, or any other method with the use of a mesh is associated with the migration of biomaterials. The pubic tuberculum is often the site of recurrent hernia. This may be associated with the inadequate mesh fixation to the tuberculum by means of non-absorbable sutures or the use of too small a mesh. Such hernia recurrences after laparoscopic operations (TAPP and TEP) are associated with the dislocation of the mesh and exposure of the hernia ring. There is also the risk of implanted biomaterial migration outside the site of implantation. Particularly dangerous, from the clinical point of view, is mesh contact with the bowel or urinary gallbladder. Through the direct reaction of the mesh with the serous wall of the above-mentioned organs, one may observe its “ingrowth”, followed by penetration to the lumen of the organ. In addition to pain and discomfort one may observe obstruction symptoms, fistulas, and abscesses. Literature data concerning the issue are of casuistic character (1, 2, 3), often with only one case. It is hard to find information concerning mesh migration or the meta-analysis of the mentioned problem.

MATERIAL AND METHODS

We analysed the number of different surgical procedures (mostly hernia operation) performed at The Department of General, Gastro-enterological Oncology, and Plastic Surgery, Medical University in Poznań during the period between 2008 and 2011. The number of patients treated for mesh migration complications was also subject to analysis. As a complication of mesh migration we assumed every clinical situation in which the patient after previous mesh implantation surgery developed complications requiring surgical intervention. Analysis was based on the evaluation of surgical protocols obtained in the years 2008-2011.

In case of surgery associated with mesh migration, we analysed the patients’ documentation and the clinical course of the above-mentioned. Due to the small number of patients subject to surgery, due to mesh migration, statistical analysis was not performed.

RESULTS

Mesh migration

During the period between 2008 and 2011, 368 mesh implantation procedures were performed at the Department of General, Gastro-enterological Oncology, and Plastic Surgery, Medical University in Poznan, mostly inguinal hernia operations (192). Table 1 presented detailed data concerning the type and number of procedures.

Case report considering patients with mesh migration

Case 1. The patient was admitted to the hospital in 2010, due to sigmoid colon tumor, detectable on palpation, almost completely closing its lumen. Endoscopy proved inconclusive and did not indicate the character of the

<table>
<thead>
<tr>
<th>Type of operation</th>
<th>Number of patients</th>
<th>Mesh migration to the lumen of the bowel (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inguinal hernia surgery with mesh implantation</td>
<td>192</td>
<td>1 (24)</td>
</tr>
<tr>
<td>Inguinal hernia laparoscopic surgery with mesh implantation</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>Abdominal hernia surgery with mesh implantation</td>
<td>77</td>
<td>2 (18; 10)</td>
</tr>
<tr>
<td>Peristomal hernia surgery with mesh implantation</td>
<td>58</td>
<td>0</td>
</tr>
<tr>
<td>Rectopexy with mesh implantation</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>368</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>
tumor. The patient underwent surgery - sigmoidectomy with “end-to-end” stapler anastomosis. After tumor section the lesion proved to be a “plug”, which was implanted two years previously during left inguinal hernia surgery by means of Rutkow’s method (“mesh-plug”). The patient had no recurrence of hernia nor other inguinal complications.

Case 2. The patient was diagnosed with severe complications, which lead to his death. In 2009, the patient underwent abdominal hernia surgery with the use of a non-absorbable polypropylene mesh which was implanted suprapitoneally. Eighteen months after the operation the mesh migrated to the peritoneal cavity, damaging the duodenal wall, leading to the development of an external duodenal fistula with a significant inflammatory reaction of the duodenum, mesh and abdominal integuments. Despite several surgical procedures the infected mesh was not removed. Conservative therapy also proved ineffective (hypotensive therapy VAC, TPN, somatostatin).

Case 3. The patient was admitted to the department in 2008, due to fecal fistula development as a complication of abdominal hernia surgery with polypropylene mesh implantation (10 months earlier). The hernia developed after classical cholecystectomy complicated by prolonged wound suppuration. After fistulography we observed the presence of a fistula between the right colon flexure and skin. During the operation we observed mesh migration towards the colon, which in consequence lead to the development of the fistula (fig. 1, 2). The infected tissues were removed together with the mesh and intestinal fistula, and the colon was sutured. The postoperative course was complicated by wound suppuration. Patient control after surgery showed no signs of fistula or hernia presence.

**DISCUSSION**

Analysis of the rate of biomaterial migration is very difficult, due to different reasons. Implantable biomaterials may migrate at a different time interval, dating back several years after initial treatment with mesh implantation. Patients with clinically visible migration may refer to other centers than the one where they were subject to surgery. This is associated with the specific nature of symptoms, which may be of sudden character (obstruction, perforation). Therefore, it is impossible to conclude if we were able to reach all cases of mesh migration in the operated group. Another problem is the diagnostic criteria for implantable biomaterial migration. As far as clinical complications requiring surgical intervention are relatively easy to verify, the various degrees of migration might be completely asymptomatic. Therefore, statistical analysis was not performed. We focused instead on emphasizing the existence of the problem. It should be noted that in case of clinical gastrointestinal symptoms, such as obstruction, fistula, and bleeding, previous mesh implantation might be an important element of the patients’ medical history.

The reasons for biomaterial displacement are diverse. The first group consists of technical errors committed during surgery, being associated with the insufficient fixation of the mesh. The use of absorbable sutures might also be important, which dissolve before the mesh is covered by surrounding tissue. In case of inguinal hernia open and TEP method operations one may observe the involution of the mesh near the end of the operation, during integument closure, as well as desufflation.
Therefore, proper mesh distribution is very important, between the musculo-fascial layers. Complications may be observed in case of recurrent hernias, when the natural anatomical structures are disturbed. The overgrowth of budding vessels and collagen fibers in case of a serosoma developing around the mesh is also important. The free serous space surrounding the mesh is no support for the biomaterial and favors mesh migration. The seroma usually develops at the junction of the biomaterial-subcutaneous tissue, thus, suprafascial mesh implantation should be avoided (on-lay). Mesh inflammation and abscess formation result in fistula development between the mesh and skin with the unveiling of the biomaterial and its external evacuation (4).

Another important group of reasons might be associated with the poor quality of used biomaterials, their dimensions changing over time. Poor quality mesh subjected to constant tension during abdominal operations lose their mechanical properties, shrink or stretch revealing the hernia ring, and lead to recurrence. There are even documented fragmentation phenomena of the theoretically inabsorbable biomaterial. Thus, it is important to use high-quality mesh material.

Another factor is the shape of the biomaterial: in case of a ‘plug’ the umbrella-like shape with the point facing towards the peritoneal cavity certainly favors its migration. This was the case of the above-mentioned sigmoid tumor. Therefore, prolene hernia system repair is gradually in retreat, with recurrence to Lichtenstein’s method with the use of a plane mesh (3).

The reason for mesh migration to the peritoneal cavity and development of duodenal and sigmoid fistulas (case 2 and 3), was probably associated with damage or peritoneal ischemia, separating the abdominal cavity from the biomaterial. The classical, non-covered polypropylene mesh after contact with the bowel leads to its damage (5). One should then consider a covered mesh authorized for intraperitoneal use (6).

In case of our study group the highest rate of migration (2 of 77 patients) was observed in patients operated for abdominal hernias. The above-mentioned procedure, often associated with extensive preparation and relative proximity of the mesh to the abdominal organs, significantly increases the risk of complications, such as mesh migration to the gastrointestinal tract. It is therefore very important to position the mesh suprapertoneally, creating a natural barrier between the mesh and intestinal wall. Proper fixation of the mesh or the use of “plugs” is yet another important factor reducing the potential risk of migration. One should also not forget, that patients subject to surgical treatment of abdominal hernias with mesh implantation, its migration might lead towards several complications and clinical symptoms, such as ‘acute abdomen’.

In conclusion, it should be noted that although the biomaterial are a boon significantly improving treatment results, and enabling to perform new procedures, one should be aware of their limitations and potential life-threatening complications.

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