SURGICAL TREATMENT OF MECKEL’S DIVERTICULUM

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The aim of the study. Assessment of own research material associated with surgical treatment of Meckel’s diverticulum (MD).

Material and methods. Retrospective analysis of medical records of 27 patients managed in the Department of Endocrine and General Surgery of Medical University in Łódź between 1st October 2002 and 31st December 2009 due to incidentally found during surgery and not producing symptoms MD and also operated on for its complications.

Results. After excision of MD causing symptoms surgical complications possibly directly associated with the removal of MD were not observed. After prophylactic excision of MD such complications occurred in 2 patients (11.11%). Moreover, in this group we found one death after the operation, but it was not attributable to performed diverticulectomy and was caused by multiple coexisting diseases. In 3 of 14 prophylactically removed and macroscopically normal Meckel’s diverticula the presence of reactive inflammation was diagnosed on histopathology.

Conclusions. Excision of MD, both producing symptoms and incidentally found, is associated with the low risk of complications. After the recognition of acute appendicitis all identified Meckel’s diverticula should be removed, even macroscopically normal, because they can present with the reactive inflammatory process. The method of MD excision depends on intraoperative diagnosis. The risk of MD-related complications may increase with age.

Key words: Meckel’s diverticulum, complications, acute appendicitis

Meckel’s diverticulum (MD) is a true diverticulum of the ileum containing all layers of the normal intestinal wall (1-6). It is present in 2% of the population (3). MD most often is situated 20-100 cm from the ileocaecal valve (7). It is usually localized on the antimesenteric border of the ileum (2, 3, 8). MD receives its blood supply from a terminal branch of the superior mesenteric artery (3, 5, 9). This diverticular artery has no branches and does not form anastomoses, in contrast to other vessels vascularizing the ileum (9). MD results from an incomplete obliteration of the omphalomesenteric duct (vitelline duct) (1-6, 8, 10, 11). It is normally obliterated between the 5th and the 7th week of gestation (2, 5, 6, 10). The omphalomesenteric duct makes a communication between the yolk sac and the intestine (1, 2, 3, 12, 13). In the 3-week-old embryo the yolk sac communicates with the gut through the broad vitelline duct receiving blood supply from paired vitelline arteries (1). During the 8th week of gestation the duct should be obliterated because the placenta takes over from the yolk sac the role of the source of fetal nutrition (1). The right vitelline artery forms the superior mesenteric artery and the left usually involutes, but occasionally its remnant persists as a mesodiverticular band connecting MD with the mesentery (1). Failure of the obliteration of the vitelline duct leads to formation of various anomalies: fistula between the intestine and the umbilicus, enterocyst, fibrous band connecting the intestine with the umbilicus, umbilical sinus or MD (1, 8, 12). MD develops the most often (12).
Typical complications attributable to the presence of MD include bleeding, bowel obstruction, diverticulitis and perforation of the diverticulum, while bleeding occurs the most often and bowel obstruction is the second most common complication (10). A foreign body entrapped in the diverticulum can cause its inflammation (10) or perforation (9). Mechanisms of obstruction include the small bowel hanged on the fibrous band attached to the umbilicus, strangulation of an intestinal loop within the pouch formed by the mesodiverticular band, intussusception with MD as a leading point, volvulus around the fibrous band and stenosis due to chronic Meckel’s diverticulitis (1). Similarly as observed in acute appendicitis (AA), luminal obstruction of MD causes distal inflammation, necrosis and even perforation leading to abscess or peritonitis (1). More rarely perforation of a peptic ulcer localized in MD results in peridiverticulitis, peritonitis or vesicodiverticular fistula (1). It is also necessary to remember that differentiation of Meckel’s diverticulitis from AA before surgery can be impossible on clinical examination.

Symptomatic MD occurs more rarely being 15.4-43.7% of all recognized Meckel’s diverticula and MD is more often found during laparotomy warranted due to other causes (6, 8, 9, 10, 12-17). The research material of Pinero et al. is the exception with 62.2% symptomatic diverticula (7). However, only 4.3% of Meckel’s diverticula detected by Peoples et al. were producing symptoms (5). MD is identified during 2.9% of appendectomies (18).

Considering surgical management of MD it is indispensable to define symptomatic and asymptomatic MD. Symptomatic MD is found to result in disease that is an indication for laparotomy, while asymptomatic is recognized during surgical procedures performed for other clinical findings and does not cause symptoms being indications for surgery.

MATERIAL AND METHODS

Between 1st October 2002 and 31st December 2009 in the Department of Endocrine and General Surgery of Medical University in Łódź MD was found in 27 patients. There were 14 men and 13 women, the mean age was 38.52 years (range 18-83 years). 25 Meckel’s diverticula were removed. 7 patients (2 men, 5 women) were operated on due to complications caused by MD. Their mean age was 48.57 years, SD=22.32 years (48.57 ± 22.32) (tab. 1).

Incidentally found and macroscopically normal Meckel’s diverticula were resected during 18 operations warranted in 10 men and 8 women (tab. 2).

During the other two operations MD was also identified, but left intact. In the 27-year-old man operated on due to AA MD was not excised due to the preferences of the operating surgeon. In the 63-year-old man operated on for bowel obstruction after the recognition of the tumor localized between the ascending and sigmoid colon completely obliterating the lumen of the large bowel, Hartmann’s procedure was performed and MD resection was abandoned due to contamination of the peritoneal cavity with fecal material. The mean age of patients with incidentally found and asymptomatic MD was 35 years, SD=19.23 years (35 ± 19.23).

RESULTS

In the group with symptomatic MD postoperative complications caused by excision of diverticulum were not observed. However, in 2 of 18 patients with asymptomatic MD removed (the 28-year-old man, the 21-year-old woman) complications eventually attributable to diverticulectomy occurred. Both patients suffered from wound infection after previous appendectomy due to phlegmonous acute appendicitis and after diverticulectomy, but in the male patient additional reactive Meckel’s diverticulitis was identified on histopathological examination. Moreover, in this group one death occurred in the 78-year-old woman after the operation performed on vital indications due to adhesive bowel obstruction and incarcerated hernia in the linea alba. However, it was not attributable to diverticulectomy and was caused by additional internal and oncologic diseases (III/IV° NYHA heart failure, chronic atrial fibrillation, type 2 diabetes and low differentiated uterine cancer diagnosed in the perioperative period, and after the surgical procedure also critical ischemia of the right lower limb below the knee). It is significant that in 3 of 14 prophylactically resected after appendectomy and macroscopically normal Meckel’s diverticula symptoms of reactive inflammation were identified on histopathological examination. In patho-
Table 1. Patients with symptomatic MD

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (years)</th>
<th>Preoperative diagnosis</th>
<th>Intraoperative appearance</th>
<th>Surgical procedure</th>
<th>Postoperative and histopathological diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>67</td>
<td>umbilical pain, nausea</td>
<td>inflamed MD</td>
<td>left upper transrectal incision, diverticulectomy</td>
<td>acute Meckel’s diverticulitis</td>
</tr>
<tr>
<td>F</td>
<td>34</td>
<td>suspicion of bowel obstruction, suspicion of AA</td>
<td>invagination of the small intestine loop into the caecum with MD as a leading point, normal vermiform appendix</td>
<td>right lower pararectal incision, devagination of the 60 cm long small intestine loop, diverticulectomy, appendectomy</td>
<td>bowel obstruction, symptoms of chronic Meckel’s diverticulitis, normal vermiform appendix</td>
</tr>
<tr>
<td>F</td>
<td>23</td>
<td>suspicion of AA</td>
<td>inflamed vermiform appendix, gangrenous MD attached to the small bowel mesentery</td>
<td>McBurney’s incision, appendectomy, diverticulectomy, suturing the small bowel mesentery</td>
<td>gangrenous Meckel’s diverticulitis, reactive appendicitis</td>
</tr>
<tr>
<td>F</td>
<td>83</td>
<td>incarcerated umbilical hernia, peritonitis, status post appendectomy in the past</td>
<td>in the hernial sac the greater omentum with multiple and old adhesions, necrosis of the portion of the small intestine and the portion of the ascending colon</td>
<td>midline incision, placing back the greater omentum from the hernial sac into the abdominal cavity, resection of the small intestine and right hemicolectomy with end-to-side anastomosis</td>
<td>chronic inflammatory infiltration of the MD, in the wall of the small intestine 5 cm from the resection margin a mass of 1 cm in diameter containing ectopic pancreatic tissue with the adenomatous hyperplasia of the bile ducts, significantly dilated vessels in the wall of the small intestine and in the mesentery, focal extravasations of the blood in the mucosa of the large bowel</td>
</tr>
<tr>
<td>M</td>
<td>57</td>
<td>bowel obstruction</td>
<td>MD hanged around the dhesion and volvulus of the small intestine loop</td>
<td>midline incision, segmental ileal resection of the 3 cm long intestinal portion with MD, end-to-end anastomosis</td>
<td>bowel obstruction due to strangulation, symptoms of the chronic inflammatory process and passive hyperaemia within the MD and the portion of the ileum</td>
</tr>
<tr>
<td>F</td>
<td>58</td>
<td>suspicion of acute cholecystitis</td>
<td>dilated hydrops-like gallbladder with gallstones, MD attached to the gall-bladder, hemorrhagic and gangrenous lesions of MD involving also the intestinal wall</td>
<td>right upper transrectal incision, cholecystectomy, ileal resection of the 15 cm long intestinal portion with MD, end-to-end anastomosis</td>
<td>gangrenous Meckel’s diverticulitis, chronic cholecystitis</td>
</tr>
<tr>
<td>M</td>
<td>18</td>
<td>suspicion of AA</td>
<td>inflamed MD, reactively inflamed vermiform appendix</td>
<td>right lower pararectal incision, wedge ileal resection of the 4 cm long intestinal portion with MD, end-to-end anastomosis</td>
<td>phlegmonous Meckel’s diverticulitis, reactive appendicitis</td>
</tr>
</tbody>
</table>

morphologists’ opinion diverticulectomy was indispensable and contributed to avoidance of reoperations. In these 3 patients diverticulectomy was performed after appendectomy due to AA – phlegmonous in 2 cases and simple in 1 case, with only one intraoperative appearance eventually suggesting reactive Meckel’s diverticulitis. Inflammatory changes in the portion of the omentum were observed and this part was resected. In none of the remaining 11 patients with MD excised after appendectomy due to AA (phlegmonous in 7 cases, simple in 3 cases and gangrenous in 1 case) symptoms of reactive Meckel’s diverticulitis were identified on histopathological examination.

Of all recognized Meckel’s diverticula 25.9% (7/27) were symptomatic. Among patients with asymptomatic MD 65% (13/20) were aged 18-29 years and the remaining patients were aged 34-78 years. Only 2 of 7 patients with symptomatic MD were under 34 years of age (18 and 23 years). Patients with producing symptoms diverticulum were 13.33% (2/15) among 15 patients aged 18-29 years, while in the group of 12 patients aged 34-83 years they were 41.67% (5/12). The observed tendency of
Table 2. Patients with incidentally found and removed asymptomatic MD

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (years)</th>
<th>The amount of patients</th>
<th>Preoperative diagnosis</th>
<th>Surgical procedure</th>
<th>Postoperative diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>M – 8</td>
<td>21–5 cases, 18, 19, 22, 24, 28, 29, 34, 43, 52 – each 1 case</td>
<td>14</td>
<td>AA – 14 cases</td>
<td>es; 1 procedure was started laparoscopically, conversion was performed after the recognition of immobile intestinal loops in the pelvis and extensive phlegmonous lesions of the vermiform appendix</td>
<td>AA (phlegmonous – 9 cases, simple – 4 cases, gangrenous – 1 case, additionally reactive Meckel’s diverticulitis in 3 patients)</td>
</tr>
<tr>
<td>F – 6</td>
<td></td>
<td></td>
<td></td>
<td>right hemicolectomy with end-to-side anastomosis, resection of the 10 cm long portion of the small bowel with MD, end-to-end anastomosis</td>
<td>gastrointestinal bleeding, adenocarcinoma of the caecum</td>
</tr>
<tr>
<td>M</td>
<td>70</td>
<td>1</td>
<td>gastrointestinal bleeding, large bowel mass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>78</td>
<td>1</td>
<td>bowel obstruction, incarcerated hernia of the linea alba</td>
<td>placing back the normal greater omentum from the hernial sac into the abdominal cavity, adhesiolyis, diverticulectomy, uterine mass tissue procurement</td>
<td>bowel obstruction, multiple adhesions impairing the intestinal passage in a few sites, omental incarceration in the hernial sac, low differentiated uterine cancer</td>
</tr>
<tr>
<td>M</td>
<td>64</td>
<td>1</td>
<td>gastrointestinal bleeding</td>
<td>ligation of a bleeding ulcer localized on the posterior pyloric wall, diverticulectomy</td>
<td>gastrointestinal bleeding</td>
</tr>
<tr>
<td>F</td>
<td>21</td>
<td>1</td>
<td>suspicion of AA</td>
<td>wedge resection of the ovary together with the basis of a ruptured hemorrhagic cyst, appendectomy, diverticulectomy</td>
<td>ruptured hemorrhagic cyst of the right ovary</td>
</tr>
</tbody>
</table>

more frequent occurrence of symptomatic MD in 34-year-old and elder patients did not present a statistical significance, but was almost significant (p=0.094, Fisher exact test). The average age for patients with symptomatic MD (48.57 years) was higher than for persons with incidentally found MD (35 years), but was not statistically different between these two groups (t=1.481, p>0.05, Student’s t-test) (tab. 3).

Ectopic tissue was not identified in any of resected Meckel’s diverticula.

DISCUSSION

All symptomatic and presenting pathology Meckel’s diverticula ought to be removed. Management of asymptomatic and incidentally found during various surgical procedures MD is an unresolved problem. Excision of the diverticulum should prevent further MD attributable diseases, but can be a cause of early postoperative complications, for example anastomotic leak.

Cullen et al. calculated that the overall risk of MD-related complications requiring surgical treatment, with expected lifetime length of 80 years, was 6.4% and they find it significant (17). Early postoperative complications occurred in 12% patients after excision of symptomatic diverticulum and in 2% after resection of asymptomatic diverticulum. Mortality after excision of symptomatic diverticulum was 2% and 1% after asymptomatic, but deaths were not attributable to resection of MD. The risk of developing late postoperative complications by 20 years was 7% after excision of symptomatic diverticulum and 2% after asymptomatic. That is why the authors recommend the removal of each asymptomatic MD in all patients

Table. 3. Differentiation of patients with symptomatic and asymptomatic MD according to age

<table>
<thead>
<tr>
<th>Age</th>
<th>Symptomatic MD</th>
<th>Asymptomatic MD</th>
<th>Together</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 34 years</td>
<td>2</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>34 years and older</td>
<td>5</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Together</td>
<td>7</td>
<td>20</td>
<td>27</td>
</tr>
</tbody>
</table>
up to 80 years unless other conditions increasing the risk of operation are present, such as generalized peritonitis.

Arnold and Pellicane after resection of all asymptomatic and symptomatic Meckel’s diverticula did not observe morbidity or mortality (15). In their research material symptomatic Meckel’s diverticula were more frequent in men and the authors think that – except for male sex – there are no criteria allowing to predict the development of symptoms caused by incidentally found MD in the future. That is why, and on the basis of low morbidity and mortality in the postoperative period, they recommend excision of all incidentally found Meckel’s diverticula in the absence of absolute contraindications, such as diffuse peritonitis or associated vascular procedures.

McKay found that in the group with MD 70% of patients younger than 50 years and only 10% of patients older than 50 years were symptomatic, while patients under 50 years were 77.78% of symptomatic patients (16). That is why he recommends removing all Meckel’s diverticula in patients under 50 years.

Park et al. found that 4 features are associated with symptomatic MD: age younger than 50 years, male sex, diverticulum longer than 2 cm and the presence of ectopic or abnormal tissue within the diverticulum (10). That is why they recommend resection of all incidentally found Meckel’s diverticula fulfilling any of these criteria.

Bani-Hani and Shatnawi found that a diameter of MD ≤ 2 cm was significantly associated with more complications, but diverticula with diameters of > 2 cm also caused complications (6). In both groups (with symptomatic and asymptomatic MD) they observed no deaths and found a similar incidence of postoperative complications. The authors did not support clearly the removal of all incidentally found Meckel’s diverticula. However, they turn attention to the fact that 4 of 28 symptomatic Meckel’s diverticula had been identified and left intact during previous surgical procedures (3 appendectomies, 1 laparotomy due to perforated duodenal ulcer). On the basis of this fact they think that excision of these incidentally found diverticula would have been a better solution. They think that diverticulectomy of asymptomatic MD is associated with the low risk of postoperative complications and deaths and does not increase it.

Robijn et al. basing on the literature data proposed a scoring system associated with the risk of complications caused by incidentally found MD in the future (19). It is based on awarding points for definite criteria. For male sex 3 points are awarded, for female sex – 1, for age < 45 years – 2, for age ≥ 45 years – 1, for the length of MD > 2 cm – 2, for the length ≤ 2 cm – 1, for the presence of the fibrous band connecting MD with the abdominal wall – 3 and 0 in the absence of the fibrous band. The authors recommend resection of MD in case of receiving 6 points or more.

Peoples et al. suggest abandoning asymptomatic Meckel’s diverticulectomies due to the low risk of operative morbidity and mortality after surgical removal of symptomatic MD and a very low probability of complications caused by MD and requiring surgical intervention in adults (5). In patients with symptomatic MD postoperative complications were not observed. After the prophylactic removal of MD complications probably attributable to this surgical procedure were found in 2 patients (2%) – intra-abdominal abscess and anastomotic leak. Also 2 deaths (2%) not attributable to incidental diverticulectomy occurred. However, in the entire group of 94 patients with MD only 4 were symptomatic, so the authors’ recommendations based on the low risk of complications after symptomatic diverticulectomy should be treated sceptically.

Stone et al. think that Meckel’s diverticula are seldom symptomatic and complications attributable to diverticulectomy are not frequent (4). They also proved that women more rarely suffer from symptoms caused by MD. They were present in 12.9% female patients and in 50% male patients (p<0.05). The authors observed no deaths. 2 of 4 postoperative complications occurred after excision of asymptomatic MD in women. That is why the authors do not recommend prophylactic diverticulectomy, especially in women.

Zani et al. in their meta-analysis made on the basis of the MD related English literature do not recommend removing all incidentally found Meckel’s diverticula because it increases the risk of early postoperative complications and 758 Meckel’s diverticulum must be removed to prevent 1 MD attributable death in the future (11). Infection and bowel obstruction occurred significantly more often in patients after resection of asymptomatic MD (5.3%)
than in patients with MD left intact (1.3%) (p <0.0001). Patients who underwent excision of incidentally identified MD had a significantly higher risk of developing bowel obstruction and other complications. That is why the authors conclude that unplanned intestinal resection and anastomosis can increase the risk of postoperative complications. They calculate that of patients with MD only 4% will need hospital stay and 3% will need surgery. Mortality related to MD is low (0.001%) and the most common in pediatric patients. The results of this metaanalysis demonstrate that leaving asymptomatic MD declines the risk of early postoperative complications without increasing the risk of late complications. There is also no convincing evidence substantiating prophylactic resection of incidentally found MD, even in children.

Ueberrueck et al. recommend to leave MD untouched after appendectomy due to gangrenous or perforated appendix, but when inflammatory stages of appendicitis are less advanced they incline to resection of MD (18). The rate of postoperative complications was higher – but not significantly higher – in patients with MD left intact (17.7%) than in patients after excision of MD (9.5%). It can be explained by more advanced inflammatory stages of the vermiform appendix in the non-removed MD group than in patients with MD resected. No late complications were observed in patients with asymptomatic MD left untouched. However, only 40% of patients from this group gave a response to the authors.

Groebli et al. think that during laparotomy warranted due to suspected and unconfirmed appendicitis, excision of all identified Meckel’s diverticula is indicated (9).

Detection of ectopic tissue within MD is the other factor determining management of asymptomatic diverticulum. The presence of ectopic tissue significantly increases the risk of MD-related complications (6, 7, 9, 10, 16). It is found in 12.23-34.44% of all resected Meckel’s diverticula (4, 6, 7, 9, 10, 12-16, 18), in 23.08-51.52% of symptomatic (7, 9, 10, 12-16) and in 9.09-20% of asymptomatic (6, 7, 9, 12-15). McKay identified ectopic tissue in none of 10 resected asymptomatic diverticula (16). In our research material no ectopic tissue was found.

Varcoe et al. demonstrated that a palpable thickened wall of MD is not a reliable method for the detection of ectopic tissue because there is only a 54% chance of the presence of ectopic tissue in thickened Meckel’s diverticula. However, 14% of not thickened Meckel’s diverticula contain ectopic tissue (12). For the authors the fact that it is impossible to confirm the presence or absence of ectopic tissue on palpation indirectly supports the recommendation of removing all incidentally found Meckel’s diverticula. Park et al. pay attention to the fact that only 38% of ectopic tissue specimens were palpable during surgery (10). Groebli et al. also think that visual examination and palpation are not reliable to detect the presence of ectopic tissue (9). Due to these observations in above articles Robijn et al. did not add the presence of ectopic tissue to their scoring system, despite they find it to be a risk factor for MD-related complications (19). In case of short MD with a wide base or when a palpable mass at the base is present they suggest wedge-shaped excision of MD to remove it entirely and to make a direct visual control of the bowel mucosa with the margin of excision possible (19). Neoplastic tissue can also be found in MD, for example carcinoma, adenomyoma, carcinoid, lipoma, leiomyoma or leiomyosarcoma and metastatic adenocarcinoma (3, 4, 9, 10, 15).

There are also no well-defined guidelines for a technique of MD resection. Diverticulectomy or small bowel resection can be performed. The choice of a method depends on the size of MD, the presence of ectopic or neoplastic tissue within a diverticulum and a type of MD-related complication. Inversion and invagination of the MD stump into the lumen of the ileum has not been recommended for ages because it can cause intussusception and bowel obstruction (8). When the inflammatory process involves the base of MD and the contiguous intestinal wall too, small bowel resection should be performed (8). It may be also necessary in case of strangulation due to volvulus or intussusception (8). If MD is the cause of bleeding from an ulcer or has a wide base, bowel resection is also indicated (2).

Varcoe et al. demonstrated that in all Meckel’s diverticula containing ectopic tissue with a height to diameter ratio ≥2 ectopic tissue was not localized at the base (12). Furthermore, in 60% of Meckel’s diverticula containing ectopic tissue with a height to diameter ratio <2 the base was involved by ectopic tissue. That is why
they recommend diverticulectomy for Meckel’s diverticula with a height to diameter ratio ≥2 or greater because there is no involvement of the base by ectopic tissue. If a height to diameter ratio is <2, small bowel resection with MD is indicated because after diverticulectomy ectopic tissue, which is often localized at the base of diverticulum, can be left.

Park et al. noticed that 13% of palpable ectopic tissue specimens were localized at the base of diverticulum (10). In such a case they recommend small bowel resection with the resection margin free of the entire mass and if ectopic tissue was not identified they find diverticulectomy sufficient.

Pinero et al. found no deaths, they also did not observe differences in prevalence of postoperative complications between the patients with symptomatic and asymptomatic Meckel’s diverticula (7). However, incidence of complications, especially wound infection and bowel obstruction in the site of anastomosis, was higher after intestinal resection than after diverticulectomy.

Stone et al. observed complications in 4 of 47 patients (12 symptomatic, 35 asymptomatic) after excision of MD (4). 3 of them underwent ileal resection and complications included wound infection in 2 cases and anastomotic leak in 1 case. In the authors’ opinion it may indicate the appropriateness of performing diverticulectomy instead of small bowel resection, particularly in patients with asymptomatic MD.

MD is found more often in men – a male to female ratio is from 1.23:1 to 2.85 (5-9, 12-17). Symptomatic diverticulum also occurs more frequently in male patients – a male to female ratio is from 1,25:1 to 4,5:1 (5-9, 12-17). Furthermore, in patients with asymptomatic diverticulum a male to female ratio is from 1.05 to 3.25:1 (4, 6, 8, 9, 10, 12, 14-17). Stone et al. received in the entire group with MD a male to female ratio 0.52, while in the group with asymptomatic diverticulum 0.3 (4). The explanation of this result is that the vast majority of asymptomatic Meckel’s diverticula were removed during gynecological procedures. Peoples et al. found a male to female ratio 1:3 in symptomatic patients, but only 4 persons were in this group (5). Only Cullen et al. received a male to female ratio <1 (0.89) in the group with asymptomatic diverticulum (17). In the entire research material of the Department of Endocrine and General Surgery of Medical University of Lodz the male to female ratio was 1.08:1, in symptomatic patients (7 patients) 1:2.5, and in asymptomatic (20 patients) 1.5:1.

**SUMMARY**

There are no guidelines for management of asymptomatic MD incidentally found during surgery. In the Department of Endocrine and General Surgery of Medical University of Lodz after excision of 7 symptomatic Meckel’s diverticula complications possibly attributable to this procedure were not observed. However, this amount is too small to suggest leaving intact each asymptomatic MD due to the low risk of complications after resection of producing symptoms diverticulum. On the contrary, after prophylactic excision of MD, in 2 of 18 patients (11.11%) complications eventually attributable to diverticulectomy occurred. The fact that in 3 of 14 patients after appendectomy due to AA and after prophylactic diverticulectomy reactive Meckel’s diverticulitis was confirmed demonstrates that macroscopically normal MD can be reactively inflamed during AA and resection of the diverticulum is then justified. The literature (9, 10, 12) demonstrates that it is difficult to confirm or negate within MD the presence of ectopic tissue increasing the risk of MD directly attributable symptoms (6, 7, 9, 10, 16). In our research material none of resected Meckel’s diverticula contained ectopic tissue. On the basis of the above informations and our own experience we take a position that it is impossible to confirm symptoms of the inflammatory process and the presence of ectopic tissue within MD macroscopically and on palpation. We have no group of patients with MD left intact to assess it according to the occurrence of MD related complications in the future. We think that all incidentally found Meckel’s diverticulum should be resected providing that absolute contraindications are absent. In our research material asymptomatic MD occured more frequently (65%) in patients under 34 years, while symptomatic was 2,5 times more common in 34-year-old and elder patients. It can indirectly support resection of each incidentally found MD due to a possibility of MD related complications in the future, when the risk of postoperative complications is higher because of more
frequent coexisting diseases in this period. We also turn attention to the fact that the oldest patient in our group, the 83-year-old woman with symptomatic MD, had undergone appendectomy in the past. However, we were unable to find out whether MD was missed or left intact intentionally.

There is also no consensus on the technique of MD excision. Small bowel resection ensures complete resection of eventually present and non-palpable ectopic tissue (12). However, it is associated with a higher risk of complications (7). Sometimes the surgeon may be forced to perform small bowel resection due to the type and extensiveness of complications caused by MD, for example hemorrhagic and gangrenous lesions of MD involving also the intestinal wall, the same as observed in one of our patients.

**CONCLUSIONS**

1. Excision of MD, either symptomatic or asymptomatic, is associated with the low risk of postoperative complications.
2. In patients suffering from AA removing of all found Meckel’s diverticulum, even macroscopically normal, is justified because they can be the site of reactive inflammation.
3. Small bowel resection may be a necessary method of MD removal due to the intensive and extensive inflammatory reactions caused by MD, involving also the portion of the intestine.
4. The risk of complications caused by MD may increase with age, but the observed tendency was not statistically significant, probably due to the relatively small amount of patients.

**REFERENCES**


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