Parasitic myomas are rare pathologic phenomena, and although they have been known for some time (1), their etiopathogenesis is still uncertain. The classic view is that these lesions arise from pedunculated subserosal myomas that have for some reason, such as a torsion around its peduncle (2), become partially or completely separated from the uterus and started to receive an alternative blood supply from another source, such as omental or mesenteric vessels (2–7). An alternative pathogenetic mechanism is that these lesions may develop from metaplasia of the peritoneum. This appears particularly likely for leiomyomatosis peritonealis disseminata (8, 9).

In very recent years, a third intriguing pathogenetic mechanism with an iatrogenic origin has emerged. There have been some reports of parasitic leiomyomas in the peritoneum after laparoscopic myomectomies or hysterectomies with the use of electric tissue morcellator (10–17). In an attempt to shed light on this singular pathologic condition, we present four cases of iatrogenic parasitic myomas that occurred after laparoscopic procedures and a review of the literature on the topic.

**MATERIALS AND METHODS**

All patients undergoing surgery in the Gynaecological and Obstetrics Department of the Policlinico Hospital of Palermo between April 2007 and March 2010 were reviewed to identify those in whom parasitic leiomyomas had been detected. Our unit is a tertiary care referral center for Western Sicily for the treatment of benign gynecologic pathologies. During the study period, 256 laparoscopic hysterectomies and 345 laparoscopic myomectomies were performed. The morcellator was used in 102 (40%) and 321 (93%) cases, respectively. The indications for surgery were the presence of pelvic pain or abnormal uterine bleeding caused by different sizes or numbers of myomas or for a fibromatosus uterus, refractory to medical treatment. An electric Steiner Morcellator (Karl Storz) with 15-mm bladders was used when the size of the myoma exceeded 3 cm or after a subtotal hysterectomy.

All patients in our unit routinely give informed consent for the use of their data for research purposes. The study was approved by the local institutional review board.
We also carried out a review on parasitic leiomyomas after laparoscopic myomectomy or hysterectomy. To this end, we identified all English language medical papers published in the period 1990 to 2010 that are available on the PubMed electronic database.

RESULTS
We identified four cases of parasitic myomas that were diagnosed and treated in our department over the 3-year study period. The main characteristics of these cases are reported in Table 1. These patients had previously undergone laparoscopic myomectomy with an electric tissue morcellator used to extract the lesions. None of them had received gonadotropin releasing-hormone (GnRH) agonists preoperatively before laparoscopic myomectomy. When we considered all women who had undergone surgery with the use of an electric morcellator (n = 423), the prevalence of this complication was 0.9% (95% CI, 0.3–2.2%). Considering exclusively those who had undergone laparoscopic myomectomy with the use of a morcellator (n = 321), it was 1.2% (95% CI, 0.4–2.9%).

Two women (patients 1 and 3) underwent a laparotomic total hysterectomy after the initial laparoscopic myomectomy and before the subsequent diagnosis of the parasitic myomas (see Table 1). The average time between the initial laparoscopic myomectomy and the identification of the parasitic myomas was 69 months (range: 24 to 108 months). In patient 2, a pregnancy occurred during the latent period. Two out of four patients were symptomatic (see Table 1). In one case, the lesion was identified during the caesarean section; in the remaining three cases, the masses were diagnosed through ultrasound. In patient 1, magnetic resonance imaging was deemed necessary to confirm the diagnosis (Fig. 1). This first case also was investigated with laparoscopy as it was our first experience with the condition. In patient 4, the parasitic masses were found in conjunction with a symptomatic uterine fibroid. The number of lesions varied from one to five. The most frequent localizations were the pelvic parietal peritoneum, the anterior parietal peritoneum at the level of the abdomen recto muscles, and along the gastrointestinal tract. Others localizations included the left paracolic fossa and the peritoneum at the level of the promontory of sacrum. In three cases, removal was successfully achieved through laparoscopic surgery, and the morcellation was performed inside an endoscopic bag; in the case detected during the caesarean section, removal was through the laparotomic incision. No intraoperative or postsurgical complications were observed. Histologic analyses on all samples confirmed the diagnosis of benign leiomyomas. Representative cases are illustrated in Figures 2 through 5.

Our review of the literature identified 13 published studies (10–16, 18–22). Nine were single case reports, two referred to two cases each, one referred to four cases, and only one reported on a case series of 10 women. Nine of the 13 studies were published within the last 5 years (since 2005). The main results of these studies are shown in Table 2.

Based on all the cases (including those from our report), we found the most common symptoms were abdominal and pelvic pain, a sense of a mass in the abdomen, and deep dyspareunia. In 29 (93%) of 31 women, the lesions were identified after a laparoscopic approach (95% CI, 81–99%); in 21 (68%) patients after a myomectomy (95% CI, 51–82%), and in 8 (26%) patients after a hysterectomy (95% CI, 13–42%). A morcellator was used in 27 (87%) of 31 women (95% CI, 73–96%). Lesions were commonly multiple and located either in the pelvis (70%) or abdomen (28%) and vagina.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (y)</th>
<th>Parity</th>
<th>Use of morcellator</th>
<th>Surgery for parasitic myoma</th>
<th>Symptoms</th>
<th>Months since first surgery</th>
<th>Interventions</th>
<th>No. pregnancies since first surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>4</td>
<td>34</td>
<td>Yes</td>
<td>LPS myomectomy, then LPT hysterectomy</td>
<td>Abdominal mass, abdominal/pelvic pain</td>
<td>72</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>Case 2</td>
<td>0</td>
<td>33</td>
<td>Yes</td>
<td>LPS myomectomy, then LPT hysterectomy</td>
<td>No symptoms</td>
<td>35</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Case 3</td>
<td>0</td>
<td>27</td>
<td>Yes</td>
<td>LPS myomectomy, then LPT hysterectomy</td>
<td>Dyspareunia, left-side tenderness</td>
<td>108</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>Case 4</td>
<td>1</td>
<td>42</td>
<td>Yes</td>
<td>LPS myomectomy, then LPT hysterectomy</td>
<td>No symptoms</td>
<td>72</td>
<td>48</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: LPS = laparoscopic, LPT = laparotomic. In both cases, hysterectomy was performed 24 months after myomectomy.
An interval since surgery of more than 2 years was found in 73%. Multiple lesions were referred in 13 (45%) of 29 patients (95% CI, 28–62%). The histology was invariably benign (100%).

DISCUSSION

The progressive diffusion of laparoscopic surgery in gynecology and the consequent improvement of laparoscopic armamentarium could explain the recent rise in reported cases of parasitic myomas (10–16, 20–22, 24). The development of electric tissue morcellators in particular was crucial as it permits shrinking the lesions into small fragments and removing them through a tiny incision made in the abdominal wall. In this way, there is the possibility that these fragments may implant themselves in the abdominopelvic cavity and subsequently develop into a large fibroid (10–14, 19). The observation that lesions are located mostly in the pelvis supports this interpretation, as the fragments are expected to move to the lower part of the abdomen because of gravity. It is intriguing that leiomyoma cells seem to show the same behavior as endometriotic cells implanted after retrograde menstruation (23).

Indirectly, the fact that most publications on this topic are very recent further supports the iatrogenic theory (6, 11–14, 16–18, 20). In fact, these publications reflect the recent diffusion of laparoscopic myomectomy throughout the world. It is likely that the more this technique is used, the higher the frequency of parasitic fibroids will become. In our study, using all the women treated with a morcellator as a denominator, the prevalence was 0.9% (95% CI, 0.3–2.2%). It raised to 1.2% (95% CI, 0.4–2.9%) when we exclusively focused on women who had undergone laparoscopic myomectomy with a morcellator; in our experience, all parasitic fibroids developed after this procedure. The frequency of this event should, however, be interpreted with caution because the number of observed cases cannot be related to the number of interventions performed with the use of a morcellator during the study period because this complication may arise several years after surgery; moreover, some asymptomatic cases may be missed. A reliable estimate would require prospective studies with long-term follow-up observation.
Overall, our study corroborates the theory of the iatrogenic origin of at least some parasitic fibroids (24). Of relevance here is the fact that this complication is not frequent, whereas the loss of tissue fragments within the abdominal cavity during morcellation is presumably extremely common, if not systematic. For this reason, it seems reasonable to hypothesize that other factors may contribute to the occurrence of this complication (15, 22). Exposure of fragments to steroid hormones and growth factors may play a role (22). It is interesting that in our series the time between the previous laparoscopic surgery and the diagnosis of parasitic myomatosis was shorter in the case of the patient who became pregnant soon after surgery.

FIGURE 3

(A–F) Laparoscopic images of the leiomyomas. The largest mass was located on the left paracolic fossa. The second seems to have originated in the mesosigmoid. The third attached to the omental appendage of the rectosigma. An additional two smaller formations were found at the peritoneal level of the sacral promontory, adhering to the anterior parietal peritoneum of the right rectal muscle (case 3).

(Cucinella. Parasitic myomas. Fertil Steril 2011.)
This could be related to typical immunologic and hormonal changes in pregnancy (25).

Even though our findings are speculative, we believe that they have some clinical implications. They emphasize the importance of an accurate use of the electric morcellator. A thorough inspection along with abundant and repeated washing and aspiration in the abdominopelvic cavity at the end of surgery is important to remove all fragments. Patients must be informed about this risk, and physicians should be aware of it. It is interesting that we found no serious clinical complications associated with the presence of parasitic myomas, and their histology was invariably benign; in our opinion, surgery must be considered mandatory in symptomatic cases, when there is progressive growth of the lesions, or when parasitic myomas are identified during other surgical procedures. Moreover, if surgery is decided on, a conservative intervention should be adopted. In these cases, we suggest a laparoscopic approach with the use of an endoscopic bag if the morcellation of the fibroids is considered.

**FIGURE 4**

(A–D) Laparoscopic images of leiomyomas. Two highly vascularized formations were located in the pouch of Douglas, without uterine connection. The first mass had been drawing both from the vascular peduncle in the original site and from a branch of the omental flap adhering to the fibroma itself. The second formation originated from the serosal surface of the sigmoid colon (case 4).

**FIGURE 5**

The two leiomyomas removed (case 4).

## TABLE 2

Review of the literature on parasitic myomas after laparoscopic surgery.

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of cases</th>
<th>Previous surgery</th>
<th>Use of morcellator</th>
<th>Months since first surgery</th>
<th>Symptoms</th>
<th>No. of myomas (diameter)</th>
<th>Location</th>
<th>Histology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ostrzenski et al., 1997 (10)</td>
<td>1</td>
<td>LPS myomectomy</td>
<td>No</td>
<td>2</td>
<td>Incisional pain and mass</td>
<td>1 (8 mm)</td>
<td>Abdominal (1)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Donnez and Nisolle, 2001 (18)</td>
<td>2</td>
<td>LPS subtotal hysterectomy</td>
<td>Yes</td>
<td>NR</td>
<td>Deep dyspareunia</td>
<td>NR</td>
<td>Pelvic (small piece of morcellated uterus)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>La Coursiere et al., 2005 (19)</td>
<td>1</td>
<td>LPS hysterectomy</td>
<td>Yes</td>
<td>10</td>
<td>Dyspareunia, dysuria, pelvic pain</td>
<td>4 (37, 37, 37, and 27 mm)</td>
<td>Pelvic (3) and abdominal (1)</td>
<td>Leiomyoma-cervical tissue</td>
</tr>
<tr>
<td>Paul and Koshy, 2006 (11)</td>
<td>1</td>
<td>LPS myomectomy</td>
<td>Yes</td>
<td>30</td>
<td>None</td>
<td>3 (NR)</td>
<td>Pelvic (1) and abdominal (2)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Takeda et al., 2007 (13)</td>
<td>1</td>
<td>LPS myomectomy</td>
<td>Yes</td>
<td>72</td>
<td>None</td>
<td>5 (60, 40, 45, 35, and 10 mm)</td>
<td>Pelvic (4) and abdominal (1)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Sinha et al., 2007 (7)</td>
<td>2</td>
<td>LPS myomectomy then hysterectomy/LPS</td>
<td>Yes</td>
<td>36 and 8</td>
<td>Abdominal mass (both), pain in 1 case</td>
<td>3 (150, 70, and 80 mm) and 1 (100 mm)</td>
<td>Pelvic (4)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Moon et al., 2008 (20)</td>
<td>1</td>
<td>LPS myomectomy</td>
<td>Yes</td>
<td>36</td>
<td>Abdominal mass</td>
<td>1 (25 mm)</td>
<td>Abdominal (1)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Kumar et al., 2008 (14)</td>
<td>1</td>
<td>LPS myomectomy</td>
<td>Yes</td>
<td>9</td>
<td>Abdominal distension, breathlessness</td>
<td>7 (250 mm, others 20–30 mm)</td>
<td>Pelvic (6) and abdominal (1)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Kho and Nezhat, 2009 (15)</td>
<td>10</td>
<td>LPS myomectomy (6), LPT myomectomy (2), LPS hysterectomy (2)</td>
<td>Yes</td>
<td>8 cases 75 (range: 2–204)</td>
<td>Pelvic pain, pelvic pressure</td>
<td>15 (diameters carrying between 30 and 120 mm)</td>
<td>Pelvic (14) and abdominal (1)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Epstein et al., 2009 (21)</td>
<td>1</td>
<td>LPS myomectomy</td>
<td>Yes</td>
<td>27</td>
<td>Abdominal mass</td>
<td>2 (30, 80 mm)</td>
<td>Abdominal (2)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Wada-Hiraike et al., 2009 (24)</td>
<td>1</td>
<td>LPS assisted myomectomy</td>
<td>No</td>
<td>48</td>
<td>Abdominal mass</td>
<td>1 (105 × 95 × 60 mm)</td>
<td>Abdominal (1)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Pezzuto et al., 2010 (22)</td>
<td>1</td>
<td>LPS myomectomy</td>
<td>Yes</td>
<td>99 (range: 36–192)</td>
<td>None</td>
<td>2 (50 and 30 mm)</td>
<td>Pelvic (2)</td>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Larrain et al., 2010 (16)</td>
<td>4</td>
<td>LPS myomectomy (2), LPS hysterectomy (2)</td>
<td>Yes</td>
<td>132</td>
<td>Pelvic pain (2 cases), mass in vagina (1 case)</td>
<td>4 (diameters carving between 40 and 70 mm)</td>
<td>Pelvic (3), vaginal (1)</td>
<td>Leiomyoma (in 1 case infiltrated by endometrial glands)</td>
</tr>
</tbody>
</table>

Note: The indication for hysterectomy was fibroids and metrorrhagia in all cases. Locations were divided in two groups: [1] pelvic locations that included the pouch of Douglas, pelvic wall, vesicouterine pouch, rectum, and sigmoid mesentery, and [2] abdominal location that included myomas of the intestine above the sigma, omentum, abdominal wall, and upper abdomen. LPS = laparoscopic; LPT = laparotomic; NR = not reported.

REFERENCES


