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Appendicular Mucocele: Possibilities and Limits of Laparoscopy. Brief Series and Review of the Literature

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Rezumat

Mucocelul apendicular: posibilitățile și limitele laparoscopiei. Serie scurtă de cazuri și analiza literaturii

Introducere: Mucocelul apendicular, dilatare chistică a apendicelui, este o boală rară, dar, din păcate, aproximativ 1/10 din cazuri evoluează spre pseudomyxoma peritonei.
Material și Metodă: Am realizat un studiu prospectiv între 1 ianuarie 2010 și 31 decembrie 2014, în scopul de a urmări incidența, simptomatologia, circumstanțele de diagnostic, tratament și evoluția acestor tumori rare.
Rezultate: Un total de șapte pacienți au suferit o operație curativă pentru mucocel apendicular: o femeie și șase bărbați, cu o vârstă medie de 59,71 ani. Semnele clinice, prezente în două cazuri, au fost necaracteristice. Ecografia efectuată în toate cazurile, a descoperit leziuni care ar fi putut ghida diagnosticul în 5 cazuri. CT efectuat în 5 cazuri a diagnosticat doar două cazuri. Toate cazurile au fost operate: abord clasic în patru cazuri și abord minim invaziv în trei cazuri. Am efectuat două hemicolectomii dreapte, o apendicectomie clasică asociată unei rezecții anterioare de rect, două apendicectomii laparoscopice și două apendicectomii cu rezecție de cec cu staplerul, una prin abord clasic și una minim invaziv. In niciun caz nu a existat ruptura tumorii mucinoase intraoperator. Spitalizarea medie a fost de 5,7 zile. Complicațiile postoperatorii au apărut într-un singur caz (14,2%), o infecție de plagă. Perioada medie de urmărire postoperatorie a fost 40,28 luni (6 – 48 luni). Nu am avut niciun caz cu recidivă sau cu pseudomixoma peritonei.
Concluzii: Mucocelul apendicular este o boala rară; acesta poate fi găsit întâmplător și poate mima apendicita acută, plastronul apendicular sau o tumoră de cec. Odată diagnosticat, tratamentul chirurgical se impune datorită riscului de perforație și evoluția tumorii spre complicații. Abordul laparoscopic poate fi folosit în cazuri selectate, asociată unor măsuri de siguranță pentru a evita perforația iatrogenă și însămânțarea peritoneală și parietală.

Cuvinte cheie: mucocel apendicular, apendicectomie laparoscopică, pseudomixoma peritonei

Abstract

Introduction: Appendicular mucocele, a cystic dilatation of the appendix, is a rare disease, but unfortunately about 1/10 of cases evolves into pseudomyxoma peritonei.
Methods: We performed a prospective study between 1 January 2010 to 31 December 2014 in order to track the incidence, symptoms, and circumstances of diagnosis, treatment and evolution of these rare tumors.
Results: A total of seven patients underwent curative surgery for a mucocele of the appendix: one woman and six men

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with an average age of 59.71 years. Clinical signs, present in two cases, were uncharacteristic. Ultrasound performed in all cases, could guide diagnosis in 5 cases. CT performed in 5 cases diagnosed only two cases. All cases were operated on: the open approach was used in four cases and a minimally invasive in three cases. We performed two right colectomies, an open appendectomy associated to anterior resection of the rectum, two laparoscopic appendectomies and two appendectomies and cecum resection with stapler, one by open approach and one by a minimally invasive approach. Intraoperative spillage of mucinous tumor did not occur in any case. The mean hospital stay was 5.7 days. Postoperative complications were present in 1 case (14.2%): wound infection. The average follow-up period was 40.28 months. (Range 6 to 48 months). No tumor recurrence or readmission, such as pseudomyxoma peritonei, has occurred. *Conclusions:* Appendicular mucocele is a rare entity; it can be found incidentally and it can mimic acute appendicitis, appendicular plastron or cecum tumor. Once diagnosed, surgical treatment is required for fear of perforation, tumor evolution and the emergence of the rule of complications. Laparoscopic approach in selected cases can be used, accompanied by safety measures to avoid iatrogenic perforation and peritoneal and parietal seeding.

Key words: appendicular mucocele, laparoscopic appendctomy, pseudomyxoma peritonei

Introduction

Apendicular mucocele, a cystic dilatation of the ileocecal appendix blocked by intralumenal mucus secretion, is due to: cystic retention (simple mucocele), mucosal hyperplasia, mucinous cystadenoma and mucinous cystadenocarcinoma. Mucocele of the appendix is rare, found in 0.25% of the appendectomies, and represents 8% of appendiceal tumors (1). Most frequently, mucocele is discovered incidentally during routine imaging or surgical explorations (open surgery or laparoscopy). It can mimic acute appendicitis or it can take a clinical appearance of right iliac fossa tumor. A percentage of 10-15% of cases of the mucocele of the appendix evolve to pseudomyxoma peritonei (1).

Methods

Between 1 January 2010 and 31 December 2014 in the First Surgical Clinic, "St. Spiridon" University Hospital, Iasi, Romania, we performed a prospective study in order to track the incidence, symptoms, and circumstances of diagnosis, treatment and evolution of these rare tumors.

Results

In this period we performed 1006 appendectomies, of these 802 by laparoscopic approach. We diagnosed 7 patients (0.7%) who underwent curative surgery for a mucocele of the appendix.

The study group consisted of one woman and six men with mean age of 59.71 years (range, 36 to 78 years). Five patients out of 7 patients were obese with BMI over 35.

Clinical signs were uncharacteristic; only pain in the right iliac fossa was common. As associated diseases we found: diabetes in 3 cases and various heart diseases in 4 cases (*Table 1*).

Preoperative diagnosis of appendicular mucocele was possible only in two cases, on the basis of history (pseudomyxoma peritonei) and CT exam. In the other three cases, the diagnosis was: acute appendicitis in one case and cystic tumor in the right iliac fossa, in two cases. In one case diagnosis was made intraoperatively, appendicular mucocele being associated with rectal cancer.

Ultrasound, performed in all cases, showed signs that could lead to diagnosis in 5 cases (*Fig. 1*). Wall calcifications in cystic tumor (2 cases) could also attract attention. CT performed in 5 cases confirmed diagnosis in other 2 cases (*Fig. 2*).

All cases were operated on: an open approach in 4 casesand a minimally invasive approach in 3 other cases (*Fig. 3*). We performed two right colectomies, an open appendectomy associated to anterior resection of the rectum, two laparoscopic appendectomies and two appendectomies with cecum resection with stapler to completely resect the mucocele (one by open approach and one by a minimally invasive approach).We have not registered any case with intraoperative spillage of mucinous tumor. The mean maximum diameter of the mucocele of the appendix for all patients was 7.14 cm (range, 4 to 12 cm). The pathology showed a mucinous cystadenoma in 3 cases, mucosal hyperplasia in 2 cases, and a low-grade mucinous neoplasm in two cases (*Fig. 4-7*).

The mean hospital stay was 5.7 days (range, 3 to 10 days). Postoperativelywe registered only a minor parietal wound (14.2%). The mean follow-up period was 40.28 months. (Range, 6 to 48 weeks). No tumor recurrence, such as pseudomyxoma peritonei, has been noted. All postoperative characteristics of patients with mucocele of the appendix are described in *Table 2*.

Discussions

Apendicular mucocele was recognized as pathological entity by Rokitansky in 1842, but the term was first used by Feren in 1876 (2). Apendicular mucocele is a generic descriptive term that refers to appendix distended by mucus, a secondary cystadenoma (63%), hyperplasia of mucus (25%), cystadenocarcinoma (11%) or blockage of the lumen of the appendix (retention cyst, endometriosis, carcinoid, etc.) (3). Apendicular mucocele can occur in the development of a benign or malignant process. Higa recommends to mention, along with the term mucocele, a description of the pathological condition that cause it (4).

Increased intraluminal pressure can cause perforation of appendicular mucocele, spontaneously or during surgical

Table 1. *Preoperative characteristics of patients with mucocele of the appendix*

	Sex	Age	Main symptoms/ signs	BI	Preoperative Diagnosis	Associate Disease	Imaging suggestive of mucocele			CEA
							US scan	CT scan	Colonoscopy	
1	M	59	Constipation, Melena/anaemia	38	Rectal cancer, incidental finding	Rectal cancer T2NoMo, biliary lithiasis	-	+	-	42 ng/mL
2	M	78	Lower right side abdominal pain, anaemia	35	Cystique tumor	Atrial fibrillation	+	+-		28 ng/mL+
3	F	62	Lower right side abdominal pain	32	Cystique tumor	Atrial fibrillation, Mitral Valve Disease, biliary lithiasis	+-	+	+	30ng/mL 2
4	M	59	Lower right side abdominal pain	40	Pseudomyxoma peritonei	Diabetus mellitus, mesenteric cystadenocarcinoma	+	+		45 ng/mL
5	M	60	Lower right side abdominal pain	25,6	Acute appendicitis	Diabetus mellitus Arterial Hypertension	+			28ng/mL
6	M	36	Lower right side abdominal pain	26	Appendiceal tumor		+			
7	M	64	Lower right side abdominal pain	38	Mucocel of the appendix	Diabetus mellitus Arterial Hypertension	+	+	+	30ng/mL

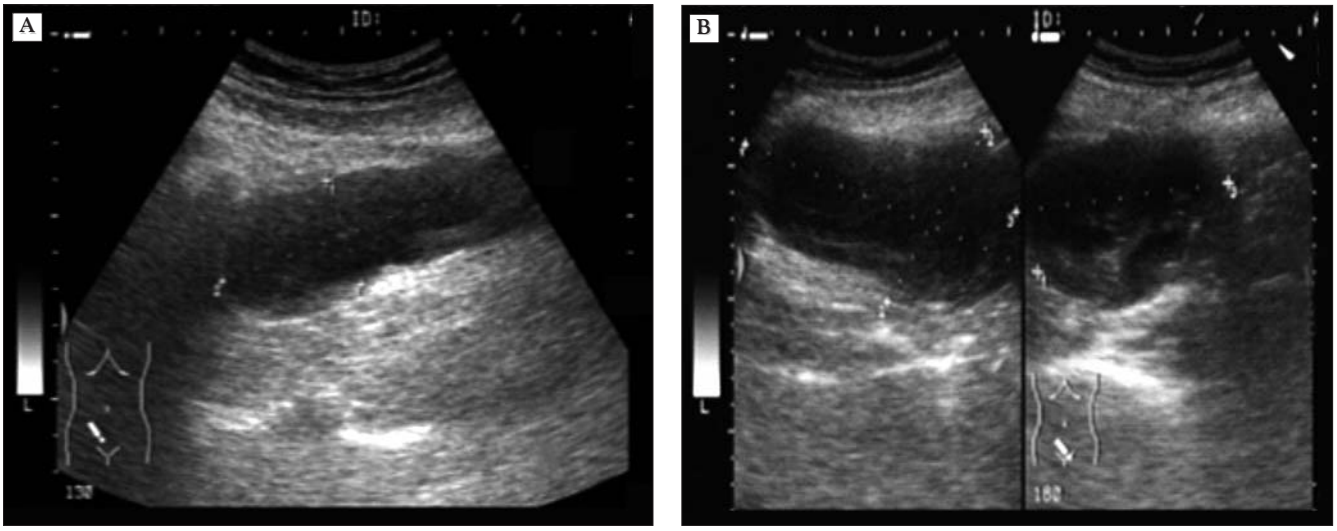

Figure 1. *Appendicular mucoceles in the right lower quadrant – US shows cystic mass with fine internal echoes*

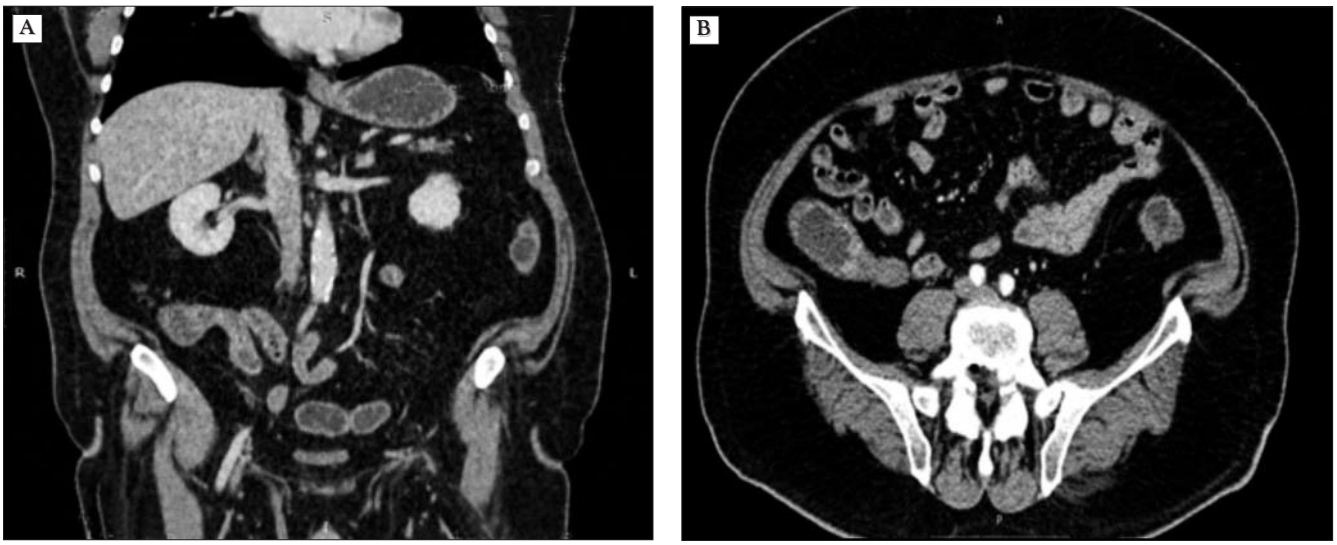

Figure 2. *Mucocele of the appendix - CT shows a well-encapsulated cystic mass and wall calcification. projecting into cecum in region of appendix*

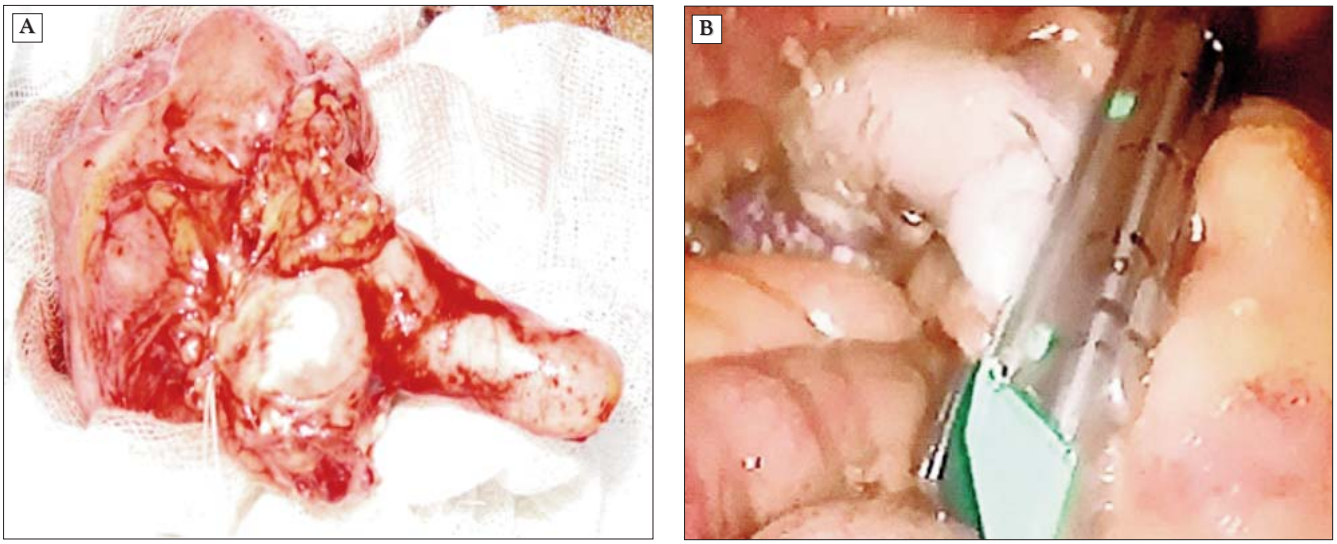

Figure 3. *Mucocele of the appendix – intraoperative view- open appendectomy (left) and laparoscopic approach with cecum resection with stapler (right)*

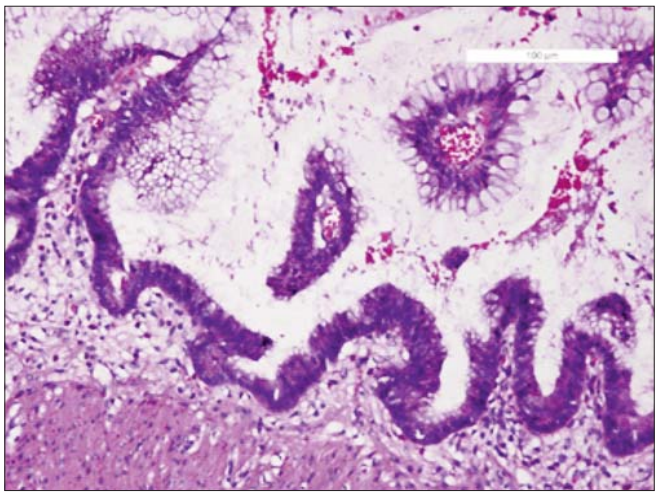

Figure 4. *Mucinous neoplasm of appendix with low-grade malignancy - appendicular epithelium with low grade dysplasia, hematoxylin eosin (HE), x20*

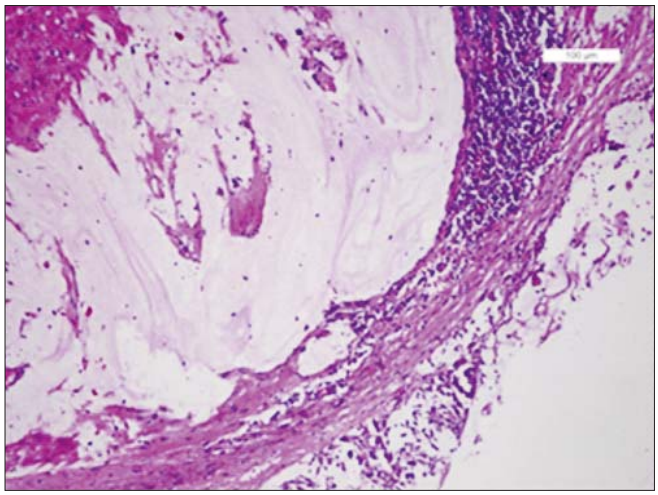

Figure 5. *Mucinous neoplasm of appendix with low-grade malignancy - intraparietal mucin without involvement muscular tunic, atrophic lymphoid follicles, submucosal fibrosis, HE, x10.*

maneuvers, with mucous content dissemination in the peritoneal cavity, which can lead to pseudomyxoma peritonei, transforming this complication in one with serious evolution and specific treatment (5). Only 10-15% of appendicular mucocelelead to pseudomyxoma peritonei, the incorrect treatment favoring disease progression.

Although appendicular tumors (including mucocele caused by malignant tumors) represent only 0.5% of appendicular pathology, malignant development of appendicular mucocele occurs in 75% of cases (6). Appendicular mucocele was associated with malignant tumors of the ovary (cystadenocarcinoma) or even with a benign ovarian cyst. Appendicular mucocele is rarely associated with colorectal cancer (20% of cases) (7). We report one case of mucocele of the appendix (mucinous hyperplasia) found incidentally during rectal cancer surgery. All data of literature shows that mucocele is an appendicular cystic lesion with an incidence of 0.1 – 0.7% of appendectomies (2-8).

According to WHO, four types of pathological lesions that can cause the appearance of mucocele of the appendix are described: simple mucocele or retention mucocele; mucocele with mucosal hyperplasia (5-25%); mucocele through mucinous cystadenoma (63-84%); malignant mucocele through cystadenocarcinoma (11-20%) (2,7,9,10).

Spontaneous or iatrogenic perforation of appendicular mucocele disseminates mucoid material into the peritoneum, which can be acellular, may contain cells with different degrees of dysplasia or malignant cells with special affinity to implantation of bowel peritoneal serous and deposits in peritoneal spaces, developing pseudomyxoma peritonei, a complication

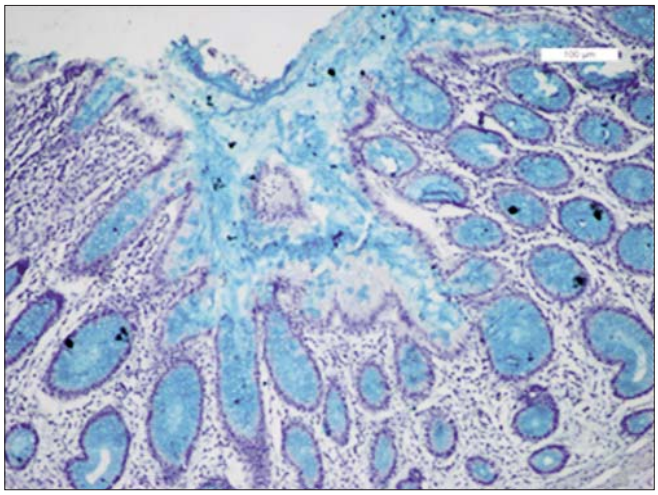

Figure 6. *Mucinous neoplasm of appendix with low-grade malignancy – appendicular mucosa with intraluminal mucin, Blue Alcian (BA), x10*

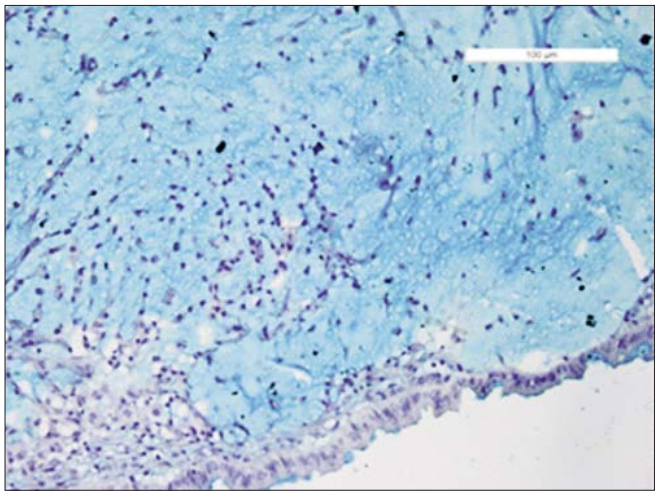

Figure 7. *Mucinous neoplasm of appendix with low-grade malignancy - dysplastic appendicular mucosa with intraluminal mucin, respectively intraparietal mucin, Blue Alcian (BA), x10*

Table 2. *Postoperative characteristics of patients with mucocele of the appendix*

	Sex	Age	Surgical treatment	Tumour size (cm)	Pathology	Morbidity	Hospital stay (days)	Follow-up (months)	Recurrence
1	M	59	Anterior Resection of Rectum appendectomy	8/3	Rectal colloid adenocarcinoma, mucosal hyperplasia	none	6	48	no
2	M	78	Right colectomy	7/4	Mucinous cystadenoma	none	6	48	no
3	F	62	Right colectomy	9/5	Intraepithelial neoplasia	none	10	36	no
4	M	59	Appendectomy and resection of cecum	12/8	Mucinous cystadenoma	none	5	12	no
5	M	55	Laparoscopic appendectomy	5/5	Mucinous cystadenoma	none	4	48	no
6	M	36	Laparoscopic appendectomy cecum resection	5/3	Mucosal hyperplasia	none	3	24	no
7	M	64	Laparoscopic appendectomy with mechanical cecum resection	4	Low grade mucinous neoplasm	Parietal infection	6	6	no

with poor prognosis (11,12). Unlike colloidal colorectal cancer and ovarian malignant tumors, which have the same affinity of peritoneal dissemination, perforation of mucocele, even when malignant, rarely results in metastases in the lymph node and liver.

Data on gender distribution diverge. Some studies show a female predominance (6). Others report a similar incidence in both sexes (5), and a few others a predominance of cases in males (1). Although appendicular mucocele can be diagnosed at any age, most cases have been reported in the literature in the decades 5-6 (1). The patients in our study were between 36 to 78 years of age. Mucocele of the appendix may be discussed in the differential diagnosis in men over 40 years with pain in the right iliac fossa.

The symptoms of mucocele are nonspecific. Up to 50% of cases may be asymptomatic (2), being discovered incidentally during imaging or surgery. In symptomatic patients, abdominal pain followed by nausea, vomiting, weight loss or genitourinary complaints (8) are the most frequent signs which mimic an acute appendicitis (13, 14). If mucocele is benign, clinically it is dominated by pain in right iliac fossa. Symptoms of malignant mucocele include weight loss, malaise and presence of abdominal tumor in the right iliac fossa (5). Stocchi found the following symptoms: abdominal pain (27%), abdominal tumor (14%), weight loss (13%), nausea, vomiting (9%) and signs of acute appendicitis (8%) (14). Thepresence of symptoms is associated with an increased incidence of cystadenocarcinoma (13). Pain in the right iliac fossa, sometimes colicky, and with signs of gastrointestinal bleeding may occur in case of intussusception (15). In addition to intestinal obstruction by intussusception, worst complication is malignant appendicular mucocele rupture, clinically translated by peritoneal signs and enlargement the abdomen. A rare complication cited in the literature is the torque of mucocele, which mimics an acute appendicitis (16).

The laboratory samples may indicate anemia in some cases and increase of carcinoembryonic antigen test (CEA) can be useful in postoperative follow-up. Preoperative diagnosis is exceptional, being an intraoperative finding (17). While good progresson imaging has been made, the preoperative positive

diagnosis increased from 15% in 1989 to 29% in 2007 (1).

Ultrasound reveals a cystic lesion encapsulated attached to the cecum. Depending on the density of mucus, content can be hypoechogenyc or anechogen; sometimes it may have varied aspects of echogenicity, with the "onion skin-like" sign, which seems to be pathognomonic for mucocele of the appendix (18, 19). Ultrasound alone cannot determine the preoperative diagnosis, only 58% of cases (1,20). Computed tomography (CT) is more accurate (21). It can highlight pericecum well-encapsulated cystic formation with thin or thick wall with parietal calcification (50% of cases).

The presence of nodes on the internal face of the post-contrast wall and wall irregularity suggests a mucocele by cystadenocarcinoma (22). An appendicular mucocele diameter less than 2 cm is usually benign, but more than 6 cm mucocele is caused by a cystadenoma and/or cystadenocarcinoma, with a perforation rate of 20% (2). Useful information for complications are brought by CT: intussusception, rupture, pseudomyxoma peritonei (8, 15, 21). Magnetic resonance imaging (MRI) may reveal appendicular mucocele, and associated lesions (6). Preoperative diagnosis may be indicated by associating ultrasound, CT (6). Differential diagnosis is made imagistically, in the case right ovary cyst, hydro or piosalpinx, abdominal lymphangioma, mesentery cysts, cystic duplicating of the bowel (the child) and other benign or malignant neighborhood tumors (leiomyomas, lipomas, carcinoid tumors, endometriosis, lymphomas and carcinomas) (5,23). The ultrasound sign "onion skin-like" and calcification of the wall advocate for appendicular mucocele. Colonoscopy can record the volcano crater sign (opening appendicular is raised by mucoceleand is covered by normal or yellowish mucosa) and can identify associated colic malignant lesions (3,24)

Complications associated with mucocele of the appendix are: intestinal obstruction by intussusception or volvulus, digestive hemorrhage and spontaneous rupture or iatrogenic perforation, with mucinous peritonitis and pseudomyxoma peritonei (23).

The correct perioperative diagnosis is very useful for selecting appropriate surgery to avoid intraoperative and postoperative complications (25). To prevent complications (perforation), surgical treatment is required in the case of confirmed or suspected diagnosis of mucocele.

So far there has been no consensus in connection with the optimal surgical treatment of appendicular mucocele; in this respect,the literature dates are scarce. It followsit remains a subject of controversy. Appendicular mucocele can be diagnosed using two procedures (right colectomy versus appendectomy) and surgical approach (laparoscopy versus laparotomy) (26). Although there are many cases in the literature referring to successful cases approached laparoscopically (27-30), most authors do not recommend laparoscopic approach, which could increase the risk of intraoperative rupture with appearance of pseudomyxoma peritonei (31,32). Laparoscopic approach ensures proper exposure of the entire peritoneal cavity and allows appendectomy, under a careful mobilization of mucocele with atraumatic clamps, if the lesion does not invade cecum or neighboring organs (3). The golden rule when mucocele is intact, betraying a benign process, is to avoid at all costs perforation during surgery. Lau reports laparoscopic resection of a12 cm appendicular mucocele with minimal manipulationand piece extraction in endobag (28). But the laparoscopic approach increases the risk of perforation, a reason for which Gonzalez Moreno suggests conversion if the diagnosis of mucocele is specified (32). We believe, after studying our cases and data from the literature, that appendicular mucocele is not a contraindication for laparoscopic surgery. However, it should be recognized that appropriate precautionary measures to avoid rupture in the abdominal cavity must be taken (33). There are authors who practise with good results singleport laparoscopic appendectomy for appendicular mucocele and with the advantage of being a minimally invasive approach (34).

Sugarbaker's experience in the treatment of pseudomixoma peritonei and peritoneal carcinomatosis imposed the open approach in the treatment of mucocele of the appendix (32). Simple appendectomy is sufficient in the case of benign mucocele or the simple cystadenoama. Extensive cyastadenoamas or cystadenocarcinoamas requires cecum resection or right colectomy if lymphnodes are invaded. Intraoperatively it will be searched for associated injuries (colon or ovarian cancer). Pseudomyxoma peritonei treatment that involves abdominal diffuse gelatinous collection with diffuse peritoneal tumor implants requires great care. Today if mucocele is malignant, right colectomy is not indicated unless cases with the lymph nodes invasion, otherwise cecum and appendix resection is considered in oncological limits (35,36). Perforated appendicular mucoceles modify the therapeutic strategy (37). If after appendectomy, peritoneal cytology is negative, negative resection margins and ileocecal lymph nodes are not invaded, it is indicated intraperitoneal lavage and intraperitoneal chemotherapy, then regular hospitalization (36,38). If peritoneal cytology is positive, after appendectomy, peritoneal cytoreductive surgery is needed with early postoperative intraperitoneal chemotherapy and hyperthermia.

If resection margins are positive after appendectomy the previous protocol will be followed, finally completed with surgery i.e. resection of the cecum. If lymph nodes are invaded-too, right hemicolectomy, peritoneal cytoreductive surgery and intraperitoneal hyperthermia and chemotherapy are to be taken into account. In cases of cystadenocarcinoma with cutaneous fistula, right colectomy is recommended (39). Perioperative chemotherapy includes mitomycin and 5-Fluorouracil. It is also recommended that these patients should be treated in specialized centers. Appendicular mucocele discovered during the evolution of pregnancy should be operated on before the birth, to avoid rupture (40). All cases will be followed up postoperatively to diagnose in due time peritoneal recurrence (41, 42). Careful supervision is required postoperatively to detect other malignancies which are commonly associated with mucocele of the appendix. Operated benign unperforated apendicular mucocele has a 100% survival prognostic within a period 5 years. The survival drops to 54% if the tumor exceeded the appendix wall. In case of perforation, patients will be followed by CT-scan every 6 months for 5 years (8).

Conclusions

Appendicular mucocele is a rare entity; it can be diagnosed incidentally as it can simulate acute appendicitis, appendicular plastron or cecum tumor. As soon as a diagnosis is reached, surgical treatment is required for fear of perforation, tumor evolution and the appearance of the rule of complications. Laparoscopic approach can be used in selected cases with clear measures to avoid iatrogenic perforation, peritoneal and parietal seeding.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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