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ORIGINAL ARTICLE

Is appendectomy a simple surgical procedure?

¿Es la apendectomía un procedimiento quirúrgico simple?

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Abstract

Objective: *Acute appendicitis is among the most applied surgical procedures around the world. One of the complications of appendectomy is stump appendicitis. The diagnosis of stump appendicitis is usually delayed.* **Material and method:** *In our study, we compiled cases with stump appendicitis after appendectomy. All cases with open and laparoscopic appendectomy were included in our study.* **Results:** *Between 2008 and 2020, 5620 appendectomy patients who were operated in the general surgery clinic were examined. Appendectomy was performed in five patients due to stump appendicitis. One of the patients with stump appendicitis presented with symptoms of generalized peritonitis, another with symptoms of ileus, the other with symptoms of incarcerated incision hernia at the McBurney incision, and the other two patients with symptoms of acute appendicitis.* **Conclusion:** *As it can be understood from our study, although appendectomy is the most common and easily seen surgical procedure in general surgical practice, it is a procedure that increases morbidity as we see in patients with stump appendicitis. Abdominal tomography appears to be the gold standard in diagnosis in stump appendicitis. Surgeons should definitely suspect stump appendicitis in patients whose symptoms have improved, even with open appendectomy scarring.*

Keywords: *Stump appendicitis. Appendectomy. Inadequate appendectomy. Remnant appendicitis.*

Resumen

Objetivo: *La apendicitis aguda es uno de los procedimientos quirúrgicos más aplicados en todo el mundo. Una de las complicaciones de la apendicectomía es la apendicitis del muñón. El diagnóstico de apendicitis del muñón suele retrasarse.* **Métodos:** *En nuestro estudio recopilamos casos de apendicitis del muñón tras apendicectomía. Todos los casos con apendicectomía abierta y laparoscópica fueron incluidos en nuestro estudio.* **Resultados:** *Entre 2008 y 2020 se examinaron 5620 pacientes apendicectomizados que fueron operados en la clínica de cirugía general. Se realizó apendicectomía en 5 pacientes por apendicitis del muñón. Uno de los pacientes con apendicitis del muñón presentó síntomas de peritonitis generalizada, otro con síntomas de íleo, el otro con síntomas de hernia de incisión encarcelada en la incisión de Mc Burney y los otros dos pacientes con síntomas de apendicitis aguda.* **Conclusiones:** *Como se desprende de nuestro estudio, si bien la apendicectomía es el procedimiento quirúrgico más común y fácil de ver en la práctica quirúrgica general, es un procedimiento que aumenta la morbilidad como vemos en los pacientes con apendicitis del muñón. La tomografía abdominal parece ser el estándar de oro en el diagnóstico de la apendicitis del muñón. Los cirujanos definitivamente deben sospechar apendicitis del muñón en pacientes cuyos síntomas han mejorado, incluso con cicatrices de apendicectomía abierta.*

Palabras clave: *Apendicitis del muñón. Apendectomía. Apendicectomía inadecuada. Apendicitis remanente.*

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Introduction

Acute appendicitis is among the most applied surgical procedures due to its 8.6% for men and 6.7% for women incidence around the world[1]. Complications seen after appendectomy include wound infection, hernia, intra-abdominal abscesses, intestinal obstruction, incisional hernias, and stump appendicitis. In studies conducted, 66% of stump appendicitis cases were reported after open appendectomy and 34% of them were seen after laparoscopic appendectomy[2]. The time gap between the appendectomy and the appearance of stump appendicitis symptoms can vary from weeks to years. Incorrect identification of the appendix base during appendectomy constitutes the main risk factor for residual appendix[3]. Stump appendicitis shows the same symptoms as acute appendicitis such as pain, nausea, vomiting, loss of appetite, starting periumbilical, and displacing the right lower quadrant (RLQ). As a laboratory finding, leukocytosis and C-reactive protein (CRP) elevation are frequently seen. Computed tomography (CT) confirms the diagnosis. The diagnosis of stump appendicitis is usually delayed due to the doctors neglecting the diagnosis and when it is diagnosed, it is observed that it causes higher morbidity with 70% perforation rate compared to acute appendicitis[2]. Complementary appendectomy is the treatment of stump appendicitis, but the timing of treatment is not well defined[4].

Material and Method

Acute appendicitis patients who were operated in Bolu Abant Izzet Baysal University Medical Faculty Hospital general surgery clinic between 2008 and 2020 were retrospectively reviewed. In our study, we compiled cases with stump appendicitis after appendectomy. All cases with open and laparoscopic appendectomy were included in our study. Patients who applied for stump appendicitis were confirmed to have undergone appendectomy with previous pathology reports. Laboratory, radiology data, and post-operative pathology results of the patients were examined before the first appendectomy. The time period between pre-stump appendectomy and inadequate appendectomy and their demographic characteristics were examined. Laboratory, radiology, and pathology results that carried out before stump appendectomy were examined.

Results

Between 2008 and 2020, 5620 appendectomy patients who were operated in the general surgery clinic of Abant Izzet Baysal University Medical Faculty Hospital were examined. Of these patients, 650 were laparoscopic appendectomy. The mean age of all appendectomy cases was 33.7 (17-88). The mean age of laparoscopic appendectomy cases was found to be 33.52 (18-76). Nine hundred and five (16.1%) of 5620 patients had perforated appendicitis and 484 (8.6%) of 5620 had normal appendix.

Appendectomy was performed in five patients due to stump appendicitis. In all patients with stump appendicitis, it was observed that open appendectomy method was performed with the classic McBurney incision. When the surgical notes of the appendectomy with retrospective insufficiency were examined, it was observed that three patients had local perforated appendicitis. Gender distribution of the stump appendicitis cases was found to be three male and two female patients. The age rankings of patients who underwent appendectomy for stump appendicitis were found to be as follows: 19-29-34-36-44 (mean 32). The periods of patients between inadequate appendectomies and stump appendectomies were 2 months, 2 years, 2.5 years, 7 years, and 20 years, respectively.

Two patients with stump appendicitis applied to hospital with acute appendicitis, one with severe peritonitis, one patient with ileus (jejunal diverticulum?), and one patient with incarcerated hernia. It was found that the first appendectomies of the patients were performed in the outer center. Applications of stump appendicitis patients have been to our clinic.

The time between the onset of patients' complaints and the stump appendectomy ranges from 2 days to 7 days. The patient with perforated stump appendicitis and cecum necrosis applied to the hospital 5 days after complaints started and a right hemicolectomy operation was performed. Conservative treatment was performed for 5 days for the patient with the diagnosis of ileus (jejunal diverticulum?) and stump appendicitis, due to the fact that the patient experienced abdominal pain and subileus 2 months ago. After not responding to conservative treatment and detecting jejunal diverticulum and ileus in CT, surgical decision was taken and stump appendectomy and partial small bowel resection were performed. A perforated stump appendicitis patient, who was operated with the diagnosis of incarcerated incisional hernia, applied to the hospital 7 days after the onset of complaints. The other two

Table 1. Findings of stump appendicitis patients

Patient	Age	WBC	CRP	Abdomen CT findings	Appendix length in stump appendectomy pathology
1	19	11,800	46	Dilatations and local air fluid levels in the jejunal loops + intestinal segment accompanied by blind ending inflammation and fecaliths due to jejunum (diverticulitis?)	4 cm
2	29	12,500	64	4 cm length compatible with acute appendicitis	3 cm
3	34	16,400	121	Gato appearance in the cecum and ascending colon. Abscess is seen in the appendix area compatible with 2 cm appendicitis	5.5 cm
4	58	10,300	124	CT was not performed USG performed for incarcerated hernia	3 cm
5	44	8400	32	2.5 cm segment in appendix area + lap in mesentery	3 cm

patients applied to the hospital 2 and 3 days after the start of their complaints, respectively.

The patients' physical examination findings before stump appendectomy had McBurney incision scar. Two patients had physical examination findings consistent with acute appendicitis. There were extensive peritonitis findings in one patient. In the case of ileus (jejunal diverticulum), there was an increase in bowel sounds, vomiting, and rebound in the RLQ. The case who applied with incarcerated hernia had erythema and non-reducing swelling and pain on the hernia sac. The patient was operated considering an incarcerated incisional hernia.

In laboratory examinations, one patient had normal white blood cell (WBC) (8400) values and three patients had high WBC values ranging from 11,800 to 16,400. It was observed that CRP was at high values ranging from 32 to 121. No features were detected in other blood parameters (Table 1).

The patient who applied only with ileus (jejunal diverticulum) on direct radiographs had small bowel-type air fluid levels, while others had no features. When abdominal BT contrast enhanced was performed in patients, one patient had a 13 mm in diameter and 5 mm wall thickness with fecalith in the RLQ and 3 cm long of blind ending tubular formation (jejunal diverticulum) and 10 mm lymphadenopathies (LAPs) around it (Figs. 1 and 2). In the abdomen CT of the patient with generalized peritonitis, the appearance of "gato" was observed in the localization cecum and proximal of the ascending colon, and in this localization, there was widespread linear density increase in peripheral oily plans, and a large number of lymph nodes, the largest of which was 7 × 8 mm in size. In addition, a



Figure 1. *In the right lower quadrant fecalith and blind ending tubular formation (black arrow), edema in jejunal loops (white arrow).*

lesion compatible with 12 mm thick appendix, which continues 1.5 cm in the appendix lobe was reported (Fig. 3). We performed abdomen ultrasonography (USG) the patient who applied with the diagnosis of incarcerated incisional hernia at McBurney incision localization and it was reported that there was a 3 cm defect and an immobile, incarcerated bowel loop in the hernia sac. During the operation, it was observed that the stump appendicitis was perforated into the incarcerated incisional hernia sac and there was an abscess in the hernia sac. In the other two patients,

Table 2. Characteristics of stump appendicitis patients

Patient	Age	Gender	Time period after inadequate appendectomy	Application diagnosis	Applied surgery
1	19	M	2 years	Ileus (jejunal diverticula)	Segmental thin bowel resection+stump appendectomy
2	29	F	7 years	Stump appendicitis	Stump appendectomy
3	34	F	2 months	Generalized peritonitis (stump appendicitis)	Right hemicolectomy
4	58	F	20 years	Incarcerated incisional hernia	Stump appendectomy+drainage abscess+repair of hernia
5	44	M	2.5 years	Stump appendicitis	Stump appendectomy

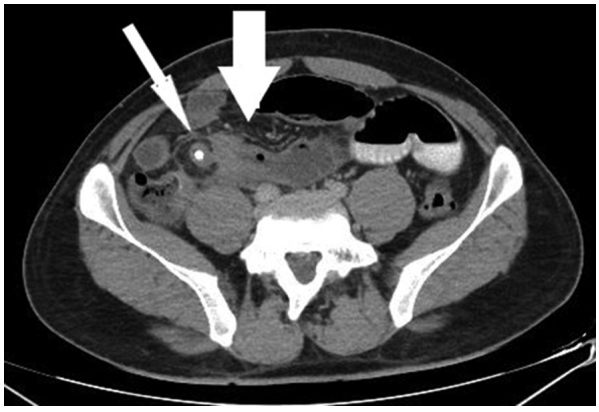


Figure 2. *In the right lower quadrant fecalith and blind ending tubular formation (thin white arrow), edema in jejunal loops (thick white arrow).*



Figure 3. *"Gato" and abscess localization cecum (white arrow), edema terminal ileum (blue arrow), stump appendicitis (black arrow).*

abdomen CT has been reported compatible with stump appendicitis 2-2.5 cm in length and 12-14 mm in thickness and LAPs in mesentery (Table 1).

Since cecum necrosis and paracolic abscess were detected in the patient with a generalized peritonitis, the stump appendectomy was performed by the right hemicolectomy procedure. The patient who applied to hospital with ileus (jejunal diverticulum) was observed during surgery that the stump appendicitis adhered to the jejunum loop and it caused an ileus by forming a brid here. In this patient, stump appendectomy procedure was performed with segmental small bowel resection. During surgery of who applied with incarcerated hernia, we observed that the stump appendicitis was perforated into the hernia sac and there was an abscess in the hernia sac and was no intestine loop in the hernia sac. Stump appendectomy, abscess drainage, and hernia repair were performed in this patient. The stump appendectomy procedure was sufficient for other patients due to stump appendicitis (Table 1). Diagnostic laparoscopy was performed in patients who did not have diagnosis of perforated stump appendicitis but due to the fact that intense adhesions occurred because of inadequate appendectomy and inflammation, it was completed with an open appendectomy procedure. In the results of postoperative pathology, appendix tissue with a length ranging from 2 cm to 5.5 cm was observed (Table 2).

Discussion

The condition that develops with inflammation of the appendix remaining after appendectomy is called stump appendicitis and this condition is very rare. The lifetime probability of developing stump appendicitis is much lower (1/50,000)[5]. Stump appendicitis signs and symptoms are the same as acute appendicitis[6]. Clinicians generally do not suspect the diagnosis of stump appendicitis in patients with appendectomy who present

with an acute appendicitis clinic, and worse, they ignore it. This situation may cause delay in diagnosis and further complications. Manoglu et al.[7] described stump appendicitis secondary cecum necrosis, which stated that this patient was followed up in the hospital twice due to abdominal pain. In our study, the patient who had appendectomy 2 months ago applied to our clinic with acute abdomen and right hemicolectomy was performed because the stump appendix was accompanied by paracolic abscess and cecum necrosis.

In studies conducted about the average time between inadequate appendectomy and stump appendicitis, Kanona et al. showed that the duration varies between 9 weeks and 50 years[8]. In our study, the time between inadequate appendectomy and stump appendicitis was found to be between 2 months and 20 years. Since the clinical and laboratory findings of stump appendicitis are similar to primary appendicitis, radiological methods USG and abdominal CT are useful for differential diagnosis. In our study, it was observed that USG and direct radiographs showed non-specific features and did not help in the diagnosis of stump appendicitis, but contrast-enhanced abdominal CT was essential for diagnosis in five patients.

In the literature, additional appendicitis tissue remaining longer than 5 mm length is a risk factor for fecaliths and stump appendicitis[9]. In patients operated with stump appendicitis, the length of the remnant appendix varied between 0.5 and 6.5 cm[10]. As acute appendicitis may prevent intense inflammation and isolation of the local location of the appendix, those two facts have been shown among the causes of stump appendicitis[11]. In the study, stump appendicitis rate after perforated appendicitis (47,621) was reported as 0.64%[12]. There is no standard approach for stump appendicitis. However, there are studies reporting that laparoscopy is superior because it provides wide exploration[13]. A thorough exploration and meticulous dissection with the critical view of the appendiceal-cecal junction is imperative to prevent from stump appendicitis. This may be facilitated through elevation of the appendix, toward the abdominal wall, providing mild tension, which will aid in the dissection of the significantly inflamed tissue planes[12]. The patients' abdominal imaging methods (ADBG, abdominal USG) gave non-specific findings and could not help diagnosis. Abdominal CT was the most important diagnostic method in all patients[14].

It is important to avoid the stump appendicitis because of the morbidity it will cause in patients. In our study, two patients presented with acute appendicitis-like examination findings, one patient presented with generalize peritonitis, one patient presented with ileus (jejunal diverticulum), and one patient presented like incarcerated hernia. Stump appendicitis can be diagnosed late because doctors do not suspect it. In the follow-up of our patients, we have seen that stump appendicitis is an important problem because it requires additional bowel resections during surgery and adds morbidities such as brid ileus in the future. To avoid stump appendicitis, it is important to perform appendectomy after the surgeon identifies the appendiceal-cecal junction. Especially in subserous retrocecal appendicitis, appendiceal-cecal junction should be identified by appropriate dissection[15]. For the identification of the appendiceal-cecal junction, it is important to dissect and ligate the recurrent branch of the appendiceal artery as this marks the true base of the appendix and to follow the tenia coli of the cecum to the base[16].

Conclusion

As it can be understood from our study, although appendectomy is the most common and easily seen surgical procedure in general surgical practice, it is a procedure that increases morbidity as we see in patients with stump appendicitis. Abdominal tomography appears to be the gold standard in diagnosis in stump appendicitis. Surgeons should definitely suspect stump appendicitis in patients whose symptoms have improved, even with open appendectomy scarring.

Conflicts of interest

The authors report no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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