



# Periappendicular Inflammatory Masses

## Periappendiküler Enflamatuvar Kitleler

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### ABSTRACT

**Aim:** Periappendicular inflammatory mass (PIM) defined as a mass located at the right lower quadrant of the abdomen due to inflammation, and can not clearly distinguish from borders of appendix. The aim of this study is evaluating the PIM.

**Method:** The patients who hospitalized for PIM evaluated retrospectively. Patient's age, gender, length of hospital stay (LOS), performing colonoscopy, comorbidity, etiology, and treatment evaluated. Also, etiology elaborated with age, gender, LOS, treatment, levels of C-reactive protein (CRP), white blood cells, neutrophil % (Neu%), and performing colonoscopy.

**Results:** One hundred fourty four patients were included to study. The mean age was  $41.35\pm 17.9$  years, and 54.2% of the patients were male. The mean LOS was  $4.2\pm 2.6$  days. Colonoscopy performed only 28.5% of the patients. The most common etiology was plastron appendicitis (PA) (75%), and 32.4% of the PA was with abscess. 67.3% of the patients were treated conservatively (medical treatment or percutaneous drainage), and the rest treated surgically. The most common surgical approach was diagnostic laparoscopy and drainage. Malignancy reported at two right at age, LOS, treatment, CRP, Neu%, and colonoscopy between etiologies were statistically hemicolectomy patients. The most common comorbidities were hypertension and diabetes (12.5%, and 8.3%, respectively). 44.4% of PIM had negative ultrasonography, 71.5% had positive CT imaging. The differences significant ( $p<0.05$ ).

**Conclusion:** Not only plastron appendicitis but also Crohn's disease, diverticulitis, mucocoele, and malignancy should keep in mind when evaluating the inflammatory mass of the right lower quadrant. Age, LOS, treatment, inflammatory markers, and performing colonoscopy significantly vary due to etiology.

**Keywords:** Periappendicular, mass, plastron appendicitis, inflammatory, right lower quadrant

### ÖZ

**Amaç:** Periappendiküler enflamatuvar kitle (PEK), batın sağ alt kadranda lokalize, enflamasyon sonucu oluşan, apandiks ile sınırları net ayırt edilemeyen kitle olarak tanımlanmaktadır. Çalışmamızın amacı PEK değerlendirilmesidir.

**Yöntem:** PEK nedeni yatırılan hastalar geriye dönük değerlendirildi. Hastaların yaş, cinsiyet, hastane kalış süresi (HKS), kolonoskopi durumu, yandaş hastalıkları, etyoloji ve tedavileri değerlendirildi. Ayrıca etyoloji; yaş, cinsiyet, HKS, tedavi, C-reaktif protein (CRP), beyaz küre (BK), nötrofil yüzdesi (Nöt%) ve kolonoskopi durumu değerlendirildi.

**Bulgular:** Yüz kırk dört hasta çalışmaya dahil edildi. Yaş ortalaması  $41,35\pm 17,9$  yıl olup, hastaların %54,2'si ise erkekti. HKS ortalaması  $4,2\pm 2,6$  gündü. Kolonoskopi hastaların sadece %28,5'inde yapıldı. Plastron apandisit (PA) %75 ile en sık etyoloji iken, PA'ların %32,4'simde apse gözlemlendi. Hastaların %67,3'ü konservatif (medikal veya perkütan drenaj), geri kalanı ise cerrahi olarak tedavi edildi. Tanısal laparoskopisi ve drenaj yapılan en sık cerrahi girişimdi. İki hemikolektomi hastasında malignite saptandı. Hipertansiyon ve diyabet (sırasıyla %12,5 ve %8,3) en sık saptanan yandaş hastalıklardı. Etiyolojiler arasında yaş, HKS, tedavi, CRP, Nöt% ve kolonoskopi açısından istatistiksel olarak anlamlı fark saptandı ( $p<0,05$ ).

**Sonuç:** Batın sağ alt kadrandaki enflamatuvar kitlelerin değerlendirilmesinde sadece plastrone apandisit değil Crohn hastalığı, divertikülit, mukosel ve maligniteler de akılda bulundurulmalıdır. Etiyolojiye bağlı olarak yaş, HKS, tedavi, enflamatuvar değerler ve kolonoskopi sonuçlarında anlamlı farklılıklar gözlenmektedir.

**Anahtar Kelimeler:** Periappendiküler, kitle, plastrone apandisit, enflamatuvar, sağ alt kadranda



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## Introduction

Periappendicular mass is the palpable mass located at the right lower quadrant of the abdomen (RLQA), can not be clearly distinguished from borders of appendix vermiformis, and known in terminology as plastron appendicitis (PA). PA is not correctly or accurately defined this condition because of the other inflammatory disease which presenting with mass. We defined periappendicular inflammatory mass (PIM) term for an inflammatory mass located at the RLQA, which can not clearly diagnosed at ultrasonography (USG) or computed abdominal tomography (CT). PA with or without abscess, inflammatory bowel disease (IBD) (complicated Crohn disease, terminal ileitis), diverticulitis, or malignancy (microperforation) of the cecum and appendix, mucocele, abscess of neighbor tissues (tuba-ovarian or psoas abscess) constitutes PIM.

The most common complaints of PIM are abdominal pain, which began more than three days before, fever, palpable mass in the RLQA. Inflammatory biomarkers increased according to the severity and type of etiology. Initially, USG than CT should perform for further imaging. Magnetic resonance (MR) enterography or elective colonoscopy should be done to clarify or exclude the diagnosing.<sup>1,2,3,4,5,6,7</sup>

Treatment of PIM is varied from conservative treatment to the right hemicolectomy according to the etiology and severity. Percutaneous or surgical drainage can perform for the treatment of abscess. Interval AP recommended for >40 years old patients for the risk of malignancy at PA.<sup>1,2,3,4,5,6,7</sup>

This study aimed to evaluate the management of the periappendicular inflammatory masses in our institute.

## Material and Methods

After receiving institutional approval from the ethics committee of Prof. Dr. Cemil Taşcıoğlu State Hospital (06.08.2019/1391), patient's records between January 2015 and October 2019 who hospitalized for PIM evaluated retrospectively. The patients peroperatively detected as complicated appendicitis excluded from the study.

The patients record evaluated for age, gender, length of hospital stay (LOS), colonoscopy, etiology, treatment, pathology, co-morbidity, and morbidity. Etiologies elaborated for age, gender, LOS, treatment, laboratory test [C-reactive protein (CRP), white blood cell (WBC), and Neutrophil% (Neu%)], USG, CT and performing colonoscopy.

Age calculated as mean  $\pm$  standard derivation; gender evaluated as male (M) or female (F). LOS calculated as mean  $\pm$  standard derivation. The Etiology evaluated as PA, simple PA (SPA), or PA with periappendicular abscess (PAWPA), IBD, suspicion of malignancy, diverticulitis, and

other rare etiologies (mucocele, psoas, and tuba ovarian abscess). Treatment evaluated as medical treatment (MT), percutaneous drainage (PD), diagnostic laparoscopy (DL), DL and drainage (DLD), appendectomy (AP), and right hemicolectomy (RH).

CRP (mg/L), WBC ( $10^3/uL$ ), and Neu% (%) as mean  $\pm$  standard deviation. Colonoscopy evaluated as performed yes or no. USG evaluated as performed but negative or performed and positive. CT evaluated as none, performed but negative or performed and positive.

## Statistical Analysis

The statistical analysis performed with SPSS 16.0. Age, LOS, CRP, WBC, Neu% calculated as mean  $\pm$  standard derivation. The ratio of male/female, etiology, treatment, colonoscopy calculated as a percentage. Chi-square, Kruskal-Wallis, and ANOVA were used to evaluate the values, and  $p < 0.05$  was accepted as significant.

## Results

One hundred forty four from 177 patients included study. The mean age was  $41.35 \pm 17.9$  years for all groups. Male was the most common gender, with a 52.4% ratio. The mean of LOS was  $4.2 \pm 2.6$  days. 28.5% of the patients performed a colonoscopy. Hypertension and diabetes were the most common comorbidities with 12.5% and 8.3% rates, respectively. The most common etiology of PIM was PA with a 75% rate, and 5.5% of the patients managed for suspicion of malignancy. 67.3% of the patients were treated conservatively (medical or percutaneous drainage), and 32.7% of the patients treated surgically. DL with drainage (25%) was the most common surgery, and right hemicolectomy performed to 4.9% of the patients. The pathology of the operated patients except for two right hemicolectomies (gastrointestinal stromal tumor and mucinous cystadenocarcinoma), reported as inflammation. The morbidity reported at seven patients (4.9%) and includes; recurrence at four patients, pulmonary complication at two patients and, surgical site infection at one patient (Table 1). Suspicion of malignancy was the eldest group with  $63.7 \pm 11.8$  years, and other rare etiologies were the youngest group with  $36.4 \pm 13.2$  years. Male was the most common gender for all groups; however, the female was the most common gender at PAWPA, IBD, and other rare etiologies. The longest LOS reported at other rare etiologies, and the shortest LOS reported at SPA. Colonoscopy offered and planned six week after from discharge, but most of the patients should not perform colonoscopy. The most common colonoscopy performed group was IBD, subsequently diverticulitis with 76.4% and 66.6% rate, respectively. PA was the most common etiology of PIM with 75%, and abscess occurred

at 32.4% of the PA. The recurrence rate was 3.7%, and interval AP performed to 1.85% of the PA. PA was the most common performed MT (SPA) with 78%. PD performed only PAWPA. DL performed to SPA and IBD, and DLD performed to PAWPA and IBD. RH performed to IBD and suspicion of malignancy patients. The highest CRP level measured at other rare etiologies, and the lowest level at diverticulitis. The highest Wbc level measured at PAWPA, and the lowest level measured at other rare etiologies. The highest Neu% ratio measured at IBD, and the lowest ratio measured at diverticulitis. The differences at age, LOS, treatment, CRP level, Neu%, and performed colonoscopy between etiology groups were found statistically significant (p=0.013, p=0.004, p=0.0001, p=0.005, p=0.03, p=0.0001 respectively) (Table 2).

**Table 1.** The results of the study (\*mean ± standard deviation)

Age (years)	41.35±17.9	
Gender	n	%
Male	78	54.2
Female	66	45.8
Length of stay (days)	4.2±2.6	
Colonoscopy	n	%
Yes	41	28.5
No	103	71.5
Etiology	n	%
Plastron appendicitis (PA)	108	75
Simple PA	73	67.6
Periappendicular abcess with PA	35	32.4
IBD	17	11.8
Malignancy?	8	5.5
Diverticulitis	6	4.2
Others	5	3.5
Treatment	n	%
Medical	82	56.9
Percutaneous drainage	15	10.4
Diagnostic laparoscopy	12	8.3
Diagnostic laparoscopy and drainage	24	16.7
Appendectomy	4	2.8
Right hemicolectomy	7	4.9
Comorbidity	n	%
Hypertension	18	12.5
Diabetes	12	8.3
Hearth Disease	7	4.9
Chronic obstructive pulmonary disease	4	2.8
Cerebrovascular accident	2	1.4
Chronic renal failure	3	2.1
Others	7	4.9

**Table 2.** The results of the etiology (\*mean ± standard deviation)

Etiology	Age* (years)		LOS* (days)		Gender		Treatment				Laboratory		Colonoscopy			
	M	F	M	F	M	F	MT	PD	DL+D	AP	RH	CRP* (mg/L)	WBC* (103/ul)	Neu%* (%)	No	Yes
PA	40.2±17.9	3.7±2.1	60	48	45	28	64	13	9	0	0	138.8±94.2	13.4±5.1	75±8.4	87	21
SPA	39.9±17	3.5±1.6	45	28	64	0	64	0	9	0	0	119.3±94.3	12.6 ±4.8	73.5±9	56	17
PAPWA	40.7±19.8	4.3±2.7	15	20	0	13	0	13	0	0	0	179.4±81.2	15.2±5.4	78.1±5.9	31	4
IBD	38.3±16.6	5.1±3.1	8	9	9	0	3	2	0	0	3	159.2±127.7	13.1±4.7	79.2±8.9	4	13
Malignancy?	63.7±11.8	5.7±2.4	4	4	4	0	4	0	0	0	4	133±108.9	13.2±5.7	72.7±8.6	3	5
Diverticulitis	45.5±14.9	6±4.7	4	2	4	4	4	0	0	2	0	84.3±79.2	12.9±4.4	72.5±8.7	2	4
Others	36.4±13.2	6.4±4.3	2	3	1	2	2	0	2	0	0	246±106	11.4±1.8	76.4±5.5	5	0
p	0.013	0.004	0.467	0.0001	0.0001	0.005	0.212	0.03	0.0001							

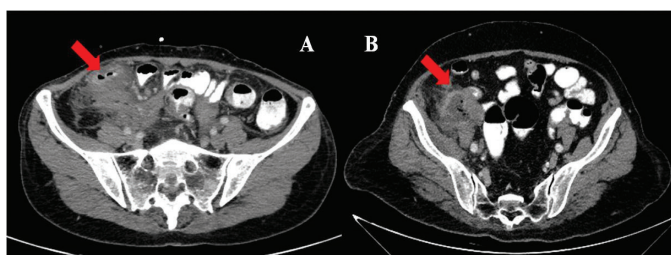
LOS: Length of stay, M: Male, F: Female, MT: Medical treatment, PD: Percutaneous drainage, DL: Diagnostic laparoscopy DL + D: Diagnostic laparoscopy + drainage, AP: Appendectomy, RH: Right hemicolectomy, CRP: C-reactive protein, WBC: White blood cells, Neu: Neutrophil %. PA: Plastron appendicitis, SPA: Simple PA, PAWPA: Periappendicular abcess with PA, IBD: Inflammatory bowel disease others: mucocoele, tuboovarian or poas abcess

The comparison of USG and CT results due to etiology is given at Table 3. 44.4% of the all PIM had negative, 55.6% had positive USG imaging. The most common negative USG imaging found at PAWPA group. 11.1% of the all PIM had none, 17.4% had negative, and 71.5% had positive CT imaging. Except other group the most common positive CT imaging found at diverticulitis group. The CT images of etiologies are given at Figure 1 and 2.

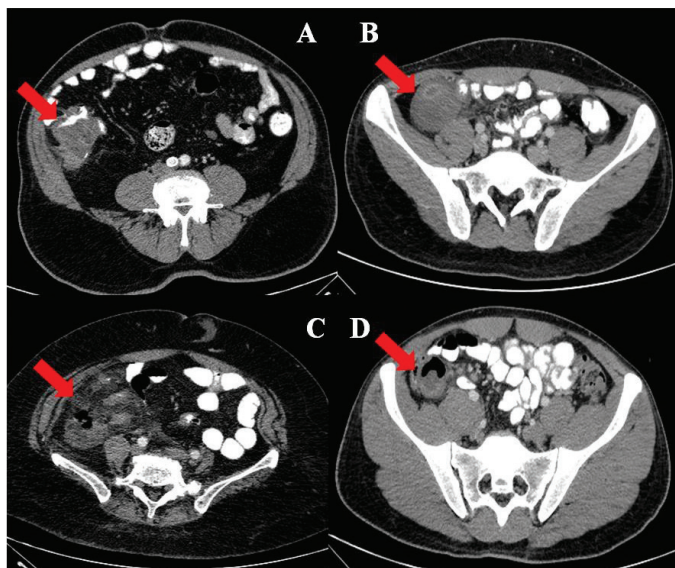
## Discussion

The most common etiology of PIM were PA (SPA or PAWPA), IBD, diverticulitis, mucocele, and malignancy in recent study. Hepatic adenoma, xanthogranulomatous inflammation of terminal ileum, metastasis to an ectopic kidney, tubercular tuba-ovarian cyst, incidental teratoma or appendiceal torsion reported as a inflammatory palpable mass at RLQA in the literature.<sup>8,9,10,11,12,13</sup>

History of abdominal pain, which began 72 hours ago, palpable mass at RLQA, and fever are the most common complaint of PIM. Inflammatory biomarkers like CRP, WBC, Neu% increases due to the severity of etiology. Plain abdominal radiography can be inadequate for evaluating



**Figure 1.** Tomographic images of A: plastron appendicitis, B: plastron appendicitis with periappendicular abscess



**Figure 2.** Tomographic images of A: malignancy, B: mucocele, C: diverticulitis, D: inflammatory bowel disease

PIM. USG is the initial imaging modality for the evaluation of PIM. A mass lesion in the RLQA, which cannot clearly distinguish from the appendix, and sometimes accompanied by a dense fluid, can found at USG or Contrast-enhanced CT. Colonoscopy should not prefer at the acute phase of inflammatory disease and prefer after six weeks to clarify the etiology. MR enterography should do for diagnosing the disease of the terminal ileum.

### The evaluation of the etiology;

Plastron appendicitis is a formation of abscess secondary to perforated appendicitis, and follow surrounding by the omentum. The rate of enclosed inflammation is 3.8-5% of all appendicitis. The incidence of PA in adults reported as 4,8%. The mean age varies from 26 to 53 years, and male is the most common gender for PA in literature.<sup>2</sup> USG and CT have higher sensitivity, specificity, and accuracy in diagnosing acute appendicitis (86%, 88%, 91%, and 90%, 93%, 94%, respectively). The specificity of CT increased to 95%, while sensitivity decreased to 75% at complicated appendicitis such as PA or PAWPA. Abscess, extraluminal air, appendiceal wall enhancement, periappendicular fat stranding are useful criteria of complicated appendicitis.<sup>14,15,16</sup> USG or CT diagnosis is more common than clinical, with a rate of 14.2% vs 5.1%. The treatment of PA is still controversial. Conservative treatment with antibiotherapy for simple PA, and percutaneous or surgical drainage for PAWPA. There are a 7.2% recurrence and a 7.6% failure rate for conservative treatment. Immediate AP is not recommended due to the 35.6% risk of morbidity, while the risk decreased to 18.4% at delayed AP, 13.5% at nonsurgical treatment, and 11% at additional interval AP with nonsurgical treatment. The success ratio of nonsurgical treatment reported as 93%, and 20% of nonsurgical treatment needed drainage. Nonsurgical treatment has a 2% risk of misdiagnosed. Malignancy detected at following 1.2% of the nonsurgical treatment and >40 years old have an increased risk for malignancy. The recommended follow up at PA after successful conservative treatment consists of colonoscopy, CT, or MRI for especially >40 years old patients, and interval AP suggested for recurrent disease and malignancy risk.<sup>2,17</sup> In the recent study, the mean age was 39.9±17 years for SPA, and 40.7±19.8 years for PAWPA and male was the most common gender at SPA, however, female was the more common at PAWPA. LOS was shorter at SPA than PWPA (3.5±1.6 vs 4.3±2.7 days). SPA was more diagnosed than PAWPA at CT (72.6% vs 60%); however, the nondiagnosed ratio was similar at CT (20.5% vs 20%). 39.7% of the SPA and 51.4% of the PAWPA cannot diagnose at USG. MT or only DL was performed for SPA (87.6% vs 12.4%), however DL + drainage or PD was performed for PAWPA (62.9% vs 37.1%). 23.3% of the SPA and 11.4% of the PAWPA performed colonoscopy at follow

**Table 3.** Comparison of ultrasonography (USG) and computed tomography (CT) results due to etiology

Etiology	USG		BT		
	Performed but negative	Performed and positive	None	Performed but negative	Performed and positive
SPA	29 (39.7%)	44 (60.3%)	5 (6.8%)	15 (20.5%)	53 (72.7%)
PAWPA	20 (57.1%)	15 (42.9%)	6 (17.1%)	7 (20%)	22 (62.9%)
IBD	9 (53%)	8 (47%)	3 (17.6%)	2 (11.8%)	12 (70.6%)
Malignancy?	4 (50%)	4 (50%)	1 (12.5%)	1 (12.5%)	6 (75%)
Diverticulitis	2 (33%)	4 (67%)	1 (17%)	0	5 (83%)
Others	0	5 (100%)	0	0	5 (100%)
Total	64	80	16	25	103

SPA: Simple PA, PAWPA: Periappendicular abscess with PA, IBD: Inflammatory bowel disease others: mucocele, tuboovarian or psoas abscess

up. The ratio of recurrence reported as 3.7%, performing interval AP reported as 1.86%, and morbidity reported as 2.8%. The pathology of interval appendectomies reported as inflammation. We planned elective colonoscopy and offered interval AP to all PA; however, the compliance rate for recommendation is very poor. 43.5% of the PA was >40 years old, interval AP has not performed anyone, and only 27.7% performed a colonoscopy.

**Inflammatory Bowel Disease (IBD):** CD, which located at terminal ileum (terminal ileitis) or ileocolic region, should be occurred inflammatory mass at RLQA. CD reported, 0.85% of the operated for appendicular inflammatory mass and 11.8% of the CT abnormalities in RLQA. 10-20% occurred spontaneous abscess, one third occurred palpable mass and 5.3% misdiagnosed as acute appendicitis at CD. Contrast-enhanced CT is useful for differential diagnosing of CD and complications. Colonoscopy or MR enterography can help clarify the diagnosis of CD. The treatment of CD includes medical treatment, percutaneous or surgical drainage, or right hemicolectomy due to the severity of the disease. PD preferred at simple and unilocular abscess. Surgical drainage should perform when PD is failure or not suitable, or multilocular. 44% of the abscess of CD was drained by percutaneously vs. 56% by surgically.<sup>4,7,17,18,19</sup> In the recent study, IBD occurred 11.8% of the PIM. Abscess occurred at 11.8% of the patients and drained surgically. DL performed to 17.6% of the CD patients for suspicion of acute appendicitis. Right hemicolectomy to 17.6% of the patients for the complication of CD. Chronic granulomatous inflammation reported for pathology. The rest of the patients

treated medically. Colonoscopy performed to 76.4% of the patients.

**Malignancy** of appendix vermiformis and cecum misdiagnosed with complicated appendicitis and RLQ mass can be the initial sign. Malignancy of appendix vermiformis is very rare and constitutes 0.4% of all gastrointestinal tract. Carcinoid tumor is the most common malignancy; adenocarcinoma represents 10-20%, one-third of adenocarcinoma is mucinous. 6-8.3% of the right hemicolectomy which performed for inflammatory mass reported as a cecal mesenchymal tumor. Diagnosing of malignancy of appendix and cecum, which presenting with RLQ mass is difficult with clinical or radiological findings, and generally diagnosed at pathology. Colonoscopy can be a useful diagnosing modality for malignancy at selected patients. The surgical treatment constitutes; AP or extends to right hemicolectomy. The conservatively treated patients with malignancy suspicion must follow up closely, and elective colonoscopy planned immediately.<sup>6,20,21,22,23</sup> In the recent study, malignancy constitutes 5.5% of the PIM. Suspicion of malignancy with PIM reported at imaging. Right hemicolectomy performed to half of the patients due to the severity of inflammation. Pathology of the appendix was reported active inflammation at two patients, GIST at one patient, and mucinous adenocarcinoma at one patient. Elective colonoscopy performed for the conservative treated patients, and cecal adenocarcinoma reported at two patients pathology and redirected for elective surgery.

**Diverticulitis:** The left side is the most common side of the colonic diverticulum, and diverticulum at cecum or

appendix vermiformis is very rare. The incidence of cecal diverticulum was reported as 0.1%, appendical diverticulum was reported as 1.4% (0.2-0.66% from autopsy and 0.004-2.1% from AP specimens). These diverticula should be congenital or acquired. The fifth decade is the most common decade for colonic diverticulitis. However, cecal diverticulitis reported as 44.54 years and appendiceal diverticulitis with an average age of 37-39 years. Most of the colonic diverticula are asymptomatic, but 10-20% of cecal, and two-thirds of appendiceal diverticulum can complicate with inflammation, perforation, etc. or misdiagnosed as acute appendicitis. The appendiceal diverticulitis has four times higher perforation and mortality rate than acute appendicitis. The clinic or radiologic differential diagnosing of diverticulitis from acute appendicitis is not easy. The diagnosing rate of appendical diverticulitis reported as 0.007% in the literature. Cecal or appendicular diverticulitis can be treated conservatively if correctly diagnosed and not complicated. Especially appendical diverticulitis operated to presumed as acute appendicitis.<sup>6,24,25,26</sup> In the recent study, diverticulitis occurred 4.2% (n=6) of the PIM. Four of the diverticulitis were cecal (66.7%), and two were appendiceal (33.3%) diverticulitis. The mean age was 45 years, and the most common male was gender found similar to literature. All cecal diverticula diagnosed at CT; however, all appendical diverticula diagnosed at AP specimens. Cecal diverticulitis treated with medical treatment, and colonoscopy performed all patients. Appendical diverticulum treated surgically with AP.

**Mucocele** is a cystic dilatation of appendix vermiformis, which occurred by blocking with an intraluminal mucus and causing to cystadenocarcinoma from cystic retention (simple mucocele). Mucocele is very rare, occurred 0.25% of the appendectomies, and constitutes 8% of appendiceal malignancy. Mucocele should misdiagnose as plastron or complicated appendicitis. A well-encapsulated cystic mass in the RLQA, often associated with mural calcifications found at imaging. AP can be adequate for simple mucocele; however, a right hemicolectomy must perform for mucinous cystadenoma or cystadenocarcinoma.<sup>27,28,29</sup> In the recent study, 1.85% of the PIM occurred by the mucocele of the appendix. AP performed, and granulomatous inflammation reported at pathology.

## Conclusion

In conclusion, not only plastron appendicitis but also CD, malignancy, diverticulitis, mucocele, and abscess of neighbor tissues must keep in mind when evaluating the inflammatory mass of right lower quadrant of the abdomen. Age, length of hospital stay, treatment, inflammatory markers, or performing colonoscopy could be significantly different between etiologies. Elective colonoscopy and

interval AP at plastron appendicitis are recommending for >40 years old patients to exclude malignancy.

## Ethics

**Ethics Committee Approval:** University of Health Sciences Turkey Okmeydanı Training and Research Hospital Clinical Research Ethics Committee (no: 48670771-514.10)

**Informed Consent:** Not obtained because the study was retrospective.

**Peer-review:** Internally and externally peer reviewed.

## Authorship Contributions

Concept: D.Ö.K., M.Y., B.G., S.E., S.H., Design: D.Ö.K., M.Y., B.G., S.E., S.H., Data Collection or Processing: D.Ö.K., M.Y., B.G., S.E., S.H., Analysis or Interpretation: D.Ö.K., M.Y., B.G., S.E., S.H., Literature Search: D.Ö.K., M.Y., B.G., S.E., S.H., Writing: D.Ö.K., M.Y., B.G., S.E., S.H.

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