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Does Loss of Appetite in Acute Appendicitis Indicate an Empty Stomach?

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ABSTRACT

Aim: Loss of appetite (anorexia) is a prevalent symptom in patients with acute appendicitis. In these cases, it can be hypothesized that the stomach is empty, and the gallbladder is contracted due to loss of appetite. In this study, we aimed to investigate gastric fullness and gallbladder status in patients with acute appendicitis. We investigated whether these parameters can be indirectly supported by imaging findings of anorexia and to what extent they are significant in terms of aspiration risk in emergency surgery planning.

Material and Methods: CT images of patients with acute appendicitis and the control group were evaluated for gastric fullness and gallbladder appearance.

Results: A total of 266 patients were included in the study. A hundred and thirty-nine patients (52.3%) were diagnosed with acute appendicitis, while 127 patients (47.7%) were classified as the control group. The proportion of patients with an empty stomach was statistically significantly higher in patients with acute appendicitis compared to the control group ($p<0.001$). Gastric filling grade 3 (high-risk solid gastric content for aspiration) was in 23% (n=32) of the cases with acute appendicitis.

Conclusion: Gastric fullness and gallbladder contraction are straightforward findings on CT that can provide indirect evidence in suspected acute appendicitis cases. Although anorexia is a key symptom, over half of patients continue oral intake irregularly, leaving up to one-fifth at high risk for aspiration during emergency surgery. Therefore, preoperative starvation protocols should not rely solely on the presence of anorexia.

Keywords: Acute appendicitis; anorexia; gastric fullness; risk of aspiration.

Akut Apandisitte İştahsızlık Midenin Boş Olduğunu Gösterir mi?

ÖZ

Amaç: İştahsızlık (anoreksi), akut apandisitli hastalarda yaygın görülen bir semptomdur. Bu hastalarda iştahsızlık nedeniyle mide içeriğinin boş, safra kesesinin ise kontrakte olduğu öne sürülebilir. Bu çalışmada akut apandisitli hastalarda mide doluluğu ve safra kesesi durumu incelenmiştir. Bu parametrelerin, anoreksinin görüntüleme bulgularıyla dolaylı olarak desteklenip desteklenemeyeceği ve acil cerrahi planlamasında aspirasyon riski açısından ne derece anlamlı olduğu araştırılmıştır.

Gereç ve Yöntemler: Akut apandisit tanısı alan hastalar ile kontrol grubuna ait BT görüntüleri, mide doluluğu ve safra kesesi görünümü açısından değerlendirilmiştir.

Bulgular: Toplamda 266 hasta çalışmaya dahil edilmiştir. Hastaların 139'u (%52,3) akut apandisit tanısı almışken, 127'si (%47,7) kontrol grubu olarak sınıflandırılmıştır. Mide içeriği boş olan hastaların oranı, akut apandisitli hastalarda kontrol grubuna kıyasla istatistiksel olarak anlamlı derecede daha yüksekti ($p<0,001$). Akut apandisit vakalarının %23'ünde (n=32) mide doluluk derecesi 3 (aspirasyon için yüksek risk taşıyan katı mide içeriği) olarak değerlendirilmiştir.

Sonuç: Mide doluluğu ve safra kesesi kontraksiyonu, akut apandisitten şüphelenilen vakalarda dolaylı kanıt sağlayabilecek, BT ile kolaylıkla değerlendirilebilen bulgulardır. Anoreksi, akut apandisitin önemli bir semptomu olmasına rağmen, hastaların yarısından fazlası düzensiz de olsa oral alıma devam etmekte ve bu durum olası bir acil operasyonda hastaların beşte birini aspirasyon riski altında bırakmaktadır. Bu nedenle, preoperatif açlık protokollerinde yalnızca anoreksinin varlığına güvenmek uygun değildir.

Anahtar Kelimeler: Akut apandisit; anoreksi; mide doluluğu; aspirasyon riski.

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INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdomen, and its lifetime prevalence has been reported to be as high as 7% (1,2). Early diagnosis is very important before the rupture of the appendix, and many morbidities and even mortality can be prevented with rapid intervention (3). As the time between diagnosis and surgery increases, the risk of complications such as peritonitis, perforation abscess, and sepsis increases. However, the diagnosis of acute appendicitis is often challenging, as clinical, laboratory, and radiological findings may be non-specific (4,5). The main imaging method in radiological diagnosis is ultrasonography, and it is very specific to visualize the appendix and measure the outer diameter or wall thickness. However, in cases where the appendix cannot be visualized on ultrasound, indirect imaging findings can be used for diagnosis (6).

Loss of appetite is one of the first symptoms of acute appendicitis (7). Theoretically, the stomach is not expected to be full in patients with acute appendicitis. However, different levels of gastric fullness can be detected in patients with acute appendicitis, especially in children. A stomach full of solid contents may increase the risk of aspiration during emergency surgical treatment (8,9).

This study aimed to evaluate gastric filling status in patients with acute appendicitis and to compare it with healthy controls.

MATERIAL AND METHODS

Patient Selection

Patients who were admitted to the emergency department of our hospital with abdominal pain between March 2018 and December 2021 and underwent abdominal CT examinations were included in the study. These patients were analyzed in two groups.

Acute appendicitis group: The patients who were diagnosed with acute appendicitis on CT and this diagnosis was confirmed histopathologically.

Control group: Patients not diagnosed with acute appendicitis on CT examination.

Patients with a history of previous abdominal operations were excluded. Patient categorization was performed by an emergency specialist based on medical records, radiology, and pathology reports. Demographic data of all patients (age, sex) were also obtained from medical records.

Ethics Approval

This retrospective study was approved by the Institutional Review Board (Ethics Committee Approval No: 2021/123) and conducted in accordance with the principles of the Declaration of Helsinki Informed consent was obtained from each participant included in the study group.

Radiological Evaluation

CT examinations were performed using a 128-slice multi-detector spiral CT scanner (Siemens Somatom Definition AS +, Siemens AG, Erlangen, Germany). CTs of all participants were accessed using a dedicated PACS workstation (Sectra IDS 7; Linkmping Sweden). Radiological images were evaluated by two attending radiologists independently, blinded to clinical findings and diagnostic categorization, with 8 years (I.F.N.) and 11 years (M.A.O) of experience in abdominal radiology, respectively.

In the acute appendicitis group, CT images were magnified by 200% and the appendix and periappendiceal region were evaluated. Appendix diameter, appendix wall thickness, and presence of appendicolith in the lumen were noted. In the control group, CT images were also examined for different intra-abdominal pathologies, and possible preliminary diagnoses were recorded.

The gastric filling was classified on a 3-point scale; grade 1 (empty stomach), grade 2 (filled with liquid), and grade 3 (filled with solid food) (figure1). The appearance of the gallbladder was classified into two categories normal and contracted (figure 2).

Figure 1. Evaluation of gastric fullness with CT images; a. no solid food or liquid contents in the stomach, b. only liquid content in the stomach, c. stomach full of solid food.

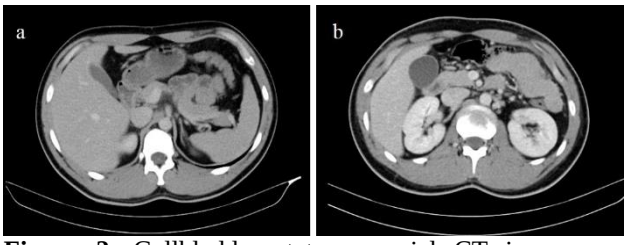

Figure 2. Gallbladder state on axial CT images; a. contracted, b. non-contracted

Statistical Analysis

Statistical analyses were performed using SPSS version 21.0 software (SPSS Inc., Chicago IL, USA). The minimum required sample size for the study was determined through a power analysis, as the total population size was not precisely known for proportional data. Based on an effect size of 0.5, an alpha error level of 0.05, and a confidence level of 0.95, the minimum sample size was calculated to be 255. Mean, standard deviation, number, and percentage values were used for descriptive variables, median and interquartile range values were used for data showing non-parametric distribution. Whether the numerical variables showed normal distribution or not was evaluated with the Kolmogorov-Smirnov test. Pearson's chi-square test was used to examine whether there was a relationship between two or more qualitative variables. Statistical significance was set at $p < 0.05$.

RESULTS

Two hundred sixty-six patients, who met the inclusion criteria, were included in the study. 65% (n=173) of patients were men. According to the CT evaluation, 139 patients (52.3%) were diagnosed with acute appendicitis, while 127 patients (47.7%) were classified as the control group. 6.5% (n=9) of the patients diagnosed with acute appendicitis were children. The mean age of patients diagnosed with acute appendicitis was 39.3±16.9 years and the mean appendix diameter was 10.1±1.7 mm in this group. The most common CT diagnoses of the patients in the control group were CT examination within normal

limits, urolithiasis, and malignancy, respectively. Detailed socio-demographic characteristics for each group are shown in Table 1. CT diagnoses of the patients in the control group are depicted in Table 2.

Table 1. Socio-demographic characteristics and appendix diameter of the groups

	Acute appendicitis (n=139)	Control (n=127)
Age (mean ± SD)	39.3±16.9	54.4±20.4
Gender (M/F)	104/35	69/58
Appendix diameter (mean ± SD) (mm)	10.1±1.7	3.8±0.8

Table 2. Abdominal CT diagnoses of patients in the control group

Diagnosis	n	%
Normal CT abdomen	35	27.56
Urolithiazis	26	20.47
Malignancy	11	8.66
Abdominal lymphadenopathy	6	4.72
Cholecystitis (acute/chronic)	6	4.72
Mesenteric panniculitis	6	4.72
PID	4	3.15
Bladder wall thickening	4	3.15
Acute pyelonephritis	3	2.36
Traumatic solid organ injury	3	2.36
Pneumonia	3	2.36
Gastroenteritis	3	2.36
Ovarian cyst	2	1.57
Acute pancreatitis	1	0.79
Choledocholithiasis	1	0.79
PSC	1	0.79
Chronic liver disease	1	0.79
Portal vein thrombosis	1	0.79
Liver hydatid cyst	1	0.79
Splenic infarction	1	0.79
Small bowel obstruction	1	0.79
Mesenteric ischemia	1	0.79
Pneumatosis intestinalis	1	0.79
Omental infarction	1	0.79
Inguinal hernia	1	0.79
Umblical hernia	1	0.79
Polycystic kidney disease	1	0.79
Endometrioma	1	0.79

PID; Pelvic inflammatory disease, PSC; Primary Sclerosing Cholangitis)

The stomach was evaluated as empty in 115 of the patients in the study group (grade 1). 69.6% of these patients (n=80) were in the patient group. The rate of those with an empty stomach was statistically significantly higher in patients with acute appendicitis compared to the control group (p<0.001). The gastric filling grade 3 was in 23% (n=32) of the cases with acute appendicitis. The gastric filling status in patients with acute appendicitis and the control group is depicted in Table 3. On the other hand, there was no significant difference in terms of gastric fullness between the groups with appendiceal diameters larger and smaller than 9 mm (Table 4).

Table 3. Comparison of gastric filling status in patients with and without acute appendicitis

		Acute appendicitis	
		Absent (n=127)	Present (n=139)
Gastric filing grade	1 (n,%)	35 (27.5)	80 (57.6)
	2 (n,%)	19 (14.9)	27 (19.4)
	3 (n,%)	73 (57.6)	32 (23)
p-value (Chi-square)			<0.001*

Table 4. Gastric filling status according to appendix diameter in cases with acute appendicitis

		Appendix diameter			p
		≤9 mm (n=55)	>9 mm (n=74)	Total	
Gastric filing grade	1 (n,%)	29(36.3)	41 (63.7)	80	
	2 (n,%)	10 (37)	17 (63)	27	
	3 (n,%)	16 (50)	16 (50)	32	
p-value (Chi-square)					**0.365**

*P value < 0.05—statistically significant

The gallbladder contracted in 58.3% (n=74) of the patients with acute appendicitis, and the rate of patients with contracted gallbladder was statistically significantly higher in patients with acute appendicitis compared to the control group (p<0.001) (Table 5).

Table 5. Comparison of the appearance of the gallbladder between groups

		Gallbladder		Total	p
		Contracted	Normal		
Acute appendicitis	Absent	74 (58,3%)	53 (41,7%)	127	<0.001*
	Present	37 (26,6%)	102 (73,4%)	139	

**P* value < 0.05—statistically significant

DISCUSSION

In this study, we aimed to investigate whether gastric filling status and gallbladder appearances were different in patients with acute appendicitis compared to the control group and the potential importance of these imaging findings in clinical use.

According to our findings, the rate of those with an empty stomach and those with contracted gallbladder in patients with acute appendicitis were statistically significantly higher when compared to the control group. Loss of appetite and vomiting are very common symptoms in acute appendicitis cases. Therefore, it can be expected that the stomach and gallbladder appearances of these patients will be compatible with the fasting state (10,11). Our findings show that this can be objectively demonstrated on CT examination and both stomach and gallbladder are empty in most cases, consistent with the clinical symptoms mentioned.

The first-line radiological imaging modality used in the diagnosis of acute appendicitis is ultrasonography. Ultrasonographic diagnosis is based on visualizing the appendix and measuring its maximum outer diameter. In cases where ultrasonography is not diagnostic, the diagnosis can be made by CT examination. However, CT is not generally used in children and pregnant women because of the risk of ionizing radiation and may not be available in the emergency room (12,13). Indirect imaging findings are used for diagnosis in cases with suspected acute appendicitis where the appendix cannot be visualized on ultrasonography. These are findings such as peritoneal fat hypertrophy, hypokinesia in the digestive loops, and pain caused by compression on the right iliac fossa. When these three findings are evaluated together, it has been reported that the sensitivity of the indirect findings reaches 83.9% and the specificity reaches 85.7% (6,12). In our study, the rate of patients with an empty stomach was statistically significantly higher in patients with acute appendicitis. Moreover, the rate of contracted gallbladder was significantly higher in patients with acute appendicitis compared to the control group. Therefore, although these imaging findings were evaluated with CT in our study, they can also be evaluated with USG in clinical practice and can be used as indirect supportive findings for the diagnosis of acute appendicitis.

Radiological evaluation of gastric fullness in suspected cases of acute appendicitis can be used for preoperative evaluation in terms of the risk of pulmonary aspiration in cases with a confirmed diagnosis, as well as its diagnostic contribution potential. Point-of-care ultrasound performed in patients who will undergo emergency surgery under general anesthesia can predict the risk of pulmonary aspiration by evaluating gastric volume and content. Studies conducted in adult patients with acute appendicitis report that gastric contents, which pose a significant risk of aspiration, are present in a small proportion of patients (8,9). In contrast, children with acute appendicitis have conventionally been considered to have gastric contents associated with an increased risk of pulmonary aspiration. In a study conducted by Evain et al., high-risk solid gastric content for aspiration was found in 13% of children with acute appendicitis (14). Solid-component gastric content is a high-risk situation for aspiration (15). The threshold for gastric volume with solid nutrients for aspiration risk remains controversial. Clinical data strongly suggest that gastric fluid volumes of up to 1-1.5 ml/kg (approximately 100 ml for an average adult) are normal and safe in fasting individuals (16). The minimum gastric fluid volume to induce passive regurgitation of gastric contents and therefore pulmonary aspiration is accepted as 200 mL (17). In our study, grade 3 (solid-high risk) gastric content was found in 23% (n=32) of cases with acute appendicitis, and %6.5 of them were pediatric patients. This means a high risk of aspiration alone in an unplanned operation for one-fifth of patients. This difference may be due to the characteristics of the patient population or the difference in radiological examination modality. The point that should be emphasized here is that gastric contents with a high risk for pulmonary aspiration can be detected in a significant proportion of patients undergoing general anesthesia for acute appendicitis. Computed tomography can also be used as an alternative to ultrasonography in the pre-operative period for this purpose.

Our study has several limitations. The first of these is the retrospective design of the study. The second limitation of our study is that we could not collect data on the appetite status of the acute appendicitis and control group because of the retrospective design of the study. Finally, there is no postoperative data on patients operated for acute appendicitis and the potential relationship between gastric fullness and complications has not been directly evaluated.

CONCLUSION

Gastric fullness and contraction of the gallbladder are easy-to-evaluate findings that can be used to obtain indirect information in cases with suspected acute appendicitis. Despite loss of appetite, which is an important symptom of acute appendicitis, up to two-thirds of patients (n=80, 57.6%) had an empty stomach. This can be explained by the fact that they continue to take oral intake, albeit irregularly, since they are not prompted by hunger. Also, it is not appropriate to use anorexia instead of pre-op starvation. CT is the gold standard for the diagnosis of acute appendicitis and can be used to evaluate the risk of pre-op aspiration. In patients with acute appendicitis, despite anorexia, one-fifth of patients have a high risk of aspiration in a possible emergency operation.

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