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RESEARCH

Effectiveness of laboratory tests in predicting pathologies on computed tomography in geriatric patients with abdominal pain

Karın ağrısı olan geriatrik hastalarda bilgisayarlı tomografideki patolojileri öngörmede laboratuvar testlerinin etkinliği

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Abstract

Purpose: Our study aimed to investigate the effectiveness of laboratory tests in predicting clinically significant pathologies (CSPs) on abdominal computed tomography (CT) in geriatric patients with abdominal pain.

Materials and Methods: Our study is a retrospective case-control study. All patients who were admitted to the emergency department due to abdominal pain had an abdominal CT scan and were 65 years of age or older were included in the study. Laboratory test results were obtained from blood tests taken at the time of admission. According to CT results, patients were grouped into two groups: "CSPs (+)" or "CSPs (-)". The relationship between laboratory results and CSPs was analyzed statistically.

Results: Five hundred eighteen patients were included in the study. CSPs (+) were detected on CT in 72.4% of the patients. Alkaline phosphatase (ALP), C-reactive protein (CRP), white blood cells (WBC), platelet, neutrophil, and neutrophil-lymphocyte ratio (NLR) values were statistically significantly higher in CSPs (+) patients. The optimal cut-off values of the tests were WBC>10.75 (x10^3/μL), CRP >150.5 (mg/L), NLR>4.4, ALP >92 (U/L). The area under the receiver operating characteristic curve of all of these tests was below 0.6 and was not sufficiently effective for diagnostic use.

Conclusion: Our study showed that using laboratory parameters alone would not be sufficient to predict CSPs on CT in geriatric patients with abdominal pain.

Keywords:. Geriatric, abdominal pain, emergency service, tomography, laboratory tests

Öz

Amaç: Çalışmamız, karın ağrısı olan geriatrik hastaların abdominal bilgisayarlı tomografisindeki (BT) klinik olarak anlamlı patolojileri (CSPs) öngörmede laboratuvar testlerinin etkinliğini araştırmayı amaçladı.

Gereç ve Yöntem: Çalışmamız retrospektif bir vaka kontrol çalışmasıdır. Karın ağrısı nedeniyle acil servise başvuran, abdominal BT çekilen ve 65 yaş ve üzerinde olan tüm hastalar çalışmaya dahil edildi. Laboratuvar test sonuçları, başvuru sırasında alınan kan tahlillerinden elde edildi. BT sonuçlarına göre hastalar "CSPs (+)" ve "CSPs (-)" olmak üzere iki gruba ayrıldı. Laboratuvar sonuçları ile CSPs arasındaki ilişki istatistiksel olarak analiz edildi.

Bulgular: Çalışmaya 518 hasta dahil edildi. Hastaların %72,4'ünde BT'de CSPs (+) olduğu saptandı. Alkalen fosfataz (ALP), C-reaktif protein (CRP), beyaz kan hücreleri (WBC), trombosit, nötrofil ve nötrofil lenfosit oranı (NLR) değerleri CSPs (+) hastalarda istatistiksel olarak anlamlı derecede yüksekti. Testlerin optimal kesim değerleri WBC>10.75 (x10^3/μL), CRP >150.5 (mg/L), NLR>4.4, ALP >92 (u/L) idi. Tüm testlerin receiver operating characteristic eğrisi altında kalan alanı 0.6'nın altındaydı ve tanısal kullanımda yeterli etkinlikte değildi.

Sonuç: Çalışmamız, karın ağrısı olan geriatrik hastalarda laboratuvar parametresi kullanımının BT'deki CSPs'yi öngörmede tek başına yeterli olmayacağını gösterdi.

Anahtar kelimeler: Geriatrik, karın ağrısı, acil servis, tomografi, laboratuvar testleri.

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INTRODUCTION

The geriatric population is progressively becoming more prevalent among admissions to the emergency department (ED). Recent data from the United States in 2021 revealed that over 27 million (19.4%) individuals aged 65 and older sought admission to EDs, with abdominal pain ranking as the second most frequent cause for admission among this cohort[1]. Notably, approximately 60% of geriatric patients admitted with abdominal pain necessitated hospitalization, 20% underwent invasive procedures, 10% experienced readmission to the ED within a two-week period, and a further 10% resulted in mortality[2,3].

Abdominal pain in geriatric patients can originate from a multitude of conditions like peptic ulcer disease, gastrointestinal bleeding, disorders of the biliary system, pancreatitis, intestinal obstruction, volvulus, diverticulitis, appendicitis, abdominal aortic aneurysm, mesenteric ischemia[4]. Diagnosing such diseases in geriatric patients may be challenging owing to various factors. These include issues in eliciting a comprehensive medical history, manifestation of symptoms that are either delayed or deviate from typical presentations, unreliable physical examination findings, absence of expected physiological responses such as fever and leukocytosis, and the presence of concurrent comorbidities[3].

Computed tomography (CT) stands out as the predominant imaging modality for assessing ED admissions of patients presenting with abdominal pain[5]. Notably, there has been a marked 17.5-fold surge in the utilization of abdominal CT scans among geriatric patients, considering various challenges such as diagnostic complexities, the necessity for highly invasive interventions, and elevated mortality and complication rates[5]. This trend has precipitated adverse outcomes such as increased hospital costs and heightened exposure to radiation and contrast material for patients[6]. Our study aimed to ascertain the predictive potential of laboratory test results in identifying the presence of clinically significant pathologies (CSPs) detectable by CT in geriatric patients admitted with abdominal pain. By doing so, we aimed to enrich existing literature by providing objective decision-making support to physicians regarding the necessity of CT scans in geriatric patients.

MATERIALS AND METHODS

Study design and setting

This retrospective case-control study was conducted in Ankara University Ibni-Sina Hospital, Department of Emergency Medicine. Ankara University Ibni-Sina Hospital serves as a tertiary care facility, with an annual approximate number of 42,000 ED admissions. Patient care within the ED is supervised by emergency medicine specialists faculty members who actively engage in both undergraduate and postgraduate education. Academic activities are meticulously coordinated and executed under the guidance of faculty members. Ankara University upholds stringent standards regarding record-keeping practices and ensures the integrity of data through meticulous management protocols. All patient medical records are securely stored within the hospital's information management system. The study was approved by the Health Research Ethics Board of our institution (number İ5-290-20) and was conducted according to the Declaration of Helsinki.

Participants

Our study enrolled individuals aged 65 years or older, admitted between January 1st, 2017, and December 31st, 2018, with a diagnosis code of abdominal pain as per the International Classification of Diseases-10 (ICD-10) criteria, and who underwent abdominal CT scans. Patients presenting with abdominal pain following penetrating or blunt trauma, those with incomplete CT report data, and instances of duplicated medical records were excluded from the study.

Procedure

Patients' demographic data, laboratory findings, and abdominal CT scans were retrieved from the Hospital Document Management System (Avicenna 2.5.1) and patient records. Abdominal CT imaging was conducted using a 4-detector CT device (Toshiba Asteion 28, 2012, and Toshiba Aquilion Prime, Japan, 2018), with or without contrast, adhering to clinical pre-diagnoses and standardized protocols with appropriate imaging techniques.

Interpretation of abdominal CT results was performed by radiology specialists within the ED. Subsequently, The patient's abdominal CT reports and images, laboratory tests, consultations, and

epicrisis forms were retrospectively evaluated by an emergency medicine specialist.

The study assessed patients based on CSPs observed in CT scan results. Patients were categorized into two groups: 'CSPs Available' and 'CSPs Not Available'. CSPs involved conditions such as intestinal obstruction (ileus, small bowel obstruction, and large bowel obstruction), non-obstructive intestinal pathologies (appendicitis, diverticulitis, diverticulosis, colitis, and perforation), vascular and hemorrhagic pathologies (abdominal aortic aneurysm, dissection or rupture, mesenteric ischemia, portal vein thrombosis, retroperitoneal hematoma, and hemoperitoneum), biliary-pancreatic pathologies (cholecystitis, cholelithiasis, cholangitis, and pancreatitis), genitourinary pathologies (urolithiasis, pyelonephritis, hydronephrosis, cystitis, and gynecological causes), intraabdominal malignancies, intraabdominal abscesses, and other rare etiologies[3,7].

Upon admission, laboratory parameters of patients were obtained through blood tests. White blood cell count (WBC), platelet count, neutrophil count, lymphocyte count, hemoglobin level, and hematocrit rate were assessed from complete blood counts. The neutrophil-lymphocyte ratio (NLR) was calculated by dividing the neutrophil count by the lymphocyte count. Additionally, various biochemical parameters including blood urea nitrogen (BUN), creatinine, sodium, potassium, chloride, calcium, magnesium, albumin, total bilirubin, direct bilirubin, alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), gamma-glutamyl transpeptidase (GGT), lactate dehydrogenase (LDH), C-reactive protein (CRP), amylase, and lipase were measured. Coagulation parameters included prothrombin time (PT), international normalized ratio (INR), and D-dimer values. Laboratory analyses were conducted using Beckman Coulter AU680, SysmexXN3000, Sysmex-XN1000, ACLTOP700, and AQT90 Flex devices. The primary objective of our study was to identify CSPs on abdominal CT scans among geriatric patients presenting to the ED with abdominal pain.

Statistical analysis

Laboratory test results were taken as numerical continuous variables. Chi-square or Fisher's Exact test was used to compare categorical variables between groups. Normally distributed continuous variables were examined with the Student's t-test, and non-normally distributed continuous variables and ordinal variables were analyzed with the Mann-Whitney U test. The cut-off value was determined by evaluating the NLR, WBC, CRP, and ALP performance with receiver operating characteristic (ROC) analysis. Sensitivity, selectivity, positive and negative predictive values, and their 95% confidence intervals (CI) were calculated for the cut-off point to be obtained as a result of the analysis. The difference between ROC curves was examined with the method proposed by Hanley and McNeil. Logistic regression analysis was performed for NLR, WBC, CRP, and ALP. $P<0.05$ was considered significant.

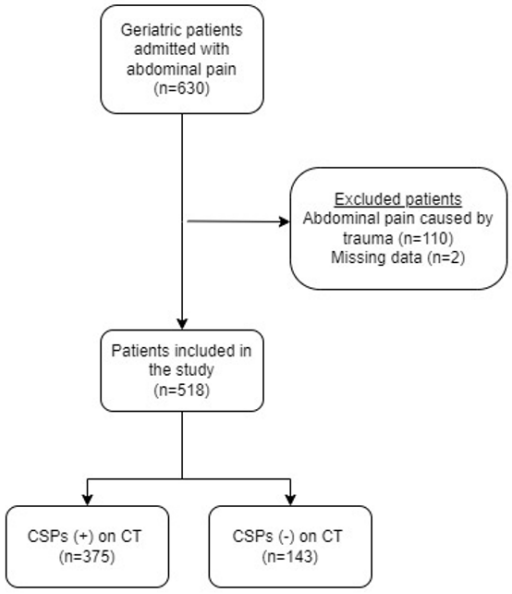

Figure 1. Flow chart.

RESULTS

A total of 630 patients met the study inclusion criteria. Among them, 110 of these were excluded from the study due to abdominal pain resulting from trauma, and two due to insufficient data. Finally, the study group comprised 518 patients (Figure 1).

Among the 518 patients included, 51% were female (n = 264) and 49% were male (n = 254) with a mean age of 75.95 ±7.76 years. Laboratory findings of the patients are detailed in Table 1.

Upon analysis of CT scans, CSPs were identified in 72.4% (n = 375) of patients, while 27.6% (n = 143) did not show CSPs. Among those with CSPs, predominant causes included intestinal obstruction

(18.3%, n = 95), biliary and pancreatic pathologies (13.1%, n = 68), and genitourinary pathologies (11.4%, n = 59) (Table 2). A significant correlation was observed between CSPs and patient age. Furthermore, significant differences in ALP, CRP, WBC, platelet count, neutrophil count, and NLR were noted between patients with and without CSPs ($p < 0.05$). However, ALP and platelet values were not clinically significant because the values were within the normal laboratory reference range in both groups. No statistically significant results were detected among other biochemical values (Table 1).

Table 1. Demographic and clinical characteristics of study patients.

Characteristics	CSPs (+) on CT	CSPs (-) on CT	p-value
Age, year	73 (65-99)	77 (65-94)	0.01
Gender			
Male	191 (50.9%)	63 (44.1%)	0.22
Female	184 (49.1%)	80 (55.9%)	
Laboratory results			
BUN (mg/dL)	23 (3-200)	25 (1-152)	0.13
Creatinine (mg/dL)	1.02 (0.24-9.45)	1.03 (0.19-7.20)	0.73
Sodium (mmol/L)	137 (114-154)	138 (113-157)	0.14
Potassium (mmol/L)	4.2 (2.0-8.8)	4.1 (2.1-7.2)	0.77
Chlorine (mmol/L)	103 (79-126)	104(80-129)	0.14
Calcium (mg/dL)	8.7 (5.7-13.6)	8.8 (4.5-10.4)	0.86
Magnesium (mg/dL)	1.9 (0.7-3.7)	1.9 (1-3.7)	0.17
Albumin (g/L)	3.4 ± 0.7	3.4 ± 0.7	0.72
Direct bilirubin (mg/dL)	0.22 (0.05-10.69)	0.22 (0.05-5.9)	0.62
Total bilirubin (mg/dL)	0.75 (0.1-14.9)	0.71 (0.15-8.29)	0.52
AST (U/L)	25 (7-1215)	26 (2-968)	0.42
ALT (U/L)	17 (3-835)	18(3-1353)	0.83
ALP (U/L)	94 (25-1355)	83 (29-1159)	<0.01
GGT (U/L)	36 (7-1691)	30 (7-735)	0.09
LDH (U/L)	255 (97-4800)	254 (125-1719)	0.52
Amylase (U/L)	58 (7-5799)	60 (12-1285)	0.64
Lipase (U/L)	24 (1-7998)	26 (3-5262)	0.87
CRP (mg/L)	84.2 (0.1-538.5)	52.6 (0.5-330)	0.01
Procalcitonin	0.74 (0.1-100)	0.7 (0.12-100)	0.77
WBC (x10^3/μL)	11.08 (0.27-64.26)	9.46 (0.48-42.48)	<0.01
Platelet count (x10^3/μL)	253 (4-967)	222 (6-598)	<0.01
Hemoglobin (g/dL)	11.6 ±2.4	11.4 ±2.4	0.58
Hematocrit (%)	35.8 (15.1-55.7)	35.7 (14.6-55.1)	0.63
Neutrophil count (x10^3/μL)	8.55 (0.02-49.21)	7.03 (0.04-27.7)	<0.01
Lymphocyte count (x10^3/μL)	1.14 (0.12-41.41)	1.32 (0.05-27.9)	0.29
PT (sec)	13.2 (9.3-117.5)	12.8 (9.5-226.6)	0.32
INR	1.14 (0.8-15.5)	1.1 (0.8-17.4)	0.48
D-dimer (ng/mL)	0.86 (0.04-11.9)	0.68 (0.02-9.9)	0.07
NLR	7.11 (0.04-132.1)	5.47 (0.05-70.8)	0.01

CSPs: Clinically significant pathologies, CT: Computed tomography, BUN: Blood urea nitrogen, AST: Aspartate transaminase, ALT: Alanine transaminase, ALP: Alkaline phosphatase, GGT: Gamma-glutamyl transpeptidase, LDH: Lactate dehydrogenase, CRP: C-reactive protein, WBC: White blood cells, NLR: Neutrophil-lymphocyte ratio, INR: International normalized ratio, PT: Prothrombin time, sec: seconds. Values are presented as the mean ± SD, median (IQR), or n (%).

Following the ROC analysis comparing CSPs with significant laboratory parameters, the area under the curve (AUC) was determined as 0.57 (95% CI, 0.51-0.62) for ALP, 0.56 (95% CI, 0.51-0.61) for CRP, 0.59 (95% CI, 0.54-0.64) for WBC, 0.59 (95% CI, 0.54-0.64) for platelet count, 0.59 (95% CI, 0.54-0.64) for neutrophil count, and 0.56 (95% CI, 0.51-0.62) for NLR (Figure 2). The optimal cut-off value for NLR to diagnose CSPs was determined as 4.4, with a sensitivity of 71.7% and specificity of 42.7%. For

ALP, the optimal cut-off value was 92 (U/L), with sensitivity and specificity of 51.73% and 70.63%, respectively. Similarly, the optimal cut-off values for WBC was 10.75 (x10^3/μL) with sensitivity and specificity of 52% and 70.63%, respectively. The optimal cut-off value for CRP was 150.5 (mg/L), with a sensitivity of 33.1%, and specificity of 84.6%. Due to insufficient sample size, the cut-off points for platelet and neutrophil values could not be calculated (Table 3). A logistic regression model assessed the impact of laboratory tests on CSPs diagnosis. The model demonstrated statistical significance, with an explanatory power of 10.1%. A one-unit increase in WBC was associated with a 2.1 times higher likelihood of CSPs on CT (odds ratio (OR): 2.1; 95% (CI): 1.3-3.2), while a one-unit increase in CRP was associated with a 2 times higher likelihood (OR: 2.07; 95% CI: 1.2-3.5) (Table 4).

Table 2. CSPs on abdominal CT

CT diagnoses	**n (%)**
Intestinal obstruction	95 (18.3%)
Biliary and pancreatic pathologies	68 (13.1%)
Genitourinary pathologies	59 (11.4%)
Non-obstruction intestinal pathologies	44 (8.5%)
Intraabdominal malignancy	30 (5.8%)
Intraabdominal abscess	24 (4.6%)
Vascular and hemorrhagic pathologies	22 (4.2%)
Other pathologies	33 (6.4%)

CSPs: Clinically significant pathologies, CT: Computed tomography

Table 3. Sensitivity, specificity, PPV, and NPV for predicting CSPs on abdominal CT

	Sensitivity	**Specificity**	**PPV**	**NPV**	**AUC**	**95% CI**
WBC>10.75 (x10^3/μL)	52%	70.6%	82.3%	35.9%	0.59	0.54-0.64
CRP>150.5 (mg/L)	33.1%	84.6%	84.9%	32.5%	0.56	0.51-0.61
ALP>92 (U/L)	517%	62.2%	78.2%	33%	0.57	0.51-0.62
NLR>4.4	71.7%	42.7%	76.6%	36.5%	0.56	0.51-0.62

PPV: Positive predictive value, NPV: Negative predictive value, CSPs: Clinically significant pathologies, CT: Computed tomography AUC: Area under the curve, CI: Confidence intervals, WBC: White blood cells, CRP: C-reactive protein ALP: Alkaline phosphatase, NLR: Neutrophil-lymphocyte ratio

Table 4. Logistic regression analysis for predicting CSPs on abdominal CT

Variable	Odds ratio	95 % CI	p-value
CRP>150.5 (mg/L)	2.07	1.22-3.50	0.01
WBC>10.75 (x10^3/μL)	2.10	1.35-3.27	0.01
ALP>92 (U/L)	1.43	0.95-2.17	0.08
NLR>4.4	1.27	0.82-1.96	0.27

CSPs: Clinically significant pathologies, CT: Computed tomography, CI: Confidence intervals, WBC: White blood cells, CRP: C-reactive protein ALP: Alkaline phosphatase, NLR: Neutrophil- lymphocyte ratio

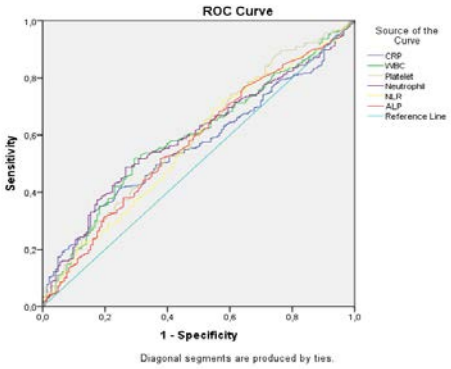

Figure 2. ROC curves of neutrophil-lymphocyte ratio (NLR), white blood cells (WBC), C-reactive protein (CRP), alkaline phosphatase (ALP), platelet, and neutrophil in the diagnosis of CSPs on abdominal CT.

DISCUSSION

Our study revealed statistically significant elevations in ALP and CRP levels, as well as increased WBC count, platelet count, neutrophil count, and NLR values among patients with CSPs detected on abdominal CT scans. Nonetheless, the AUC values for all these parameters remained below 0.6, indicating their poor predictive performance for detecting CSPs.

Existing literature has predominantly focused on exploring the association between specific diagnoses like appendicitis and cholecystitis with laboratory parameters. Our study aims to enhance clinical utility by adopting a holistic approach to geriatric patient care, encompassing the evaluation of all abdominal pathologies. This comprehensive perspective offers clinicians greater convenience in diagnosis and management strategies.

Our study findings indicate that relying solely on laboratory parameters is inadequate for predicting CT-detected CSPs in geriatric patients admitted with abdominal pain. Therefore, clinicians should refrain from solely basing assessments of abdominal pathology on laboratory results, as such an approach may lead to inaccurate conclusions.

Abdominal pain ranks among the primary causes for admission of geriatric patients to the ED. Previous studies have revealed the presence of CSPs on CT scans in 55-88% of geriatric patients admitted to the ED[8]. Our study concurs with this literature, as we observed CSPs on CT scans in 72.4% of cases.

Common etiologies of abdominal pain in geriatric patients comprise small bowel obstruction, diverticulitis, vascular emergencies, urinary tract infections, and biliary tract diseases[2,8]. Our study corroborates these findings, identifying them as the predominant sources of abdominal pain among our cohort.

Age constitutes a significant determinant in the triage process of patients' admission with abdominal pain in the ED. Advanced age correlates with various adverse outcomes among geriatric patients[3]. Lewis et al. reported elevated hospitalization and mortality rates among patients aged 75 years and older compared to other age cohorts[2]. Platon et al. found no significant difference between CSPs and age. However, they included all patients >16 years of age in their study, not just the geriatric age group[9]. Conversely, our study detected a noteworthy age difference between patients with and without CSPs on CT scans, with the mean age of CSP-positive patients being lower. Differences between our findings and existing literature might stem from the limited sample size of our study.

Recent research indicates a correlation between elevated WBC counts in patients with abdominal pain and the presence of CSPs on CT scans. Platon et al. linked CSPs exclusively with elevated WBC counts and relative lymphopenia, reporting a sensitivity of 53.5% and specificity of 73.7% for increased WBC in predicting CSPs on CT[9]. Similarly, Gans et al. observed significantly higher WBC and CRP levels in the CSPs group among 2961 patients, with increased WBC demonstrating a sensitivity of 73.9% and specificity of 57.5%[10]. Contrarily, our study identified a weak predictivity of increased WBC for CSPs. We argue that relying solely on increased WBC may prove insufficience in diagnosing CSPs, given its association with various factors such as comorbidities and physiological stress.

CRP levels are subject to variation based on factors such as race, gender, age, and socioeconomic status[11]. Additionally, it is established that any infection or inflammation within the body results in elevated CRP levels[12]. In our study, we noted that the CRP concentration among patients without CSPs exceeded the normal reference level (52.6 mg/L). However, the absence of comprehensive knowledge regarding the comorbidities of the patients included

in our study hinders the establishment of an accurate relationship between CRP levels and CSPs.

Research indicates varying sensitivity and specificity rates for CRP, WBC, and NLR markers in diagnosing CSPs[13]. Atema et al. conducted a review of 580 cases of appendicitis, concluding that neither WBC nor CRP levels alone could reliably confirm acute appendicitis suspicion in patients with abdominal pain[14]. Through meta-analysis, Gans et al. demonstrated that a CRP cutoff >10 mg/L yielded a 36.9% false positive rate and a 23.1% missed urgent diagnosis rate in diagnosing CSPs among patients with abdominal pain[10]. In our study, CRP levels were significantly elevated in CSP cases. However, it was determined that CRP levels alone were not sufficiently reliable for diagnosing CSPs.

Platelets play an important role in the inflammatory process and can serve as valuable markers in diagnosing and prognosticating non-traumatic abdominal pain conditions like acute appendicitis, acute cholecystitis, and acute mesenteric ischemia[15]. Perez-Soto et al. identified a significant correlation between elevated platelet count and complicated appendicitis in appendicitis patients[16]. However, Shen et al. in their meta-analysis comprising 2.321 cases, did not find any association between platelet levels and appendicitis[17]. Furthermore, research indicates that elevated mean platelet volume (MPV) and decreased platelet distribution width support the diagnosis of acute mesenteric ischemia and appendicitis[15]. Our study, however, concluded that platelet levels lack clinical significance in predicting CSPs. Patients with CSPs had platelet levels within normal laboratory reference ranges, rendering platelet value ineffective as a diagnostic tool. Additionally, given the unknown status of factors such as sepsis, hematological disorders, and oncological conditions that could influence platelet levels, establishing a precise relationship between platelet levels and CSPs was not feasible in our study.

Serum amylase and lipase assays are standard procedures in the assessment of patients presenting with abdominal pain. Elevated serum amylase and lipase levels can indicate pancreatic conditions such as acute pancreatitis, chronic pancreatitis, pancreatic duct stone, pancreatic trauma, as well as gastrointestinal system disorders including cholecystitis, mechanical intestinal obstruction, and peptic ulcer[18]. Diagnosis of acute pancreatitis often relies on detecting serum amylase and lipase levels elevated beyond three times the upper limit of normal[19]. Rompianesi et al. demonstrated that lipase showed higher sensitivity and specificity compared to amylase in diagnosing acute pancreatitis[20]. Our findings did not identify a significant correlation between amylase, lipase levels, and CSPs. This could be attributed to the inclusion of diverse abdominal pathologies beyond pancreatitis in our study cohort.

AST, ALT, ALP, and GGT are commonly utilized markers for diagnosing liver and biliary tract disorders. According to Padda et al., elevated AST, ALT, ALP, and GGT levels had moderate sensitivity and high specificity in identifying acute calculous cholecystitis or choledocholithiasis[21]. Controversially, Beliaev et al., in a study involving 177 patients, found no significant association between AST, ALT, ALP, and GGT levels and acute cholecystitis[22]. Similar to Baliev et al.'s study, our results failed to establish a clinically significant correlation between CSPs and AST, ALT, ALP, and GGT, due to the limited size of our sample cohort. Furthermore, the low incidence of patients with biliary and pancreatic disorders in our study (13.1%) may have contributed to these outcomes. Logistic regression analysis confirmed the ineffectiveness of these parameters in diagnosing CSPs.

Literature includes studies examining the utility of PCT in diagnosing and prognosticating abdominal pathologies. Yaow et al. highlighted PCT's potential role in assessing the severity of acute cholecystitis and predicting complications; however, they underslined the necessity for further evidence to its use as a guideline[23]. Meyer et al. reported that elevated PCT levels do not aid in predicting surgical complications such as mesenteric ischemia, bleeding, perforation, or ileus[24]. Similarly, our study did not identify a significant relationship between PCT levels and CSPs.

NLR serves as a biomarker for predicting systemic inflammation, sepsis, and bacteremia[25]. Elevated NLR levels have been linked to conditions such as pancreatitis, appendicitis, and peptic ulcer perforation[26]. Beliaev et al. determined the optimal cut-off value for NLR in diagnosing acute cholecystitis as 4.1, with a sensitivity of 81% and specificity of 98%[22]. Jung et al. demonstrated that NLR had a higher specificity and sensitivity compared to other diagnostic parameters in cases of perforated appendicitis[27]. Likewise, Destek et al. reported a sensitivity of 69.2% and a specificity of 85.7% for NLR in diagnosing mesenteric ischemia[28]. In our study, we observed a significant correlation

between CSPs and NLR, consistent with existing literature, with a determined cut-off point for NLR of 4.4. However, logistic regression analysis revealed that NLR levels alone could not reliably diagnose CSPs.

D-dimer stands is widely used fibrinolytic marker in diagnosing lower extremity deep vein thrombosis and pulmonary artery embolism. Cudnik et al. showed that elevated D-dimer levels had a sensitivity of 96% and a specificity of 40% in diagnosing mesenteric ischemia[29]. Similarly, Destek et al. reported a sensitivity of 83.3% and specificity of 85.7% for D-dimer in diagnosing mesenteric ischemia[28]. Beyond mesenteric ischemia, the diagnostic utility of D-dimer has been explored for various other conditions. Kumar et al. identified a sensitivity of 72.7% and specificity of 70% for D-dimer in diagnosing appendicitis[30]. Furthermore, D-dimer levels were significantly higher in the strangulated intestinal obstruction group compared to the simple intestinal obstruction group[31]. However, our study did not establish a significant correlation between CSPs and D-dimer, primarily due to the limited number of patients with vascular pathology.

Our study is subject to several limitations. Firstly, it is retrospective and conducted at a single center. Additionally, diseases with diverse pathogenesis and laboratory profiles were collectively assessed without conducting subgroup analyses. Another significant limitation pertains to the lack of information regarding comorbidities that could influence patients' laboratory values. Lastly, the sample size is relatively small, further constraining the study's generalizability and statistical power.

Our study concluded that relying solely on laboratory parameters lacked adequate diagnostic efficacy in predicting CSPs on CT scans among geriatric patients presenting with abdominal pain. Future research endeavors should consider larger, multicenter, and prospective studies integrating anamnesis and physical examination findings in conjunction with laboratory test results. Employing such comprehensive approaches may yield more accurate predictions of CSPs in geriatric patients with abdominal pain.

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