



Significance of Tomography and CRP in Abdominal Pain Management

Karın Ağrısının Yönetiminde Tomografi ve CRP'nin Önemi

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ABSTRACT

Purpose: We evaluated whether abdominal tomography is necessary for patients who have been admitted to the emergency service because of non traumatic abdominal pain and effect of C-Reactive Protein (CRP) and tomography to the patient management.

Materials and Method: On retrospective study, we recorded demographic data, tomography diagnoses, CRP and leucocyte values operation and following decisions of 199 patient who were 18 years old and over and were admitted to emergency service because of abdominal pain and were scanned abdominal tomography. 104 patient were hospitalized and their CRP values, tomography diagnoses, end of operation diagnoses were recorded from patient files. The statistical analysis was performed using the Chi-square test and the diagnostic value was assessed through the logistic regression test.

Results: A statistically significant relationship was observed between anormal tomography findings and high CRP and leucocyte values of the 199 patients included in the study. The tomography findings and CRP values were found to be efficient in discharge and hospitalization rates. When tomography finding and CRP value were combined, the operation decision was effected.

Conclusion: Based on our study; in the event of abdominal pain, CRP can predict abnormal tomography finding and it is more valuable than leucocyte. When tomography was used with CRP, it affects the operation decision.

Key words: CRP, Abdominal tomography, Abdominal Pain, Leucocyte

ÖZET

Amaç: Çalışmamızda, acil servise travma dışı karın ağrısı başvurularında abdominal tomografinin gerekliliğini değerlendirdik. Bu sayede, C-Reaktif Protein (CRP) ve tomografi bulgularının hastanın yönetimine etkisini ölçmeyi amaçladık.

Materyal ve Metod: Geriye dönük yapılan çalışmada acil servise karın ağrısı ile başvurup abdominal tomografi çekilen 18 yaş ve üzeri 199 hastanın demografik özellikleri, tomografi bulguları, CRP ve lökosit değerleri, yatış veya taburculuk kararları ile hastaneye yatışı yapılan 104 hastanın CRP değerleri, tomografi tanıları, operasyon sonu tanıları hasta dosyalarından kaydedildi. İstatistiksel analizde ki-kare, tanısıl değerliliğin ölçülmesinde ise lojistik regresyon testi kullanıldı.

Bulgular: Çalışmaya alınan 199 hastanın anormal tomografi bulgusu ile CRP ve lökosit yüksekliği arasında anlamlı ilişki bulundu. Tomografi ve CRP'nin taburculuk ve yatış oranını etkilediği görüldü. Tomografi bulgusu ve CRP birlikte kullanıldığında, operasyon kararını etkilediği bulundu.

Sonuç: Çalışmamıza göre; karın ağrısında CRP yüksekliği, anormal tomografi bulgusunu ön görebilir ve lökositten daha değerlidir. Tomografi ve CRP birlikte kullanıldığında operasyon kararı etkilenmektedir.

Anahtar kelimeler: CRP, Abdominal Tomografi, Lökosit, Karın ağrısı

INTRODUCTION

The diagnosis of acute abdominal pain is an important process which involves the patient history, physical examination, routine laboratory tests and imaging methods and may prove to be complicated. Studies have shown that the use and diagnostic accuracy of computed tomography (CT) have increased in the diagnosis of acute abdomen¹. CT has become the gold standard in the diagnosis of acute abdomen². However, CT is also an important source of medical exposure to ionizing radiation and the dose and side effects of the radiation increases parallel to the advancing imaging technology³.

The C-Reactive Protein (CRP) and leukocyte count tests are used to eliminate possible differential diagnoses in acute abdominal pain. CRP is an acute phase reactant. In case of inflammation it starts to increase within the first ilk 6-8 hours and starts to fall as the inflammation subsides. It has a half-life of 4-9 hours⁴. The leukocyte count increases in case of acute or chronic inflammation as well as acute physical or emotional stress⁵. These tests may serve as guides for advanced imaging techniques.

The purpose of our study is to evaluate the necessity of abdominal tomography in the light of the CRP and leukocyte tests of patients who present to the emergency room with non-traumatic abdominal pain. Thus, we aim to observe the role of the CRP, leukocyte count and tomography findings in the management of the patient (including admittance to and discharge from the hospital and the decision for surgery).

MATERIAL and METHODS

The study had a retrospective design. Adult patients aged 18 and above who presented with abdominal pain to the emergency department

which has an annual patient turnover of 200.000, between March 1, 2013 and August 31, 2013 and had undergone abdominal tomographies were enrolled in the study. From the hospital data processing system, 1200 patients who had presented to the emergency department and were referred for a CT based on a prediagnosis of abdominal pain codem as R10 according to the International Code of Disease-10 (ICD-10) were retrieved. CT was interpreted by radiologists. 1001 patients with known oncologic diseases, cirrhosis, history of trauma, chronic renal failure requiring dialysis, those who have left the emergency service without permission, and patients whose tomographic or discharge diagnoses involved gynaecological or urological pathologies were excluded from the study.

The 199 patients were included in our study. The demographic characteristics, CRP and leukocyte values, abdominal tomography results, and the final assessment in the emergency service (admission or discharge) of the 199 patients included in the study were recorded from the patient files. Patients were divided into two categories based on their ages. The first group were between 18 and 60 years of age and the second group were aged 60 years and above. A CRP value over 5mg/dl and a leukocyte value over 10000/uL were accepted as abnormal. patients from among the 199 patients were admitted to the hospital. The CRP values, tomographic diagnoses, the decisions for surgery and follow up, and the postoperative diagnoses of the 104 patients were recorded from the patients file. The statistical analysis of the data was carried out using the "SPSS for Windows version 16.0" (SPSS Inc. Chicago, IL, ABD) software. The analysis was performed with the help of the Chi-square test and the diagnostic value was assessed through the logistic regression test. ROC analysis was

performed using the logistic regression test, which pointed out the AUC (Area under the Curve) for CRP and leukocytes.

Based on the hospital records, 199 patients who had presented to the emergency department with abdominal pain and had undergone abdominal tomographies were included in the study. Among the patients, 101 (44.7%) were male while 98 (43.4%) were female. In terms of age, 127 (63.8%) were between 18-60 years of age and 72 patients were aged 60 years and above (36.2%). The youngest patient was 18 and the oldest one was 90 years old and the mean age was 52.3 ± 20.6 years.

Among the 199 patients included in the study, 114 (57.3%) had normal leukocyte values, while 8 (4%) had low, and 77 (38.7%) had high values (Normal leukocyte value= 4-10 103/uL). The CRP value was below 1 mg/dl in 115 patients (57.8%), between 1-5 mg/dl in 47 patients (23.6%), and 5 mg/dl or above in 37 patients (18.6%) (Normal CRP value= 0-0.5 mg/dl). The tomographies were normal in 127 patients (63.8%), while 72 patients (36.2%) had abnormal tomography results. The abnormal tomography results are presented in Table 1. The statistical comparison of the leukocyte and CRP levels with the tomography

results in 199 patients pointed to a statistically significant relationship between the abnormal tomography results and the high CRP ($p=0.00$) and leukocyte values ($p=0.004$). High leukocyte and CRP values, and abnormal CT results were observed to individually influence the decision for discharge and the ratio of the admitted patients ($p=0.00$). The age of the patient did not have any influence on the leukocyte and CRP tests, and the tomography results ($p>0.05$).

Among the 199 patients, 95 (47.7%) were discharged, while 104 (52.3%) were admitted. From the 104 patients who were admitted to the hospital, 61 (59%) were followed up at the clinic and 43 (41%) were operated. The postoperative diagnoses of the patients who have undergone surgery are presented in Table 2. Among these 104 patients, 63 (61%) had normal CT results while 41(39%) had abnormal CT images. The CRP level was below 1 mg/dl in 43 patients (41%), between 1- 5 mg/dl in 28 (27%), and over 5 mg/dl in 33 patients (32%). It has been statistically demonstrated that the CT results and the CRP values did not individually influence the decision for surgery ($p>0.05$). However, the CRP and tomography results in combination were observed to influence the decision for surgery ($p=0.017$).

Table 1. Tomography Findings.

Tomography findings	No(%)
Normal	128(63)
Cholecystitis, cholangitis, pancreatitis	22(11)
Intestinal obstruction	21(10)
Abdominal mass	7(3.5)
Ascites	6(3)
Appendicitis	3(1.5)
Intestinal edema	3(1.5)
Perforation	2(1)
Vascular(Aortic dissection, mesenteric thrombosis)	2(1)
Inguinal hernia	1(0.5)
Diverticulitis	2(1)
Volvulus	1(0.5)
Crohn	1(0.5)
Total	199(100)

Table 2: Postoperative diagnoses of the patients

Diagnosis after operation	Patient Number(%)
Appendicitis	17(39.5)
Cholecystitis,pancreatitis	7((16.2)
Perforation	6(13.9)
Abdominal mass	4(9.3)
Ileus	3(6.9)
Ovarian cyst rupture	2(4.6)
Pyloric stenosis	2(4.6)
Intraabdominal Abscess	1(2.3)
Volvulus	1(2.3)
TOTAL	43 (100)

DISCUSSION

In recent years, CT has become a more prominent method in the diagnosis and differential diagnosis of abdominal pain⁶⁻⁸. Although it is a rapid, reliable and non-invasive method, it causes radiation exposure and brings a financial burden⁹. Although studies have demonstrated that the diagnostic accuracy of CT is high, it is still unclear if the method changes the clinical management of the patient⁹. In a retrospective study, it was observed that the use of CT in the emergency department has increased six times in 35 years, although the ratio of missed diagnoses of appendicitis among surgical diagnoses remained unchanged¹⁰. In another study, no change was observed between the use of CT and the ratio of negative appendectomies and perforations¹¹. However, various studies have demonstrated that the use of CT in abdominal pain influences the

diagnosis and the management of the patient (admission, discharge or surgery). In a prospective study, the use of CT in case of abdominal pain has changed the management of the patient by 42% and admissions to the hospital were reduced by 17.5%¹². Another study has shown that the use of CT changed the management of 60% of the patients who presented with abdominal pain¹³. In a study conducted on patients aged 60 or above, although the CT had changed the diagnosis, it had no influence on the management of the patient (discharge/admission)¹⁴. In the same study, CT was also used in the differential diagnosis for surgery of inpatients. In the study by Rosen et al., CT was shown to modify the diagnosis and patient management by 50%⁷. The study by NG et al. has shown that CT does not change the diagnostic accuracy in the patients admitted to the surgical clinic, although the mortality and the duration of the hospital stay were reduced⁸. It should be borne in

mind that not all incidences of acute abdominal pain are surgical cases. Our study has demonstrated that the CT results influence the decision for admission or discharge. However, when the patients admitted to the hospital were investigated, it was observed that the abnormal tomography results did not play any role in the decision for surgery. On the other hand, CT in combination with the CRP results was found to statistically significantly influence the decision for surgery.

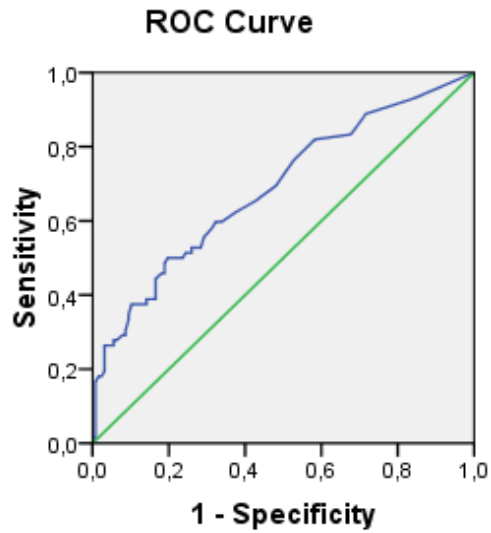
Studies are still unclear about the necessity of CT in case of acute abdominal pain. The criteria for the selection of the patients to be scanned using CT are yet to be described. Currently, there is no classification such as the Canadian C-spine rule or the Ottawa ankle rules to be used for CT in acute cases of abdominal pain⁹.

The diagnosis of abdominal pain usually involves laboratory tests and imaging methods besides the patient history and physical examination. CRP is among the tests used for this purpose. If the correlation of CRP and CT in acute abdomen is clearly defined, the accuracy of the diagnosis and the patient management may be modified. In a study, the predictive value of negative CRP results in predicting the CT results was found to be low, whereas values over 27 mg/l were observed to have a 91% specificity. According to the study, while normal CRP values did not give an idea about the necessity of CT, high CRP values were found to be an indicator for CT scan¹⁵. The same study also led to similar results for the leukocyte values (specificity: 71%). In another study, a significant relationship was observed between normal granulocyte percentages and negative CT results in patients between the ages of 21 and 35². In the study by Chi CH. et al., the CRP and leukocyte values of the patients who presented to the emergency department with abdominal pain and were admitted to the hospital were tested and the specificity of CRP was found to be 64% for serious cases, while its sensitivity was 79%. In addition, it

was also observed that CRP is a superior test than leukocytes and that the specificity was greater in case of the combination of increased CRP and leukocyte, while the sensitivity remained the same¹⁶. In our study, we have evaluated the predictive value of high leukocyte and CRP values in the management of the patient and in terms of abnormal CT results. A significant relationship was observed between high CRP and leukocyte values and abnormal CT results. The specificity of CRP values over 5 mg/dl for abnormal tomography results was found as 90%, while the sensitivity was 35% (+ LR 3.5). Leukocyte values over 10000/uL had a 52% sensitivity and 70% (+ LR 1.7) specificity for abnormal CT results. In order to compare the efficacy of diagnostic tests, an ROC analysis was performed using the logistic regression test, which pointed out the AUC (Area under the Curve) for CRP as 0.69 and the AUC for leukocytes as 0.59 (Figure 1,2). According to the results of our study, high CRP values can predict abnormal CT results and their predictive value is higher than the leukocyte count. We have observed that higher CRP values influence the decisions of hospitalization and discharge, although they do not have an individual influence on the decision for surgery. The observation that positive surgical diagnoses are possible in spite of normal CRP values is an interesting outcome of our study. This may be explained with the long duration until CRP rises to levels above normal and may thus be still within normal limits at the time of presentation. In this case, it may not be very practical to determine cut-off values for the CRP.

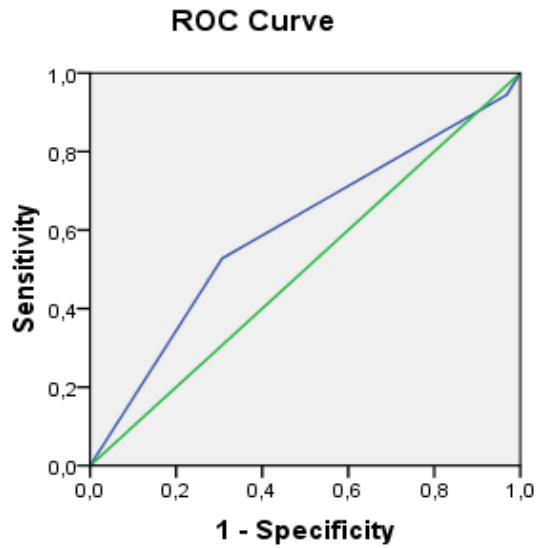
In the study by Lawrence M. et al., the age and gender were not found as factors related to the request of CT; however, that study was conducted on patients aged 60 or above¹⁴. In another study, no significant relationship was observed between the age and the decision for the admittance or discharge of the patients who presented with acute abdominal pain¹⁶. Also in our study, the age was not found to influence the

management of the patient or to predict an abnormal tomography in patients ages 18 and above.



Diagonal segments are produced by ties.

Figure 1. ROC analyze for CRP and Tomography; AUC:0,69



Diagonal segments are produced by ties.

Figure 2. ROC analyze for Leucocyte and Tomography AUC:0,59

The retrospective design is the greatest limitation of our study, since we have not been able to reach any data on the physical examination findings of the patients. Any chronic diseases, alcohol abuse or drugs, which may increase the CRP and leukocyte values, were not indicated in the patient files.

CONCLUSION

In our study we found that abdominal tomography influence the decision for admission or discharge. CRP can predict abnormal tomography finding and it is more valuable than leukocyte. in the event of abdominal pain. When tomography was used with CRP, it affects the operation decision.

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