

Use of abdominal Computed Tomography (CT) by the emergency physicians in patients presenting with acute abdomen; A Retrospective Observational study in a large tertiary center

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Abstract

Background: Acute abdomen is defined as a sudden onset abdominal pain that requires an urgent intervention. It is a very common presentation within an emergency department (ED). Computed tomography (CT) is a commonly used imaging modality in conjunction with clinical assessment to formulate diagnosis of an acute abdomen. The use of CT helps avoid admissions admissions for non-specific abdominal pain presentations.

Aims of the study: To compare the ED clinical working diagnosis with the CT diagnosis (CT report by a consultant radiologist) for patients with acute abdominal pain subjected to CT abdomen. We also wanted to know the final surgical diagnosis on the patients needing surgical operative intervention.

Methods: We retrospectively gathered the 6 months electronic medical records of the patients presenting to ED with acute abdomen, who had a diagnostic CT scan requested from ED. The data was obtained from their electronic records provided by Health care information technology affairs (HITA) using a designed questionnaire. The data was analyzed with counting numbers and calculating the percentages.

Results: 9124 patient case notes were retrieved through HITA, who presented with acute abdominal pain and satisfied the inclusion criteria. 124 (1.3%) patients had a CT requested by the ED. Ninety seven patients (78%) who underwent CT scan had a reported finding. The CT findings of seventy-one (57%) patients matched the clinical diagnosis of ED. 19 (15%) patients had an emergency surgical operative intervention.

Conclusion: CT investigation for acute abdomen is appropriately deployed by the ED physicians and a significant number of patients' CT findings matched the ED clinical diagnosis.

Introduction

Acute abdomen is a common presentation seen in ED, accounting for approximately five per cent of the cases [1]. It is defined as a sudden onset of abdominal pain that requires an urgent medical or surgical intervention [2]. ED evaluation for acute abdomen can be difficult and should be assessed accurately to prevent mortality [3,4]. With the advancement in imaging techniques, ED physicians are more equipped to diagnose and manage acute abdominal emergencies [3,5].

The causes of acute abdomen can vary according to demography. It tends to be more challenging in elderly with higher mortality rate, thus requiring an urgent admission and management [3]. The most common cause of acute abdomen leading to admission is appendicitis followed by diverticulitis [6]. The prevalence of acute cholecystitis, acute diverticulitis and abdominal aortic aneurysm (AAA) rupture is increasing [7].

Diagnosis of acute abdomen includes clinical evaluation, blood tests and imaging. Whereas clinical evaluation alone is sensitive, it is less specific in diagnosing acute abdomen in comparison to imaging. Ultrasound (US) and computed tomography (CT) are the most

common imaging studies used for evaluating acute abdomen in ED. CT is more sensitive (89%) in detecting acute abdomen cases compared to ultrasound (70%) [8].

CT is recommended for all patient with acute abdomen except in pregnant women, acute cholecystitis, or AAA, where US is preferred. The use of contrast enhancement with CT is indicated to detect ischemic and vascular lesions causing acute abdomen with careful consideration in patient with history of allergies, renal impairment, or taking biguanides [3].

With the increased use of CT and other imaging modalities for the diagnosis of acute abdomen in the past years, admission with a definite diagnosis instead of a nonspecific cause has increased [9]. A prospective observational study showed that 37.6% of the patients presenting to the

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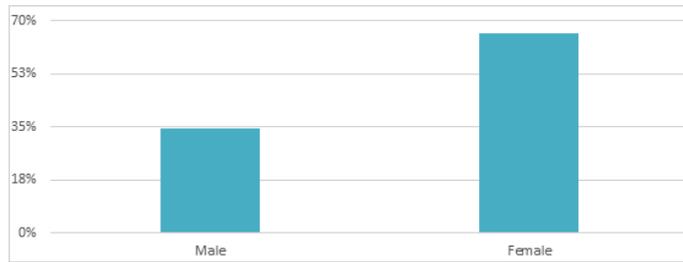


Figure 1. The Ratio of patients with/without previous abdominal surgery

Table 1. Summary of patients' characteristics

Characteristics	Number (percent)
Male	40 (32.26%)
Female	84 (67.74%)

Table 2. The Ratio of patients with/without previous abdominal surgery

	Frequency	Percentage
Had previous abdominal surgery	59	48%
No previous abdominal surgery	65	52%

ED with acute abdomen needed hospital admission and 36.2% of those were admitted to the surgical ward [10].

Our study is intended to find out the use of CT abdomen by physicians for patients, who present with abdominal pain in the ED and to compare the CT findings with the working diagnosis, made by the physician prior to requesting CT.

Methods

A data request was sent to the HITA for retrieving the case records of all patients, who presented with acute abdominal pain to the ED over a 6 months retrospective period. From the 9124 patient records received, only 124 patients satisfied the inclusion criteria for our study. The clinical details of all these patients were recorded on the excel sheet including demographics, onset of pain duration, orders for imaging modalities, surgical consultation (prior or after CT), verified CT report findings, time when the verified radiology report (from consultant radiologist) was available, surgical intervention etc. The data was sent to the hospital statistician for analysis.

Inclusion Criteria

Patients with acute abdominal pain (defined as > 2 hours and < 7 days), where a CT scan was performed by the ED physician.

Exclusion Criteria

Pregnant females.

Acute abdominal trauma. Patient with established diagnosis before arrival to ED.

Results

Demographics

Patients presented to the ED with abdominal pain between August 2020 to January 2021 were included. During that time, a total of 9124 patients were registered with acute abdominal pain. 124 patients met the inclusion criteria. Patients age ranged from 5 to 90 years with a median age of 50 years. Sixty-eight percent were female (Figure 1, Table 1). Forty-five percent had previous abdominal surgery (Table 2).

Diagnosis and Disposition

One-hundred and twenty-four patients (1.3%) who presented to ED with abdominal pain, underwent CT within the ED, requested by an ED physician.

The time of onset of abdominal pain ranged 6.88 days (mean 1.41 days) (Table 3).

One hundred & seven (86%) patients had CT done with intravenous contrast (Table 7, Figure 5).

Ninety seven (78%) patients who underwent CT scan had a positive finding on the verified report by a consultant radiologist (Table 4, Figure 2).

The CT findings of seventy-one (73%) patients matched the clinical working diagnosis of ED physician.

Twenty (16%) patients who had CT findings required surgical consultation (Table 6, Figure 4).

Table 3. Time of onset of pain (in days)

	Range	Mean
Time of onset of pain	6.88	1.41

Table 4. The patients who had positive CTs

	Frequency	Percentage
Positive CT	97	78.2%
Negative CT	27	21.8%

Table 5. Consultation prior to CT

	Frequency	Percentage
Consultations prior to CT	10	8.1%
No consultations prior to CT	64	51.6%
NA	50	40.3%

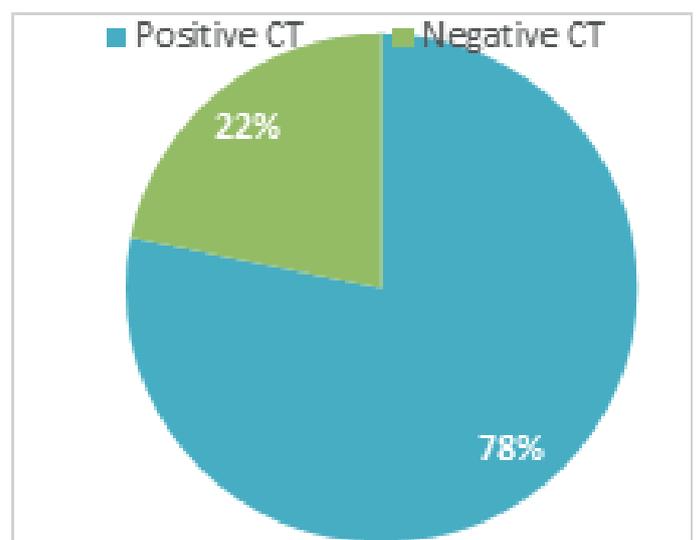


Figure 2. The patients who had positive CTs

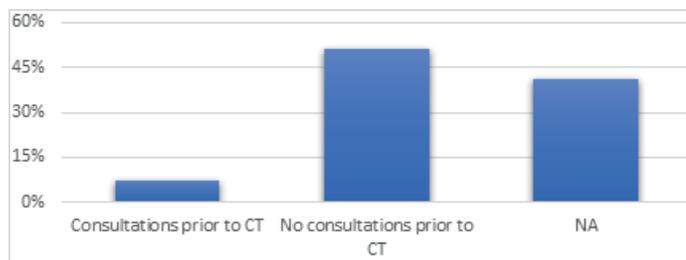


Figure 3. Consultation prior to CT

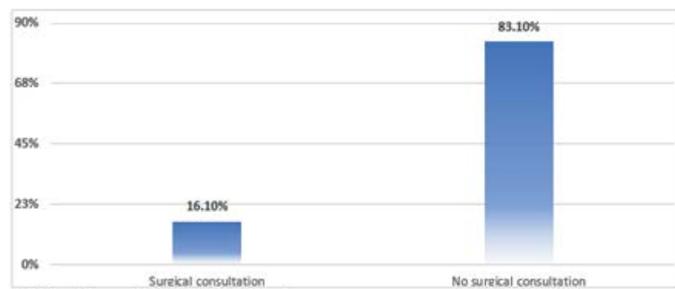


Figure 4. Patients with CT and surgical consultation

Table 6. Patients with CT and surgical consultation

	Frequency	Percentage
Surgical consultation	20	16.1%
No surgical consultation	103	83.1%
NA	1	0.8%

Ten (8.1%) consultations were made by the ED physician, prior to the CT request (Table 5, Figure 3)

Twenty patients (16%) with positive report underwent operative management (Table 9).

One hundred & four (84%) patients with findings on the CT did not require surgical consultation.

The time required for the CT scan report to be verified by a radiology consultant ranged from 60-818 min.

Discussion

Acute abdominal pain is commonly presented condition in the EDs worldwide. Evaluation of acute abdominal pain by the emergency physician is imperative. Currently with the advancement of technology, emergency physicians tend to be more skilled in diagnosing and managing acute abdominal pain. Though the conventional approach to acute abdominal pain includes history, physical examination and laboratory tests yet radiological tools ensure a non-invasive, safe and definitive diagnostic conclusion.

In our study, approx 9000 patients presented during a period of six months to the ED with a presenting symptom of acute abdominal pain. Only a selected number of patients (1.3%) underwent CT scan due to either an accurate diagnosis by ED or it turned out to be a medical cause of abdominal pain.

This also indicates how clinicians in the ED differentiate presenting symptoms to an appropriate working diagnosis, without unnecessary use of readily available radiological resources. This also complies with the basic medical principle of relying more on clinical examination and less dependence on investigations.

In 15 patients the ED diagnosis matched the surgical diagnosis, which again reinforces the clinical maturity shown by the ED physicians upfront.

There were ten consultations made by ED prior to CT, which signifies there was enough confidence in the clinical diagnosis to warrant early speciality help.

Conventional radiology (abdominal x-ray) carries its own limitation, particularly when compared to other imaging modalities. For example, plain abdominal film can show the presence of perforation or obstruction in many cases but can miss early presentation of these conditions. CT scan is almost always required to reach a definitive diagnosis in these clinically suspected cases.

CT scan also carries its own limitation. One is failure in detecting the disease at an early stage. For example, it is less accurate in detecting acute diverticulitis in presence of colon cancer. Another example is cholecystitis, as it may fail to detect gallstone when compared to US.

Only two patients (1.6%) in our study had all three radiological modalities (abdominal X-ray, US and CT abdomen) used. This could be due to demand of patients' clinical scenario or occasionally a recommendation comes from the radiologist e.g an US was requested to rule out cholecystitis but an incidental radiological mass seen at the same anatomical site, needed further evaluation on CT. As our

Table 7. CT with and without contrast

	Frequency	Percentage
With contrast	107	86.3%
without contrast	17	13.7%

Table 8. Miscellaneous findings

	Frequency	Percentage
"Radiology report findings" that matched the ED clinical diagnoses	71	73%
"Radiology report findings" that matched the "Emergency Diagnosis" & "surgical diagnosis"	15	15.4%
Patients with positive "Radiology reports findings" who went for operative intervention	20	16%
Patients who had all three radiology investigations i-e CT, abdominal series and Ultrasound	2	1.6%

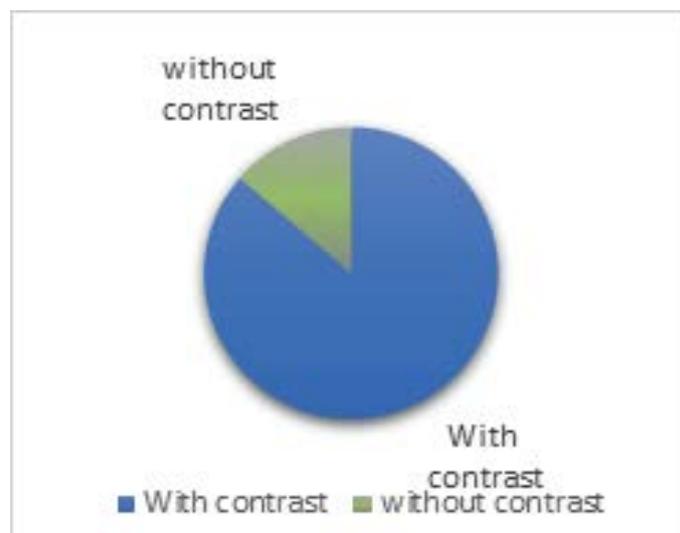


Figure 5. CT with and without contrast

Table 9. Number of surgical cases who underwent emergency surgery

Surgical diagnosis	Number of cases
Acute Appendicitis	9
Bowel Obstruction	7
Intussusception	1
Perforated gallbladder	1
Incarcerated hernia	1
Mesenteric Cyst	1
Total	20

institution is a large tertiary center complexity in presentation of cases is not uncommon.

Twenty patients (16%) were diagnosed as surgical conditions on the CT, which needed emergency surgery. This can also show the current trend of managing more and more surgical conditions conservatively.

Our study demonstrates the diagnostic accuracy of CT scan with sensitivity of sixty-one percent. This would be useful not only to detect the site of the disease but also the severity, which is pivotal in deciding surgical or medical management. Inflammatory process/disease is the most common presentation to the ED and our study confirms this trend (Table 2).

Majority of the CT studies were done with IV contrast, which usually enhances the quality of the CT abdomen studies (Table 7, Figure 5).

Our study findings support an introduction a diagnostic pathway for patients presenting with acute abdominal pain to the ED. This pathway will standardize the workup done in ED including a verbal discussion with a radiologist prior to placing a CT abdomen request.

Limitations

A limitation of the design of the study was that data were obtained retrospectively on the basis of the available documentation from ED and CT report. Information might have been misinterpreted or missed due to this design. This study was performed in a tertiary center in Saudi Arabia, although none of the cases described were referrals from other hospitals, the patient population may differ from other institutions.

Conclusion

In essence, our study shows that CT scan is a useful tool with high accuracy rate to detect common causes of non-traumatic acute abdomen in the ED. This method presents its potential in identifying bowel obstruction, inflammatory conditions, and perforation but it also has some limitations.

A widely used diagnostic tool to evaluate acute abdominal pain is CT scan.

With the increased use of radiological images, and in specific CT scan, admission with definitive diagnosis has increased compared to nonspecific diagnosis.

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