

Acute Abdomen; Pre and Post-Laparotomy Diagnosis

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Abstract

Background: Abdominal pain is a common presentation that requires almost immediate management. It is sometimes crucial to diagnose at the earliest and make a decision as to operate. Therefore it is necessary for the physician to be familiar both with the presentations of common causes of abdominal pain and the validity of diagnostic tests. Diagnosis of acute abdomen before laparotomy is essential in reducing the morbidity and mortality while preventing from unnecessary operations especially where the diagnostic facilities are limited and clinical awareness plays an important role in the diagnosis and management.

Objectives: This study attempted to compare pre and post-operative diagnosis in acute abdomen.

Materials & Methods: This was an observational study, conducted from February to December 2005. The study included 139 consecutive patients referred to Sina hospital (Tehran, Iran) presented with symptoms of acute abdomen, operated to see the negative laparotomy rate, the diagnostic accuracy and predictive values of different investigations in acute abdomen. Statistical analysis was performed using SPSS software version 11.5. P value of < 0.05 was considered as a level of significance.

Results: All 139 patients with diagnosis of acute abdomen underwent emergency laparotomy. Acute abdomen was most common in the age group 20-29 years with male predominance. Acute appendicitis (57.6%) was the most common cause of surgical condition, and then the most common causes of acute abdomen were peritonitis (14.4%) and bowel obstruction (7.9%) in male and ovarian cyst torsion (24.5%) in female patients. The negative laparotomy rate was 12.2% (P value < 0.05). In 77.7% of patients, the pre and post laparotomy diagnoses were the same. The diagnostic accuracy rates in male and female patients were 92.2% and 79.6%, respectively. In our study granulocytosis had the highest sensitivity (79.3%) and X-ray had the highest specificity (88.8%). The highest positive predictive value was related to ultrasonography (97.6%), while urinalysis showed the highest negative predictive value (91%).

Conclusion: The decision to operate is based on the results of a good history and thorough physical examination(s) with the guidance of investigative tools. Diagnostic modalities could

guide the physician in confirming the diagnosis. An accurate diagnosis of acute abdomen can avoid from unnecessary operations so reduces the rate of negative laparotomies.

Keywords: Acute abdomen, Laparotomy, Diagnosis

Introduction

The acute abdomen may be defined generally as an intra abdominal process causing severe pain and often requiring surgical intervention. It is a condition that requires a fairly immediate judgment or decision as to management (Module 2, 2008:1).

Abdominal pain is a common presentation to emergency department. It is vital that the physician has an understanding and be familiar with the presentations of common diseases that cause abdominal pain (Laurell H, 2006:2, Flasar MH, 2006:3).

Preoperative diagnosis of acute abdomen is crucial to minimize the morbidity and mortality especially where the diagnostic facilities are limited (Chhetri RK, 2005:4).

While most of the etiologies of acute abdomen are not life threatening, rapid diagnosis and therapy may be life saving in some cases. Preoperative accurate diagnosis prevents from unnecessary laparotomies and results in reducing negative operations (Saleh M Abbas, 2007:5).

Previous studies have shown that a considerable volume of diagnostic errors would be reduced by paying more attention to diagnosis before laparotomy (Gauderer MW, 1997:7).

Abdominal Pain represents 5% of emergency room visits. Only 10% of these evaluations require surgery. Acute abdomen accounts for 10% of malpractice claims (Graff, 2001:6).

Nowadays, despite availability of different diagnostic tools and progress in new imaging methods like ultrasonography(US) and computed tomography scanning, correct pre-operative diagnosis of acute abdomen still remains challenging.

The diagnosis of acute abdomen is not always straightforward and an accurate diagnostic approach is required to get the right decision.

Improvement in the surgeons' power of decision making in confrontation with such patients is the basic pivot of disease diagnosis and therapy, particularly in developing countries with limited diagnostic facilities (Chhetri RK, 2005:4).

A few studies considering the accuracy of pre-operative diagnosis has been performed. The *goal* of this study is to compare pre and post laparotomy diagnosis and to identify the rate of negative laparotomies as to guide practicing surgeons confronted with acute abdomen.

Materials and Methods

This was an observational study performed in emergency surgical ward of Sina hospital (Tehran University of Medical Sciences; Tehran, Iran) from February to December 2005, to compare the pre-operative diagnosis based on clinical examination and evaluations with the post-operative diagnosis of acute abdomen.

The study included 139 cases of all age groups and both genders with clinical manifestations suggestive of acute abdomen that underwent laparotomy. The excluded patients were those who had a history of trauma (traumatic acute abdomen). Case series method was considered as the method of sampling.

Patients were examined by the admitting surgical team after taking a thorough history, Relevant points in the history included the patient's gender, site of pain, character of pain, fever, loss of appetite, change in bowel habit, vomiting, abdominal distension and urinary or genital symptoms. Factors in the clinical examination that were considered of significant contribution to the final diagnosis included temperature, tachycardia, and abdominal tenderness and localized or generalized guarding.

In all studied cases, white blood cell (WBC) count with a differential leukocyte count (DLC) and measurement of neutrophil percent were performed on admission. Urinalysis (UA)

performed for 95% of patients. Abdomen X-ray, US and serum amylase level measurements were performed in some cases considering the clinical suspicion. Pre-operative diagnosis was made by surgical residents based on clinical examination and investigations compared to the post operative diagnosis.

Rate of negative laparotomy, sensitivity, specificity, positive and negative predictive values considering leukocytosis (WBC count $\geq 11,000$ per micro liter in peripheral blood smear), granulocytosis (neutrophils $>75\%$ in DLC), UA (considered positive if contained ≥ 5 WBC or \geq RBC or showed pregnancy), US and X-ray were all calculated. Statistical analysis was performed using SPSS software version 11.5. Student's t-test and Chi-square test were used to calculate the significance level and a P-value of <0.05 was considered significant.

Results

Total 139 patients diagnosed with acute abdomen underwent emergency laparotomy. Ninety (64.7%) were male and 49(35.3%) were female. Mean age of the patients was 35.3 ± 18.6 with the range of 9-85 years. Sixty-eight patients (49%) were 20-29 years old.

The most common symptoms in our patients with abdominal pain were nausea (69.1%) and vomiting (43.9%). The most common clinical signs were abdominal tenderness (97.1%), voluntary guarding (66.9%) and rebound tenderness (66.2%). The signs and symptoms of the patients are summarized on table 1.

Table1: Signs and symptoms of patients presented with acute abdominal feature

| Symptom | N (%) | Sign | N (%) |
|----------------------|-----------|-----------------------|------------|
| Abdominal pain | 139(100%) | Abdominal tenderness | 135(97.1%) |
| Severity of pain: | | Rebound tenderness | 92(66.2%) |
| Mild | 22(15.8%) | Voluntary guarding | 93(66.9%) |
| Moderate | 93(66.9%) | Generalized guarding | 27(19.4%) |
| Severe | 24(17.3%) | Localized guarding | 84(60.4%) |
| Charecter of pain: | | | |
| Colic | 53(38.1%) | | |
| Continuous | 86(61.9%) | | |
| Nausea | 96(69.1%) | | |
| Vomiting | 61(43.9%) | Pulse Rate ≥ 110 | 50(36%) |
| Loss of appetite | 59(42.4%) | Temperature ≥ 38 | 30(21.6%) |
| Bowel habit(+) | 16(11.5%) | | |
| Abdominal distention | 14(10.1%) | | |

Acute appendicitis was the most common cause of acute abdomen (56.8%).Acute appendicitis was the etiology of acute abdomen in 67% of male and 38.8% of female patients. Other common causes of acute abdomen were peritonitis (14.4%) and bowel obstruction (7.9%) in male, and torsion of an ovarian cyst (24.5%) in female patients. The pre and post laparotomy diagnosis are reported in table 2.

Table 2: The causes of acute abdominal pain

| Pre-operative diagnosis | N (%) | Post-operative diagnosis | N (%) |
|-------------------------|-----------|--------------------------------|-----------|
| Appendicitis | 84(60.4%) | Appendicitis | 79(56.8%) |
| PeriStonitis | 12(8.6%) | Peritonitis due to: | 20(14.4%) |
| | | Perforated appendicitis | 5(3.5%) |
| | | Perforated peptic ulcer | 8(5.7%) |
| | | Pancreatitis | 2(1.4%) |
| | | Perforated cholecystitis | 1(0.7%) |
| | | Infected uterine carcinoma | 1(0.7%) |
| | | **AMI | 3(2.2%) |
| Cholecystitis | 9(6.5%) | Ovarian cyst torsion | 12(8.6%) |
| Ovarian cyst torsion | 5(3.6%) | Cholecystitis | 10(7.2%) |
| Ruptured *AAA | 5(3.6%) | Intestinal obstruction due to: | 10(7.2%) |
| | | Adhesion | 3(2.2%) |
| | | Volvolus | 3(2.2%) |
| | | Incarcerated hernia | 2(1.4%) |
| | | Tumor | 1(0.7%) |
| | | Invagination | 1(0.7%) |
| Intestinal obstruction | 3(2.2%) | Ruptured AAA. | 4(2.9%) |
| Other disease | 30(15.1%) | Ectopic pregnancy | 1(0.7%) |
| | | Peritoneal hematoma | 1(0.7%) |
| | | Aortodeodenal fistula | 1(0.7%) |
| | | Abdominal wall abscess | 1(0.7%) |

*AAA =Abdominal aortic aneurysm

**AMI =acute mesenteric ischemia

Leukocytosis and granulocytosis were observed in 66.2% and 80% of patients, respectively. Eighty percent of patients suffering from peritonitis and 77.5% of appendicitis patients had leukocytosis. Granulocytosis had the highest sensitivity (79.3%).

UA was positive in 20.1% of patients. One had ectopic pregnancy. Urinalysis had the highest negative predictive value (91%).

Abdominal X-ray was requested for 54 (38.9%) patients. In 10 patients (18.5%) abnormal findings were present. Abdominal X-ray was performed for 100% of patients with bowel obstruction and 80% of them were found to be positive. Overall X-ray had the highest specificity (88.8%) and the lowest sensitivity (46.6%) and negative predictive value (25%).

US was performed in 72(51.8%) patients. They were 41(56.9%) female and 31(43.1%) male patients. Fifty-eight (80.6%) patients had positive findings. Overall US performed for 83.7% of female and 34.4% of male patients. Correct diagnosis in 100% of patients with cholecystitis and ovarian torsion and 68.6% of patients with appendicitis, was performed with US. US had the highest positive predictive value (97.6%). Serum amylase level was measured in 62 patients (44.6%). Liver function tests were requested for 27.7 of patients. Sensitivity, specificity, positive and negative predictive value of leukocytosis, granulocytosis, urinalysis, and abdominal X-ray, US and serum amylase level are summarized in table 3.

Table 3: Predictive values of investigations

| | Leukocytosis | granulocytosis | *UA | **US | X-Ray | Amylase |
|------------------------|---------------------|-----------------------|------------|-------------|--------------|----------------|
| Sensitivity (%) | 70 | 79.3 | 78 | 79 | 46.4 | 74 |
| Specificity (%) | 84.5 | 83.3 | 81 | 73 | 88.8 | 50 |
| ÷ PPV (%) | 96 | 97 | 68 | 97.6 | 95.4 | 71 |
| #NPV (%) | 80 | 60 | 91 | 60 | 25 | 54 |

*UA= Urinalysis

**US= Ultrasonography,

÷ PPV= Positive predictive value

NPV= Negative predictive value

Total negative laparotomy rate was 12.2% (P value < 0.05). Comparison of pre and post laparotomy diagnoses is shown in table 4.

Table 4: Comparison between pre and post-operative diagnosis

| Final diagnosis | Exact **PO | One of PO | None of PO |
|------------------------|-------------------|------------------|-------------------|
| Peritonitis | 9(45%) | 11(55%) | 0(0%) |
| Appendicitis | 70(88.6%) | 9(11.4%) | 0(0%) |
| Cholecystitis | 8(80%) | 1(10%) | 1(10%) |
| Ovarian cyst torsion | 2(16.7%) | 7(58.3%) | 3(25%) |
| Intestinal obstruction | 4(40%) | 4(40%) | 2(20%) |
| Rupture of *AAA | 4(100%) | 0(0%) | 0(0%) |

*AAA=Abdominal aortic aneurysm

**PO = Pre-operative diagnosis

In 77.7% of patients, pre and post laparotomy diagnosis were the same. The diagnostic accuracy rates were 92.2% and 79.6% in male and female patients, respectively. All of the patients with rupture of abdominal aortic aneurysm had correct pre-operative diagnosis. In 88.8% of patients with appendicitis and 87.5% of patients with cholecystitis, both the pre and post-operative diagnoses were the same. Pre-operative diagnosis was correct in only 50% of ovarian cyst torsion.

Discussion

Despite improvement in clinical evaluations and advancement in diagnostic methods, correct diagnosis of acute abdomen is still sometimes difficult. Patients with acute abdominal pain are a heterogeneous group that consumes a great deal of a surgical department's resources (Saleh M Abbas, 2007:5). In cases when the diagnosis is suspected, laparotomy has been advised to be performed (Scott Hs, 1993:8), but this policy has increased the rate of negative laparotomies (Tadvrel P, 1992:9).

In this study, acute abdomen was most common in 20-29 years (49% of patients). This result is similar to statistics from other studies, reporting the prevalence of acute abdomen mostly in 20-29 years old patients (Chhetri RK, 2005:4). The causes of acute abdomen are several and their relative incidence varies in different populations. Several factors are described to be

responsible for these differences. Socioeconomic factors and diet have mostly been incriminated to be responsible for the observed differences (Kotiso, 2006:10).

Among the etiologies leading to laparotomy, in this study acute appendicitis was the commonest and observed in 56.8% of cases. Peritonitis and bowel obstruction were observed in 14.4% and 7.9% of cases respectively. Other studies, reported acute appendicitis to be the leading cause of acute abdomen in 55% cases (Chhetri RK, 2005:4), visceral perforation and bowel obstruction in 8-12% and 15-24% of cases of laparotomy, respectively (Heelar M, 1997:11).

The most frequently ordered study for abdominal pain is the CBC. The CBC should never be used to make the sole diagnosis; however, because nearly 11% of normal adults have an elevated WBC count and 13% have left shifts (Bohrn M, 2004:12). In our study, the sensitivity and specificity of leukocytosis were 70% and 84.5% respectively and of granulocytosis were 79.3% and 83.3% respectively.

Other studies reported the sensitivity of leukocytosis equal to 77-87% and the specificity equal to 63-67%. Sensitivity and specificity of granulocytosis in other reports were 91.5% and 64.5%, respectively (Chhetri RK, 2005:4). In our study, none of these tests had the required sensitivity and specificity to predict of acute abdomen etiology.

Urinalysis was performed for 95% of patients and in 28 (20.1%) cases had positive findings. In a study performed, urinalysis had sensitivity and specificity 75% and 84% respectively (Chhetri RK, 2005:4) and in our study, 78% and 81% respectively. Regarding previous studies, UA is advised to be performed for all acute abdomen patients to exclude urinary tract infection (UTI), diabetes, renal stones, ectopic pregnancy and normal pregnancy (Heelar M, 1997:11).

Plain abdominal radiography performed for 54 patients (41.5%), it had the most accuracy of diagnosis in mechanical bowel obstruction with sensitivity of 83.3% and specificity of 97%. X-ray had the highest specificity (88.8%) and the lowest sensitivity (46.6%). Chhetri reported sensitivity of 64.8% and specificity 88.8% for plain abdominal X-ray (Chhetri RK, 2005:4). Bowel obstruction is usually confirmed by abdominal radiography in decubitus (horizontal) and upright positions. In these positions most of the findings are as follow: intestinal loop caliber >3 centimeters, air-liquid level and gas increase in colon.

In our study, US was performed for 72 patients (51.8%). The sensitivity and specificity of US was 79% and 73% respectively. In our study the diagnostic accuracy for cholecystitis was as high as 100%. Chhetri reported sensitivity and specificity of 69.4% and 81.5 for US in the diagnosis of acute abdomen and the diagnostic accuracy of 95% for cholecystitis (Chhetri RK, 2005:4).

Serum amylase measurement was performed in 62 patients (44.6%). Its sensitivity and specificity was 74% and 50% respectively.

In our study negative appendectomy rate was 13.2% which is similar to the statistics presented by other studies between 15- 30% (Boleslawski E, 1999:13, John PF, 1990:14). The negative laparotomy rate was 12.2% in this study. Overall accuracy rate was 69.8%. In this group of patients, the pre and post-laparotomy diagnosis were the same. In other investigations, the overall accuracy of diagnosis has been reported 80% by skilled physicians and 50% by young physicians (Paterson-brown S, 1991:15). In the study of Chhetri, negative laparotomy rate was 17.6 % (Chhetri RK, 2005:4).

Conclusion

Acute abdomen diagnosis is based on complete history taking, physical examination and

investigation tools including laboratory tests and radiological findings. The investigative modalities are good guidance and helpful to confirm the diagnosis. For example, when suspicious to intestinal obstruction, one can perform abdominal X-ray which would be a great help in diagnosis confirmation or sonographic guidance for the diagnosis of cholecystitis. High levels of serum amylase may guide our suspicion toward pancreatitis. A preoperative accurate diagnosis prevents from negative laparotomies.

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