

VALUE OF 'COUGH SIGN' IN ESTABLISHING THE DIAGNOSIS OF ACUTE APPENDICITIS IN THE EMERGENCY DEPARTMENT

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SUMMARY :

Purpose: The objective of the study is to examine the reliability of the cough sign in order to diagnose acute appendicitis in adult patients, compared to four other commonly used tests. **Methods:** We conducted a prospective clinical trial of 182 consecutive patients referred to our university-based emergency department within the study period. Adult patients with the chief complaint of acute-onset non-traumatic right lower quadrant abdominal pain were enrolled in the study. Cough sign, rebound tenderness, right lower quadrant tenderness, guarding and percussion tenderness were sought on examination. Specificity, sensitivity, negative and positive predictive values of the five tests in diagnosing acute appendicitis were calculated. **Results:** Fifty-one out of the 182 patients had a presumptive diagnosis of acute appendicitis and 44 were found to have acute appendicitis. Positive cough sign was found to be the most sensitive examination method (95% in general). The negative predictive value of the test was also the highest among the five tests in our study (98%). Percussion tenderness was the most specific method. Rebound tenderness had the highest positive predictive value of the five tests. **Conclusion:** We conclude that the cough sign can serve as a useful aid in establishing the diagnosis in acute appendicitis in the emergency department evaluation of adult patients with non-traumatic, acute-onset right lower quadrant abdominal pain.

Key Words: Acute Abdominal Pain, Acute Appendicitis, Diagnosis, Cough Sign.

INTRODUCTION

Right lower quadrant (RLQ) abdominal pain is a common complaint in the emergency department (ED) patient population. To establish the diagnosis of acute peritoneal inflammation due to acute appendicitis in these patients, one must identify localized peritonitis in RLQ. So far, there is no clear-cut evidence regarding the sensitivity and specificity of symptoms and clinical signs in detecting peritonitis in emergency settings.

In this study, we compared the sensitivity and specificity values of five tests to diagnose acute appendicitis- cough sign, rebound tenderness, RLQ tenderness, percussion tenderness and guarding.

PATIENTS AND METHODS

This prospective clinical study comprised 182 consecutive adult patients who presented at our university-based ED between August 1, 1997 and February 1, 1998, excluding 39 patients who

were lost to follow-up. The sole inclusion criterion was to have presented at our ED with the chief complaint of acute-onset RLQ abdominal pain. The term 'acute-onset' was described as pain lasting for less than a week. Exclusion criteria consisted of ages younger than 18, a recent history of thoracoabdominal trauma, a positive pregnancy test. The mean age of the patients was 30.6±16.2 years (range: 18 and 79). The male:female ratio was 98:123 or 0.79.

The study patients were evaluated by the emergency physician on duty in the ED. Adjunctive laboratory tests (complete blood count, X-rays, ultrasonography, urinary beta-Human Chorionic Gonadotropin etc.) were ordered in 78% of the patients. B-HCG and complete blood count were the tests most often ordered (%44 and %41, respectively). 69 patients (37%) including 51 patients who had a presumptive diagnosis of acute appendicitis have undergone an ultrasound examination. The above-mentioned five tests were performed in all patients in order to detect peritonitis.

To examine the patient for cough sign, patients lying supine on the bed were asked to cough. The patients' responses to cough were regarded as positive if it produced sharp localized pain in RLQ. The test was repeated up to 3 times in case of equivocal findings. After repeated tests, the physician interpreted the results and made his/her decision as positive or negative. The physician performing the test was blinded to the other work-up results of the subject. The emergency physician who performed the cough test carried out the other four tests in a row without delay and recorded the results. Although subject to bias, this method was chosen in order not to hamper the patient flow and care in the ED.

After a complete physical examination was

accomplished, a General Surgery consultant was called for if any clinical suspicion existed or any of the tests was positive. 39 of the cases (21 female, 18 male) had to be transferred to another institution due to financial problems, and refusal of treatment by the patient. These 39 cases were excluded from the study owing to the difficulty of follow-up.

Fifty-one out of the 182 (221-39) study cases had a presumptive diagnosis of acute appendicitis after the consultations were completed. These 51 patients underwent surgery and/or laparoscopy. Post-operative histological diagnoses of these patients were also recorded. Of the 182 patients with proper follow-up, 44 were found to have acute appendicitis, 7 were ruled out for acute appendicitis, and 131 patients were not operated on.

In the analysis of the data, 5 diagnostic tests were examined in terms of sensitivity and specificity in establishing a diagnosis of acute appendicitis in ED settings. Patients were also asked to report one test as 'the most painful' and one test as 'the least painful' among the five diagnostic procedures.

RESULTS

Table I demonstrates the findings of the 182 consecutive adult patients with RLQ abdominal pain on presentation.

The findings are those recorded by the emergency physician on duty. However, the general surgical consultant who was called for to evaluate the patients with suspected acute appendicitis agreed with all the findings except for only one patient. This patient was a 37-year-old man who, according to the emergency physician, was presumed to have peritonitis. This patient was not operated on and turned out to

Table I: The results of five diagnostic tests and verification of acute appendicitis in patients presented with RLQ pain in the ED. Sensitivity and specificity (per cent) values of five diagnostic tests in detecting acute appendicitis in patients with acute RLQ pain were also depicted in the lower row.

	cough sign	Reb. tend.	RLQ tend.	Percuss. tend.	guarding	Operated on	Acute app.
	(+/-) (sens. %; spec. %)	(+/-) (sens. %; spec. %)	(+/-) (sens. %; spec. %)	(+/-) (sens. %; spec. %)	(+/-) (sens. %; spec. %)		(+/-)
Female (n=102)	17/85 94; 97	21/81 94; 95	25/77 90; 88	19/83 94; 97	20/82 94; 94	22	18/4
Male (n=80)	25/55 96; 94	32/48 92; 84	33/47 92; 82	20/60 71; 96	23/57 82; 93	29	26/3
General	95; 95	93; 89	91; 85	83; 96	88; 93		

have acute gastroenteritis. Male to female ratio of 51 patients whose findings persisted and underwent surgery was 29:22. The patients who underwent operation represented 28% of all patients who had been referred to the ED with RLQ pain and followed up. Eighty-six percent of the patients' histological diagnoses proved to be acute appendicitis (Table 2).

The interpretations of the five diagnostic tests performed to detect localized peritonitis were analyzed to calculate the sensitivity and specificity. These figures are also depicted in Table I. Of these, cough sign was found to be the most sensitive test. False-negative cough sign was reported in two patients (1 male and 1 female). The most specific test was percussion tenderness (96% in general). The least specific test was RLQ tenderness (85% in general). Sensitivity values of percussion tenderness and guarding were lower in male patients compared with females: 71% vs. 94% and 82% vs. 94%. Of the 77 patients who underwent an ultrasound examination, negative ultrasounds were more common in females which suggests a low threshold for emergency physicians to order an USG in females.

Positive and negative predictive values of the 5 tests were demonstrated in Table 3. PPV indicates the probability of the presence of the disease when the test result is positive. On the other hand, NPV defines the probability of the absence of the disease when the test result is negative. All tests had obviously high NPV values (90-98%). Cough sign yielded high PPV

as well as NPV.

Pain responses elicited in our study associated with the procedures were depicted in Table 4. Cough sign was the test most commonly reported as 'the least painful procedure'. Fifty percent of the study patients reported cough sign as the least painful test.

DISCUSSION

Acute appendicitis is commonly encountered in the ED patient population and is most common in men between 20 and 30 years of age. This study was carried out to test the reliability of cough sign in establishing a diagnosis of acute appendicitis in the ED setting. Controversy still exists over determining which patient is to be operated on. A typical history of periumbilical pain eventually migrating to RLQ generally triggers the physician's suspicion. In a patient with a typical history, the decision to operate is usually based on the detection of rebound tenderness and localized guarding or tenderness on digital rectal examination (1,2). These findings are helpful, though painful methods for patients and cough sign can also be used as an adjunct in the diagnosis.

In this prospective clinical study cough sign was sought concurrently with other conventional tests, namely rebound tenderness, RLQ tenderness, percussion tenderness and guarding. Cough sign was found to be the most sensitive test. In terms of specificity, it followed the percussion tenderness with a slight difference (Table 1).

Table 2: Histological diagnoses of the 51 patients (22 female, 29 male) who underwent appendectomy.

	acute app.	normal appendices	diverticulitis	faecolith
Female (n=22)	18	2	1	1
Male (n=29)	26	3		

Table 3: Positive and negative predictive values (PPV and NPV) of five diagnostic tests in detecting acute appendicitis in patients with acute RLQ pain.

	cough sign	reb. tend.	RLQ tend.	percuss. tend.	guarding
	(PPV% ; NPV%)	(PPV% ; NPV%)	(PPV% ; NPV%)	(PPV% ; NPV%)	(PPV% ; NPV%)
Female	89; 98	90; 97	85; 96	90; 96	85; 95
Male	85; 98	89; 96	89; 94	86; 90	85; 96
General	87; 98	90; 97	87; 95	88; 93	85; 95

Table 4: The results of the patient survey about the pain experienced during the tests.

	cough sign	reb. tend.	RLQ tend.	percuss. tend.	guarding
The most painful test	3	63	20	45	51
The least painful test	91	12	55	16	8

With regard to diagnostic purposes, laparoscopy is of great importance. Especially in equivocal presentations; in young women in whom acute peritoneal inflammation may be due to acute appendicitis, pelvic inflammatory disease or ovarian diseases, laparoscopy allows the surgeon to visualise and treat both appendicular and gynaecological disease states (3).

In our study we calculated general sensitivity and specificity values of the cough sign as 95% both (Table 1). On the other hand, in the study conducted by Golledge et al, the values were 82% and 50%, respectively (4). Higher sensitivity value found in this study implies that a negative test may exclude acute appendicitis more reliably (low number of false negative tests). Higher specificity value means a positive test indicates acute appendicitis more reliably.

A major drawback of the study is the possibility of bias because of the performance of all the tests by the same physician. To avoid this possibility of bias, separate physicians who were blinded to patients' data should have performed and interpreted the tests. Such a design was not feasible for us in the busy everyday practice of emergency care. More objective conclusions can be made if studies in which this drawback could be avoided are conducted.

Tests employed to seek for localized peritonitis in the RLQ region are generally painful methods of examination (4). Although not analyzed in detail, 50% of the study patients reported cough sign as 'the least painful procedure' which is consistent with the findings of Jeddy et al (5) (Table IV). Therefore, the compliance of patients and physicians with this procedure can be higher than with others.

In the present study, 131 of the 182 study patients (72%) whose follow-up is completed were diagnosed to have non-surgical diseases. Of these, 78 (59%) were found to have nonspecific abdominal pain, 20 gastroenteritis, 21 urinary tract disorders, 8 pelvic inflammatory disease and 4 perimenstrual pain. Eight patients presented at our ED once again with similar complaints but they were not admitted or found to have surgical disease.

In the study published by Golledge et al., 14 patients out of 58 who underwent appendectomy

were found to have histologically normal appendices (4). The sample size of the study is small and negative appendectomy rate is too high (24%). In our study 44 patients out of 51 who were appendectomized (86% true positive) were found to have appendicitis. Rate of false-positive diagnosis as acute appendicitis (14%, negative appendectomy rate) is lower than previous findings. Jeddy et al (5) reported acute appendicitis in 56 out of 60 patients whose cough sign was positive (93% true positive).

Positive and negative predictive values of the diagnostic tests are shown at Table III. Negative predictive values are found to be higher than similar studies (56% in the study by Golledge). Because of the high negative and positive predictive values, cough sign may be useful in the triage of patients with RLQ pain in the ED evaluation. In addition, it can also reduce the time period during which these patients are observed in the ED and can foster more cost-effective care in the ED for patients with RLQ pain.

CONCLUSION

We conclude that cough sign can be a useful tool in establishing the diagnosis of acute appendicitis in the emergency department evaluation of adult patients with non-traumatic, acute-onset RLQ abdominal pain. The test can be used together with the other diagnostic methods.

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