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THE DIAGNOSTIC ACCURACY OF CLINICAL AND LABORATORY PARAMETERS IN THE DIAGNOSIS OF ACUTE APPENDICITIS IN THE ADULT EMERGENCY DEPARTMENT POPULATION

General Surgery

Dr.Prabhu Dutt Modi Assistant Professor, Department of Surgery , Zydus Medical College And Hospital, Dahod, Gujarat

Dr.Bharat.N. Hathila Assistant Professor, Department of Surgery, Zydus Medical College And Hospital, Dahod, Gujarat

ABSTRACT

The aim of the study was to identify the optimal combination of clinical and laboratory parameters that should facilitate the emergency department surgeon's definite decision. The study group comprised 120 patients with suspicion of acute appendicitis (AA). In 60 patients the AA diagnosis was confirmed intraoperative and by histological analysis. Clinical parameters included: appetite, vomiting, diarrhoea, dysuria, signs of localized peritonitis and pain migration. Measured laboratory parameters were: C-reactive protein (CRP), complete blood count (CBC) and the urine test strip. The control group of patients were more likely to present following symptoms: no changes in appetite ($P < 0.001$), diarrhoea ($P = 0.009$) and dysuria ($P = 0.047$). CRP and white blood cell count (WBC) were significantly higher in the group with confirmed AA compared to the control group (44.7 vs. 6.6, and 13.6 ± 3.9 vs. 9.0 ± 3.4, respectively; $P < 0.001$). The multivariate logistic regression analysis identified lack of appetite ($P = 0.013$), absence of diarrhoea ($P = 0.004$), and positive finding of signs of localized peritonitis ($P = 0.013$), as well as WBCs ($P < 0.001$) and negative urine test strip results ($P = 0.009$) as statistically significant predictors of AA. The highest percentage of correctly classified cases (82%) was achieved by combination of common clinical exam and basic inexpensive laboratory parameters (WBCs and urine test strip). Acute appendicitis in the emergency setting may be successfully ruled in based on elevated WBCs and negative urine test strip in combination with signs of localized peritonitis, lack of appetite and absence of diarrhoea. Since CRP did not contribute to the overall diagnostic accuracy, its use in AA diagnostic protocols is of no value.

KEYWORDS

appendicitis; emergency service; white blood cell count; C-reactive protein; urinalysis

INTRODUCTION

Despite improvements in diagnostics and increasing surgical experience, the rate of negative appendectomies, even in most advanced medical centers, fails to fall below 10% . According to various studies the rates of false positive findings in the diagnosis of appendicitis vary from 8 to even 30% . Keeping in mind the possible serious and potentially fatal complications of unrecognized appendicitis, a relatively high rate of negative appendectomies (10-15%) is being considered acceptable among surgeons . Diagnosis of AA is one of the most common dilemmas which surgeons encounter in the emergency room. The typical clinical picture, with pain migration towards the right lower quadrant of the abdomen or signs of localized peritonitis, is unfortunately found in much less patients than it is thought. On the other hand, too much reliance on laboratory findings can misguide a surgeon's diagnosis. Broad differential diagnoses, especially in women, and an unclear clinical picture can frustrate a surgeon, leading him to order a Multi-slice Computed Tomography (MSCT). However, although MSCT of the abdomen very accurately recognizes AA, it uses a high dosage of harmful radiation which makes it absolutely unacceptable for routine use in patients suspected of having appendicitis . Searching through medical literature we can find various laboratory parameters (e.g. white blood cell count (WBC), neutrophil-to-lymphocyte ratio (NLR), platelets (Plt), mean platelet volume (MPV), C-reactive protein (CRP), fibrinogen and even bilirubin) being evaluated as potential diagnostic markers for AA, but results according to different studies vary substantially . On the other hand, some large meta-analyses found that individual laboratory and clinical parameters alone have low or no predictive value in the diagnosis of AA, but combined their predictive value increases a lot .

MATERIAL AND METHODS

We retrospectively analyzed 120 (46 males) patients admitted to the Emergency Department of the Hospital with a suspicion of acute appendicitis. The data were retrospectively collected through Hospital information system. Every patient with acute onset of right lower quadrant abdominal pain and without history of appendectomy was considered as suspected of having AA. This procedure is in accordance with the basic surgical education that every patient with right iliac fossa pain and without history of appendectomy is suspected of having appendicitis until proven otherwise. In 60 patients the AA diagnosis was confirmed intraoperative and by histological analysis (AA group). The other 60 patients were processed and discharged, without confirmation of AA (control group). All discharged patients were confirmed as negative through follow up examination that occurred during following 2 to 3 days. Patients with palpable mass in right lower abdominal quadrant and patients with chronic pain were not analysed. Patients with chronic right iliac fossa pain (longer than one month) are not suspected of having appendicitis because long experience of surgical dealing with acute abdomen showed that acute appendicitis never presents with longstanding pain. Palpable right iliac fossa mass is a sign of organized inflammatory mass around inflamed organ that is formed as a result of patient`s defensive mechanism („walled off appendicitis“) and therefore is a contraindication for operation. It is treated conservatively with antibiotics and delays appendectomy (4-6 months). This sign of palpable mass is rare and when present the management is clear - conservative treatment. This is the reason why most of the studies that are dealing with diagnosis of appendicitis also exclude patients with this sign. The Hospital Ethical Committee granted the approval for the retrospective analysis of the study data. Clinical and laboratory parameters, relevant to AA diagnosis, were analysed among the study participants. Clinical parameters included: appetite, vomiting, diarrhoea, dysuria, signs of localized peritonitis (rebound tenderness/guarding) and pain migration. Measured laboratory parameters included: inflammatory markers (CRP measured by immunoturbidimetry on the Beckman Coulter AU680 analyzer (Beckman Coulter, Brea, USA)); parameters of the complete blood count (CBC) (WBC, red blood cell count (RBC), red cell distribution width (RDW), Plt and MPV measured on the Siemens Advia 2120i 6-diff automated hematology analyzer (Siemens, Enlargen, Germany)); the urine test strip (iChem Velocity Urine Chemistry Strips for in vitro use with the automated iChemVELOCITY System (Beckman Coulter, Brea, USA)). Positive findings of blood (≥ 0.3 mg/L) and/or leukocytes (≥ 25 WBC/μL) on the test strip were considered as „positive result “.

RESULTS

The statistical analysis revealed that the AA group was older than the control group ($P = 0.020$). The laboratory parameters were compared between the control and AA subgroups. C-reactive protein and WBC were significantly higher in the AA group (44.7 vs. 6.6, and 13.6 ± 3.9 vs. 9.0 ± 3.4, respectively; $P < 0.001$). There was no statistically significant difference in RBC count, RDW, platelet count or MPV, between groups. The percentage of positive findings of the urine test strip was tested with the comparison of proportions test between groups. The test revealed no statistically significant difference ($P = 0.555$). To identify variables that contribute most to the diagnosis of acute appendicitis, the logistic regression analysis was performed.The univariate logistic regression analysis included clinical symptoms and laboratory parameters as independent variables. The confirmed/rejected AA diagnosis was a dependent variable. The univariate

logistic regression identified lack of appetite (P = 0.002), absence of diarrhoea (P = 0.001), dysuria (P = 0.017) and positive finding of signs of localized peritonitis (P = 0.014) as statistically significant independent predictors of AA. Vomiting and pain migration did not have an impact on predicting the appendicitis diagnosis outcome. Regarding laboratory parameters, the univariate logistic regression identified WBCs (P < 0.001) and negative urine test strip results (P = 0.020) as statistically significant predictors of the AA. The rest of the laboratory parameters did not have an impact on predicting the appendicitis diagnosis. Finally, we combined the significant variables from the univariate regression analysis and performed the multivariate logistic regression analysis. The results identified lack of appetite (P = 0.013), absence of diarrhea (P = 0.004), and positive finding of signs of localized peritonitis (P = 0.013), as well as WBCs (P < 0.001) and negative urine test strip results (P = 0.009) as statistically significant predictors of AA. The combination of clinical and laboratory parameters improved the percent of cases correctly clas-sified compared to clinical and laboratory parameters alone (82% and both 77%, respectively).

DISCUSSION

For the first time, the results of our study identified the combination of WBCs and negative urine test strip results as important predictors of AA diagnosis. Similar to results of other studies, we found that symptoms of typical migratory pain and localized signs of peritonitis in the right lower quadrant are, although very specific, relatively rare in patients with AA. In those cases the diagnosis is not very difficult. However, a problem exists with all other cases where those specific symptoms are absent, and that is when the surgeon has to rely on some other parameters. In our study we found that no changes in appetite, diarrhoea and dysuria are important negative predictors for AA, especially when combined with normal WBC and positive results of urine test strip analysis. However, the attending surgeons need always to bear in mind that there is no sign, symptom, or laboratory test, or their combination, that is 100% reliable in the diagnosis of acute appendicitis . Although a bit peculiar, especially in the light of achieved high sensitivity (93.3%) in discriminating AA patients, and despite the literature findings that support the determination of CRP in the diagnosis of acute appendicitis, the logistic regression did not identify CRP concentration as a significant contributor to the acute appendicitis diagnosis in our study. Perhaps the underlying cause includes the same information that WBC and CRP offer, and thus one variable becomes redundant. Literature data even clearly demonstrates that CRP is not a good tool for helping the surgeon make the diagnosis of appendicitis and it should not be measured in suspected appendicitis, thus supporting our results . Regarding urine test strip analysis, the observed results are quite interesting. There were no differences in the proportion of patients with the positive urine test strip between the AA and the control group, however, the logistic regression analysis revealed the positive urine findings as a statistically significant negative predictor of AA. Logistic regression is a technique for analyzing problems in which there are one or more independent variables that determine an outcome. The goal of logistic regression is to find the best fitting (yet biologically reasonable) model to describe the relationship between the dichotomous characteristic of interest (dependent variable or outcome variable) and a set of independent (predictor) variables, and therefore yields completely reliable statistical results that are shown in this study.

CONCLUSION

Acute appendicitis in the emergency setting may be successfully ruled in based on elevated WBCs and negative urine test strip in combination with signs of localized peritonitis, lack of appetite and absence of diarrhea. Since CRP did not contribute to the overall diagnostic accuracy, its use in AA diagnostic protocols is of no value.

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