ORIGINAL ARTICLE

IMPACT OF CT-FACT ON NEGATIVE APPENDECTOMY RATES: PROSPECTIVE EVALUATION FROM A TERTIARY CARE HOSPITAL

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ABSTRACT

OBJECTIVE: To determine and compare the frequency of negative appendectomy in cases of acute appendicitis with and without pre-op computed tomography. **DESIGN:** Experimental study (Clinical trial). **PATIENTS AND METHODS:** A total of 116 patients, presenting to the emergency department, Ziauddin University Hospital, Karachi, with acute abdominal pain were assessed using Alvarado scoring system for the clinical diagnosis of acute appendicitis by primary attending surgeon. All patients fulfilling the inclusion criteria and diagnosed as acute appendicitis on clinical grounds through Alvarado score of 7 or more, were offered pre-op CT scan and informed consent was sought. Those patients who was agree and give consent for pre-op CT scan will placed in group A while those who were not give consent for pre-op CT scan were placed in group B. Patients in group A were subjected to computed tomography (CT scan) for the radiological diagnosis of acute appendicitis based on operational definitions, before going for appendectomy, whereas group B patients were proceed to appendectomy directly. After performing appendicectomy, the resected sample was then sent for histopathological examination to the same laboratory and examination conducted by an experienced pathologist. Data was entered on a predesigned proforma. **RESULTS:** The negative appendectomy rate was 6.9% in 4 patients with pre appendectomy CT and 19% in 11 patients without pre appendectomy CT (P- value 0.04). **CONCLUSION:** The results show that CT in patients with suspected appendicitis leads to lower negative appendectomy rates. Therefore, we propose that preoperative imaging be considered part of the routine evaluation of women suspected of having acute appendicitis.

Key Words: Negative appendectomy, acute appendicitis, with and without pre-op computed tomography.

Introduction

Appendicitis is one of the most common surgical abdominal condition and appendectomy is one of the commonest emergency procedures performed globally.[1] It is the most common cause of acute abdomen in all age groups where 10% of general population develops acute appendicitis with highest incidence in second and third decades of life.[2] Where delayed diagnosis of acute appendicitis and treatment has adverse outcomes, like perforation which lead to death, there are also high rates of negative appendectomies (NA), that is appendectomies in patients with false diagnosis of appendicitis.[3]

Negative appendectomies rate of over 20% were considered normal previously, however, this has changed during the past few decades.[4] Negative appendectomies have constantly posed great burden on

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the health care. With complications like incisional hernia, intestinal obstruction secondary to adhesion, and stump leakage, negative appendectomies lead to greater morbidity and mortality.[5]

Historically, pre-operative imaging was reserved for ambiguous cases based on supportive medical and physical examination.[6-8] However, with the increase in utilization of computed tomography (CT) scan in the diagnosis of acute appendicitis, the rates of negative appendectomies have been reduced along with its subsequent complications in the West.[1] Jones et al reported that there was a significant progressive decrease in the rate of negative appendectomies over the 3 years: 17% in 2000, 9% in 2001 and 2% in 2002 which coincided with progressive increase in the use of CT: 52% in 2000, 74% in 2001, and 86% in 2002.[8] Chooi WK et al showed a decrease in negative appendicectomy rates from 22.2% to 11.4% in without and with pre-op imaging with CT scan respectively.[9] Cusheri et al demonstrated that the prevalence of negative appendicectomy was 9.8% in patients who had no pre-op imaging as compared to 8.1% having a pre-op USG and 4.5% having a pre-op CT scan.[10] Park JH et al showed CT scan and ultrasonography utilization rates as an initial imaging modality to be 93.1% (92.0%-94.1%), and 6.5% (5.6%-7.6%), respectively and the NAR in patients undergoing CT only, complementary ultrasonography following CT, ultrasonography only, and complementary CT following ultrasonography to be 3.3% (2.6%-4.1%), 27% (14%-44%), 9% (4%-16%), and 8% (2%-20%), respectively.[11] Abdelhalim MA et al demonstrated negative appendicectomy rate of 18% when no pre-op CT scan was used as compared to 1% when pre-op CT scan was used.[12]

The role of preoperative imaging has extended beyond the mere diagnostic tool for acute appendicitis and has become vital in identifying those complicated cases that may be amenable to alternatives to immediate surgery.[13,14] In a country like Pakistan, where surgical intervention is not only costly but also not commonly available, the high rates of negative appendectomies and their complications adds insult to injury. The use of preoperative CT scan in diagnosis of acute appendicitis can significantly reduce the burden of such complications as well as the burden on healthcare. This study aims to determine the decrease in the rate of negative appendectomies attributed to the use of preoperative CT scan in patients suspected of acute appendicitis.

Material and Method

This Experimental study (Clinical Trial) study was conducted from October 2017 to March 2018 in Radiology department of Ziauddin University Hospital, Karachi, after approval from ethical committee. Total 116 patients presenting to the radiology department referred from emergency department of Ziauddin University Hospital, Karachi, with acute abdominal pain were assessed using Alvarado scoring system for the clinical diagnosis of acute appendicitis by primary attending surgeon were selected with patient s age ranging from 18 to 60 years. The mean age was 35.5 – 10 years of both genders. Patients with incidental appendectomy and pregnant patients were excluded from the study. Full history, clinical examination and laboratory investigations (Complete Blood Count along with ESR) were carried out.

Sample size is calculated using OpenEpi online sample size calculator (http://www.openepi.com/SampleSize/SSCohort.htm), considering the frequency of negative appendectomies of 18% for without pre-op CT scan[14] and 1% with pre-op CT scan,[14] and using 95% confidence interval with power of test at 80%. The total sample size came out to be 116 (58 in each group). Nonprobability consecutive sampling technique was applied to collect the samples.

All patients fulfilling the inclusion criteria and diagnosed as acute appendicitis on clinical grounds through Alvarado score of 7 or more, were offered pre-op CT scan (Toshiba 16 slicer CT scan) and informed consent was sought. Those patients who was agree and give consent for pre-op CT scan will placed in group A while those who were not give consent for pre-op CT scan were placed in group B. Patients in group A were subjected to computed tomography (CT scan) for the radiological diagnosis of acute appendicitis based on operational definitions, before going for appendectomy, whereas group B patients were proceed to appendectomy directly. Baseline labs and anaesthesia fitness shall be taken for both groups. After performing appendicectomy, the resected sample was then sent for histopathological examination to the same laboratory and examination conducted by an experienced pathologist.

Data was entered on a predesigned proforma. Proforma was include demographic features of the patients, Alvarado score, CT scan findings (if applicable), histopathology report and final outcome i.e. true or negative appendicectomy. Data was entered by an independent observer, who was not involved in the research process.

Bias was controlled by getting every CT scan done as per protocol of the radiology department and reporting done by an experienced radiologist and evaluation of histopathological findings by an experienced pathologist.

The data were entered and analyzed using SPSS version 20. Mean and standard deviation were calculated for all numerical variables like age, BMI, Alvarado score, while frequencies and percentages were calculated for all categorical variables like gender distribution, marital status, Alvarado score, radiological diagnosis of acute appendicitis (only for group A) and histopathological findings. Frequency of negative appendectomy (NAR) was calculated in both groups and chi-square test was used to compare frequency of negative appendectomy (NAR) between two groups. Statistical significance was taken at p-value less than 0.05. Stratification was done with regards to age and gender to control effect modifier. Chi-square test was applied to determine the effect of these on outcome variable and a p-value of less than 0.05 were taken as significant.

Results

One hundred sixteen patients met the inclusion criteria, the overall average age was 36.5 years with standard deviation 6.8 (range 18-60 years). The average age of patients in preoperative CT group was 34.8 years with standard deviation 6.7 (range 18-60 years) and average age of patients in without preoperative CT group was 38.4 years with standard deviation 7.5 (range 18-60 years).

The overall average BMI was 24.3 years with standard deviation 4.21. The average BMI of patients in preoperative CT was 24.98 years with standard deviation 5.26 and average BMI of patients in without preoperative CT was 25.1 years with standard deviation 76.2.

The overall average Alvarado score was 8.4 with standard deviation 2.3. The average Alvarado score of patients in preoperative CT was 9.1 with standard deviation 2.1 and average score of patients in without preoperative CT was 8.7 with standard deviation 2.0 in (Tab. 1).

30 (51.7%) patients were female and 28 (48.3%) were female in pre operative CT group, 22 (37.9%) patients were female and 36 (62.1%) were female in without CT group Overall Male participants were more than female.

The negative appendectomy rate was 6.9% in 4 patients with pre appendectomy CT and 19% in 11 patients without pre appendectomy CT (P- value 0.04) (Tab. 2).

(Fig. 1) of CT Fact (Axial and Coronal views) represents a blind ending dilated tubular structure in right iliac fossa arising from cecum with perifocal fat stranding consistent with appendicitis.

Stratification for negative appendectomy in both groups with regards to age, gender, marital status and BMI was done all results showed no significance results.

Variables	Groups	N	Mean ± SD
Age	Total	116	36.5 ± 6.8
	With CT	58	34.8 ± 6.7
	Without CT	58	38.4 ± 7.5
Body mass Index	Total	116	24.3 ± 4.21
	With CT	58	24.98 ± 5.26
	Without CT	58	25.1 ± 6.2
Alvarado Score	Total	116	8.4 ± 2.3
	With CT	58	9.1 ± 2.1
	Without CT	58	8.7 ± 2.0

Table 1: Descriptive statistics of study population

		Negative appendectomy		Total
		No	Yes	
Groups	With CT	54	4	58
		93.1%	6.9%	100.0%
	Without CT	47	11	58
		81%	19%	100.0%
Total		101	15	116
		87.1%	12.9%	100.0%

Table 2: Distribution and comparison of negative appendectomy in both groups P-value= 0.04 (Significant)

Figure 1: CT Fact shows dilated appendix (appendicitis) in right iliac fossa in axial and coronal views

Discussion

A retrospective study found the rate of negative appendectomy for 22.9%. A meta-analysis by Andersson has demonstrated that all clinical and laboratory variables are weak factors alone, but they can improve sensitivity in combination.[15] However, in our relatively large series we could find only four independent risk factors, which, if all present, could account for only 24% of cases.

The key point of proper patient care lies in a balance between the perforated appendicitis and the negative appendectomy. Delayed diagnosis is one of the main causes of perforated appendicitis. Physicians should be cautious of delaying surgery of AA since after 36 hours of untreated symptoms, the risk of perforation is increased to 5% every 12 hour period.[16] In our study, the time from the patients arrival to emergency room and diagnosis verification, transportation to operating theater differed twice between groups. Looking at this point, abdominal CT scan can reduce the time to diagnosis, which allows having correct diagnosis and decreases the chance of negative appendectomies.[17]

Studies showed that abdominal CT scans are relatively accurate and increase correct AA diagnosis up to 95%. Moreover, there is a possibility to increase correct diagnosis to 98% when abdominal CT scan is combined with physical examination.[18] Stroman et al. reported the negative appendectomy rate close to 15% with only abdominal CT scan results and without taking into consideration the patient s clinical picture.[17] As we see, abdominal CT scan can improve correct diagnosis, but there is still a need of physical examination. However, in the present study abdominal CT scan was only used for a small number of patients due to its costs. The abdominal ultrasound was used in most cases - 75%. The results indicated that inflamed appendix was seen in 16.5% of patients in group A. In our opinion, this has increased the number of negative appendectomies.

The Alvarado score and clinical diagnosis of appendicitis have remained relevant concepts.[19] Patients, who scored 3-6 points, with reference to Alvarado score, were more likely to have negative appendectomy. Although Alvarado score of less than 7 has been suggested to exclude AA, in our study there were 66.3% patients with inflamed appendix, who had Alvarado score of up to 7.[20] The lower negative appendectomy rate associated with preoperative CT at our institution is similar to others reported in the literature, with recent rates in the range of 1.7-11.4%.[21,22] The use of CT resulted in a 50% decrease in the negative appendectomy rate at one institution (11.4% with preoperative imaging vs 22.2% without). An even more substantial reduction in the negative appendectomy rate was observed in a multicenter study (6.6% vs 20.6%), which showed an inverse relationship between negative appendectomy rate and CT utilization.[23] Therefore, we would advise additional tests prior to operation, such as abdominal CT scan.

Conclusion

Acute appendicitis is still often misdiagnosed and the rate of negative appendectomies remains rather high. A high rate of negative appendectomy is caused by using solely clinical examinations to diagnose acute appendicitis. Additional investigations such as observation and abdominal CT should be used to prevent this.

Conflict of Interest: None

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