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Sensitivity and Specificity of CT scan Abdomen in diagnosing Appendicitis

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Abstract

Introduction: Appendicitis is one of the commonest surgical emergencies. Although diagnosis is straightforward in most of the cases but some of the cases it is challenging and imaging is needed to rule out other causes of right lower abdominal pain. This is especially important in female patients where uterine and ovarian pathologies can present in similar ways and it becomes mandatory to get imaging done to accurately diagnose the disease. Use of imaging not only helps in difficult cases to accurately identify the disease but is also now used liberally because of increasing medicolegal issues and in cases where patient wants to be quite sure of diagnosis before undergoing surgical intervention. While no imaging modality can 100 percent diagnose or exclude the diagnosis but these modalities combined with clinical and radiological adjuncts significantly improve diagnostic certainty

Aim: Use of radiology in diagnosing appendicitis is no more limited to complicated and dubious cases and is more often than past. The idea of conducting this audit was to see how frequently radiology is used in our department for diagnosis of acute appendicitis, what are the modalities used for diagnosis and what is the specificity and sensitivity of different radiological procedures for accurate diagnosis, the gold standard to compare being final histopathology of appendix.

Methods: Records of all patients who underwent appendectomy in Dubai Hospital, UAE from jan 2018 to jan 2019 were retrospectively analyzed using electronic record system. Clinical diagnosis and radiological findings were compared with histopathology as gold standard for negative appendectomy rate. The sensitivity and specificity of different radiological procedures was calculated as well.

Results: Total 165 patients underwent appendectomy in specified duration. CT scan was found to be 100% specific and 91.4% sensitive in diagnosing appendicitis while clinical diagnosis was accurate in 88.5% cases.

Keywords: Appendicitis; CT scan sensitivity for appendicitis; Imaging modalities for diagnosis of appendicitis

Introduction

Life time prevalence of acute appendicitis is attributed to be 7-8% [1]. Although there is great improvement in diagnosis and management over past few decades still it carries significant morbidity and mortality [2]. Prompt diagnosis followed by surgical removal of appendix is therefore necessary to prevent complications associated with delay such as perforation and

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peritonitis. Traditionally surgeons used to relay on clinical features and physical examination but over the past two decades, the use ultrasonography (US) and computed tomography (CT) techniques for the evaluation of patients suspected of having appendicitis has added valuable input to the accuracy of diagnosis [3].

The rate of negative appendectomy has significantly decreased by increased use of CT scan [4]. There are many types of CT SCN that can be used for diagnosis of appendicitis like CT scan abdomen and pelvis with contrast, FACT or limited CT scan of Right iliac fossa with rectal contrast. CT scan findings typical of appendicitis can demonstrate fat stranding around the wall, increased diameter, loss of air in appendicular lumen, appendicolith and thickened appendiceal wall. Similarly, free air, free fluid, abscess and phlegmon all are also signs of appendicular inflammation [5].

Before ordering CT SCN history, clinical examination and laboratory tests should point towards clinical diagnosis of appendicitis.

Most recent metanalysis comparing ultrasound and CT scan abdomen for diagnosis of appendicitis concluded that CT scan abdomen is much more sensitive and specific than ultrasound for diagnosing acute appendicitis [6]. Furthermore, CT SCAN abdomen with both iv and oral contrast is superior than CT scan with only iv contrast in diagnosing appendicitis [7]. Studies also showed that sensitivity and specificity of low and high dose CT area comparable [8]. Regardless of all while doing CT scan for diagnosis of acute appendicitis the benefits should be implemented at the cost of other factors such as radiation dose, timing and cost [9].

We did a retrospective audit to look for accuracy of CT scan abdomen and ultrasound in detecting appendicitis in patients undergoing appendectomy at general surgery department of Dubai Hospital, UAE for a duration of one year by comparing histopathology with radiological diagnosis. By corelating histopathological diagnosis with radiological diagnosis we hence calculated specificity and sensitivity of CT scan abdomen and ultrasound abdomen diagnosing appendicitis.

Materials and Methods

Setting: Department of General Surgery Dubai Hospital, UAE

Duration of Study: From Jan 2018 to Jan 2019

Sample Size: Total 165 patients who underwent appendectomy during the specified duration were included in audit.

Sampling Technique: Continuous sampling

Data collection: Medical records of all the patients were reviewed retrospectively using electronic medical records used in our hospital from jan 2018 to jan 2019.

Data analysis: All analysis will be conducted by using the Statistical package for social sciences (SPSS) version 24. p Value is used for changes in quantitative viable for significant changes and numbers and percentage are used for descriptive variables.

Results: Total 165 appendectomies were performed between Jan 2018 till Jan 2019.

Mean age was 23 years.

For sex data:

Table 1: Gender distribution in population.

Sex					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	107	64.8	64.8	64.8
	2	58	35.2	35.2	100
	Total	165	100	100	

Male patients in audit 107/165 – 64.8%

Female patients in audit 58/165 –35.2 %

Histopathological findings:

They were acute inflammation, acute supportive appendicitis, Tran's mural inflammation of appendix with or without fecalith and gangrenous perforated appendix. 8 cases of fibrous obliteration of lumen of appendix with neuroma of tip without inflammation reported.

Table 2: Histopathology findings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	137	83	83	83
	2	28	17	17	100
	Total	165	100	100	

137 out of 165 showed that its appendicitis i.e., 83%

28/165 showed negative appendectomy i.e., -17

CT scan findings:

CT scan abdomen and pelvis was done in 63.0% patients .

Us abdomen done in 5.4% cases

Imaging used over all in 68.4% cases

31.55 cases had clinical diagnosis.

Table 3: CT scan findings

CT scan findings					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	93	56.4	56.4	56.4
	2	11	6.7	6.7	63
	3	4	2.4	2.4	65.5
	4	5	3	3	68.5
	5	52	31.5	31.5	100
	Total	165	100	100	

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1. CT scan done and is positive for appendicitis – 93/165 – 56.4%
2. CT scan done and is negative ie normal appendix – 11/165 – 6.7%
3. Us done and showed appendicitis -4/165 -2.4%
4. Us done and showed normal appendix -5/165-3%
5. No image done /clinical diagnosis 52/165 -31.5%

Table 4: Comparison of CT SCAN findings with histopathology.

			Histopathology reports		Total
			1	2	
CT scan findings	1	Count	85	8	93
		% within CT scan findings	91.40%	8.60%	100.00%
	2	Count	0	11	11
		% within CT scan findings	0.00%	100.00%	100.00%
	3	Count	2	2	4
		% within CT scan findings	50.00%	50.00%	100.00%
	4	Count	4	1	5
		% within CT scan findings	80.00%	20.00%	100.00%
	5	Count	46	6	52
		% within CT scan findings	88.50%	11.50%	100.00%
Total		Count	137	28	165
		% within CT scan findings	83.00%	17.00%	100.00%

1. 91.4% of CT diagnosed patients have histologically proven appendicitis while 8.6% of CT diagnosed patients have negative appendectomy
2. All patients who had normal appendix on CT had normal appendix on histopathology as well. Sensitivity of CT scan is 91.4% while specificity is 100%.
3. All patients who had us done and it showed appendicitis out of all these patients 50% had histologically proved appendicitis and 50% had histologically negative appendix, ie sensitivity of us is 50% in detecting appendicitis.
4. Patients whose ultra sound showed normal appendix 80% of these patients had appendicitis on histopathology and 20% had normal appendix on histopathology specificity of us is 20%.
5. Patients with clinical diagnosis of appendicitis 88.5% of these patients had appendicitis on histopathology and 17% had normal appendix on histopathology.

Discussion

The incidence of taking normal appendix out is reduced to as low as 1.7–7%, which is attributed to increased use of computed tomography (CT) [10]. Routine use of CT is unnecessary for the diagnosis of appendicitis in male patients unless history is dubious, patient is at age where malignancy can be a possibility or history is prolonged and appendicular mass formation needs to be ruled out to prevent morbidity related to surgical intervention. On the other hand there is evidence now to treat mild appendicitis with antibiotics only and in that case CT may contribute to unnecessary surgery [11].

There is no doubt that since the advent of CT scan diagnostic accuracy has improved to a significant extent [12]. In light of this, in 2010 the Dutch College of Surgeons introduced a guideline entitled ‘‘diagnostics and treatment in acute appendicitis’’ which recommends pre-operative imaging in the diagnosis and treatment of acute appendicitis. The guideline mandates the use of either ultrasonography or CT SCAN for clinically suspeCTed appendicitis for accurate diagnosis before surgery [13].

CT scan can be of great help in female patients as Ovarian cysts, benign and malignant ovarian neoplasms, leiomyoma, endometriosis and pelvic adhesions can mimic appendicitis [14].

Our audit showed that Imaging was used over all in 68.4% cases while 31.55% cases had clinical diagnosis. CT SCAN was done in 63% cases while ultrasound was done in only 5.4% cases.

Moreover our audit showed that the type of CT SCAN used was not consistent and following types of different CT scans were used

CT kub 20/93, 21.5%

CT kub followed by CT with contrast 9/93, 5.4%

CT scan abdomen plain 12/93, 7.2%

CT scan abdomen with iv contrast 49/93, 52.6%

CT scan abdomen with iv and oral contrast 9/93,9.6%

Our results show that CT scan abdomen has 100% specificity in diagnosing appendicitis while sensitivity of CT scan is 91.4 % at the same time clinical diagnosis alone without help of imaging diagnosed 88% cases of appendicitis.

We used imaging in all female patients and male patients above 40 years. Imaging was also used in patients where history was not clear or history was 3 days or more to rule out appendicular mass.

Clinical diagnosis was made on basis of history and Alvarado score.

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The results on basis of this audit cannot be generalized as the number of patients are very small and there were no consistent guidelines for use of imaging (CT scan /ultrasound abdomen) further more even the CT scan abdomen was not done with one protocol some patients have plain some had with contrast so the results are biased.

Based on our audit results it can be concluded that CT SCAN is a better modality than ultrasound abdomen in detecting appendicitis. However, ultrasound can be used while CT scan is contraindicated but this is now also overcome by use of FACT which does not only avoids contrast but also uses less time as only limited view of right iliac fossa are scanned and gives better results.

It goes with out saying that clinical examination should always be kept superior than radiological diagnosis and management can be changed if clinically indicated regardless of CT scan findings.

When combined with history and physical examination is an excellent tool for diagnostic accuracy and should be performed in;

1. All female patients if no contraindications as other gynecological pathologies cannot be excluded without imaging.
2. Prolonged history or in case of palpable mass to rule out appendicular lump.
3. Patients more than 40 years of age or where personal or family history merits exclusion of malignancy.

Conclusion

Sensitivity and specificity of CT scan in diagnosing appendicitis is very high as per results from our institute (91.4% and 1005 respectively). However these results can not be generalized as all patients with histopathological diagnosis of appendicitis did not undergo CT scan as well as different protocols were used for performing CT scan based on patient's condition and radiologist preference some had plain abdominal CT scan, some had CT KUB while others have CT scan with contrast (some with oral and iv and others with iv only). Although literature review shows that use of different types of contrast enhancement versus non-enhancement as well as low dose and standard dose CT SCSN has very minimal effect on sensitivity and specificity of CT SCAN in diagnosing appendicitis.

As far as our institute is concerned the results of audit were discussed and the opinion of radiologist was that CT SCAN with oral and iv contrast is much more accurate than plain CT or CT with iv contrast only. Our institute also recommends use of oral contrast specially in thin patients as they have less fat and giving oral contrast enhances diagnostic accuracy.

Where there is no consensus for the use or no use of oral and iv contrast as well as different radiological doses in determining efficacy of CT SCAN abdomen for diagnosis of acute appendicitis but its use definitely increases to diagnostic accuracy when used sensibly along with clinical diagnosis.

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