

Visualization of Normal Appendix during Non-Contrast Renal CT Scan at King Hussein Medical Centre

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ABSTRACT

Objective: To evaluate the rate of visualization of normal appendix, its caliber and position among patients without history of prior surgery presenting to the Radiology Department for non-contrast renal CT scan in stone protocol.

Methods: A total of 125 patients with no history of appendectomy who underwent non-contrast computed tomography scan in stone protocol for evaluation of their renal colic between March and August 2011 were included in this study and their images were reviewed. Identification of normal appendix, its contents and location along with the adequacy of intraperitoneal fat were evaluated in both axial, coronal and sagittal planes.

Results: Normal appendices were visualized in 91.2% of cases. The most common location of appendiceal tip was paracolic, and the maximum outer diameter of the normal appendix ranged between 3 and 9mm (mean 5 ± 1.2 mm). Intraperitoneal fat was adequate in 71% of the cases.

Conclusion: Most of normal appendices are seen on non-enhanced Multi Detector Computed Tomography scan in stone protocol as identification of normal appendix is critical to exclude the diagnosis of acute appendicitis among patients with right sided abdominal pain.

Key words: Appendicitis, Computed Tomography, Normal appendix

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Introduction

The appendix was first described in the 16th century, and in 1886, Reginald Fitz described the term "appendicitis" and emphasized the need for early diagnosis and surgical intervention.⁽¹⁻³⁾ Acute appendicitis is the most common cause of acute abdominal pain with a lifetime risk reaches 7% and usually presents in a classical clinical feature in only 60% of cases and the diagnosis is usually based on clinical and laboratory findings except in atypical cases where imaging plays an important role especially ultrasonography (US) and computed tomography (CT).⁽⁴⁻¹⁰⁾

US is widely available, inexpensive and mobile

with no need for patient preparation and has no ionizing radiation with reported sensitivity between 76-94%.^(2,9) According to a study by Rioux, the detection of normal appendix on US safely rules out appendicitis, however, the negative US scan does not exclude the diagnosis.^(9,11) Magnetic Resonance Imaging (MRI) is also used in cases of suspected appendicitis especially in pregnant women due to lack of ionizing radiation with good reported visualization rate reaching 78%.⁽¹²⁾

With the introduction of multi detector CT (MDCT) technology, visualization of normal appendix was improved as the spatial resolution

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Table I: Appendiceal tip position among the study group

Position	No.	%
Paracolic	51	45
Retrocecal	11	10
Pelvic	16	14
Midline	36	31
	114	100

Table II: Appendiceal contents

	No.	%
Air	43	38
Different contents (Fluid, Faecal matter)	69	60
Appendicolith	2	2

becomes higher and with the ability to evaluate the appendix by multiplanar reformation images.^(4,13) The rate of visualization of normal appendix ranges from 43% to 91%, with few studies found in the literature addressing this issue.^(14,15)

Several studies show that lack of visualization of appendix on CT reliably excludes the diagnosis of acute appendicitis especially in the absence of secondary inflammatory signs and the visualization of normal appendix suggests a normal scan.^(14,16,17)

The aim of this study was to evaluate the rate of visualization of normal appendix, its position, content, caliber and the presence or absence of adequate intraperitoneal fat at King Hussein Medical Centre (KHMC).

Methods

This study was conducted at the Radiology Department at King Hussein Medical Centre between March and August 2011. A total of 125 patients were included in this study, 81 were males and 44 females. The age range was (11-67 years) with median age 46 years. All patients had symptom and signs of urinary tract calculi and presented to the Radiology Department for evaluation of renal colic by non-contrast CT scan in stone protocol. Patients with previous history of appendectomy or who had clinical suspicion of acute appendicitis were excluded from this study.

Examinations were performed using 16-slice MDCT scanner (GE light speed, GE Medical Systems, Milwaukee, Wis.) and 64-slice MDCT scanner (Brilliance, Philips Medical Systems, Cleveland, Ohio). Renal stone protocol included a frontal scout view at 70 KVp and 30 mA, followed by 5-mm slice thickness helical scan from the diaphragm down to symphysis pubis. Scan parameters included: 120 KVp, 250 mA, collimation 0.6 mm, pitch 1, and table speed of 50-mm per rotation. Axial images were

reconstructed at 3mm thickness with a 1.5mm increment. Neither oral nor intravenous contrast materials were used.

Reconstructed images reviewed using Picture Archiving and Communicating System (PACS) workstation (IMPAX, Agfa Healthcare, Ridgefield, NJ) and interpretation of images done with axial, coronal and sagittal planes by two experienced radiologists.

The position of caecum was identified with the localization of ileocaecal junction, and then the appendix was identified if visualized. The appendix was interpreted as visualized or non-visualized and its thickness was measured from the area of maximum caliber. The presence of intraluminal air and appendicolith was recorded and the locations of the tip of appendix relative to the caecum were described as paracolic, midline, pelvic and retrocecal. The adequacy of intraperitoneal fat was considered as adequate if fat completely surrounds the caecum.

Results

Among patients included in this study, 114 normal appendices were visualized (91.2%). Normal appendix was seen on axial images alone in 110 scans and in four cases confident visualization required coronal and sagittal reformation images. The tip of appendix was most commonly located in paracolic position (45%), followed by midline position (31%). In 14% of cases the position was pelvic and retrocecal in 10% as shown in Table I.

Intraperitoneal fat was described as adequate in 89 patients (71%), and inadequate in 36 patients (29%). The luminal contents of visualized appendices included air in 43 patients, fluid and faecal matter in 69 patients (Fig. 1 & 2). In two cases calcified appendicolith were demonstrated (Table II). The maximum outer diameter of the normal appendix ranged between three and nine mm (mean 5 ± 1.2 mm) and in 85% of cases the outer diameter was greater than 5mm.



Fig. 1: Normal appendix

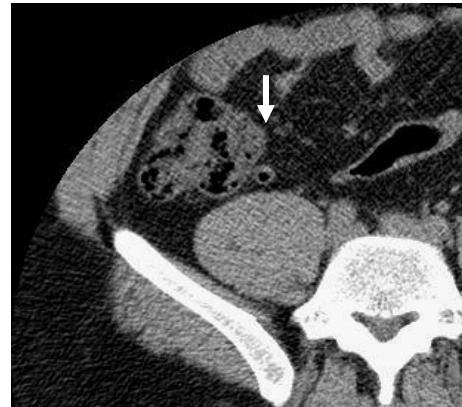


Fig. 2: Air filled appendix

Discussion

Appendix is a blind-ended tubular structure arising from postero-medial aspect of the caecum with average length 8 cm and variable location of its tip. The pathogenesis of acute appendicitis is luminal obstruction leading to distension, venous and lymphatic congestion with subsequent bacterial invasion of the wall.^(18,19)

Puylaert was first to describe ultrasonographic features of acute appendicitis in 1986, with US being the imaging modality of choice in cases of suspected appendicitis until late 1990's when CT scan became the most imaging modality used in adults with suspected appendicitis with high accuracy rate.^(19,20) On CT, appendix is seen as thin-walled tubular structure, collapsed or filled with gas or fluid and surrounded by fat. CT criteria of acute appendicitis include thick appendix, periappendiceal fat stranding and wall diameter greater than 6-7mm along with calcified appendicolith.^(18,21,22) The rate of visualization is directly related to age, as it increases with age, probably due to an increase in intra abdominal fat.⁽²³⁾

This study showed a high visualization rate compared to other studies which is attributed to the use of multiplanar reformates and patient selection regarding age group and appears comparable to the results of other studies.⁽²⁴⁾

Only two cases with appendicolith were described in this study which is explained by patients older age group as the presence of appendicolith in children is associated with perforated appendicitis and found in 65% of cases with acute appendicitis, while in adults it is seen less commonly (28%) and can be seen in symptomatic and asymptomatic adults.^(25, 26) In view of results of this study, we recommend

routine scanning for normal appendix when reporting non contrast renal CT scan.

Limitation of our study

The limitation includes lack of surgical correlation as there was no documented pathological report of normal appendix.

Conclusion

Most of normal appendices should be seen on non-enhanced MDCT scan as identification of normal appendix is critical to exclude the diagnosis of acute appendicitis among patients with right sided abdominal pain.

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