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Assessing the Impact of the Amount of Contrast Material used in Abdominal CT Examinations for the Diagnosis of Appendicolith

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Abstract

Aim: The aim of the present study was to investigate the impact of the amount of contrast material used in abdominal CT examinations regarding the diagnosis of appendicolith.

Methods: This was a cross-sectional study that was performed in the Department of Radiology to evaluate the diagnostic value of the CT examination in patients with acute appendicitis. One hundred patients that met the inclusion criteria entered the study using census method. Demographic data of patients including age, gender were obtained.

Results: In 70 cases, CT scans indicated acute appendicitis, and post-appendectomy pathology supported the diagnosis. CT scan patients had 5 false positives and 8 false negatives. Patients exhibited retrocecal appendixes and decreased peritoneal fat on CT scans. CT scans with minimal clinical suspicion had 88.6% sensitivity, 82.8% specificity, 95.5% positive predictive value, and 78.2% negative predictive value based on pathology findings. We analyzed CT and ultrasonography by patient gender.

Conclusion: If acute appendicitis, nephrolithiasis, or ureterolithiasis is suspected, this research advises an abdominal CT using the following methodology. The CT treatment should begin with a low-dose pelvic CT scan of the cecum without contrast. Next, have a second CT scan with oral and IV contrast.

Keywords: Acute appendicitis; Appendicoliths; Nephrolithiasis; Computed Tomography (CT); Contrast material

Introduction

Emergency rooms see many cases of abdominal discomfort from acute appendicitis. Acute uncomplicated and complex appendicitis are epidemiologically and clinically separate disease entities[1] therefore supporting the assumption of a different mechanism and illness course. Most situations (70–80%) are simple. The incidence of simple acute appendicitis has been falling, but the incidence of complex acute appendicitis has remained pretty stable over time.[2] Evidence from recent randomized trials[3-7] and meta-analyses[8-10] have demonstrated that individuals with uncomplicated acute appendicitis may be treated safely and effectively with antibiotics. The latest 5-year findings further support the assumption that antibiotic therapy alone is a safe alternative to appendectomy for uncomplicated acute appendicitis even at long-term follow-up.[11] In addition, antibiotic treatment for uncomplicated acute appendicitis is linked with large cost savings[12] possibly having a major influence on total health care expenditures depending on the prevalence of acute appendicitis.

The data from the medical record of the patient is usually utilized for the clinical diagnosis (e.g. positive symptoms of appendicitis, psoas sign in the physical examination, fever and increased inflammatory levels in lab tests). If a clear diagnosis of appendicitis has not been obtained following the findings of the physical examination, anamnesis, lab tests and transabdominal ultrasonography (U/S) (and having eliminated the possibility of pregnancy), a Computed Tomography (CT) examination of the abdomen should be conducted. This is particularly important

for individuals with atypical appendicitis or probable perforation.[13] From the aforementioned description, radiological imaging may be essential for appendicitis diagnosis. In the event of suspected appendicitis, the amount of the effective CT dosage employed in both the unenhanced and contrast-enhanced CT scans is crucial. Hence, they do not properly define contrast material–enhanced CT exams, which are routinely employed in CT imaging.

Contrast medium administration is utilized in CT to improve greater picture quality. If the person can repair DSB double-strand breaks, DNA repair follows.[14] However that technique likely applies to both unenhanced and iodine-enhanced CT tests. Therefore, the influence of iodine supplementation on radiation exposure is meaningful in spite of the physiological and physiologic intricacies of cellular impacts. It's important to characterize contrast medium dose's impact on individual patients.

Hence, studying the influence of the quantity of contrast material utilized in abdominal CT exams regarding the diagnosis of appendicolith.

MATERIALS AND METHODS

This was a cross-sectional study that was performed in the Department of Radiology, Gouri Devi Institute of Medical Sciences and Hospital, Durgapur , West Bengal, India to evaluate the diagnostic value of the CT examination in patients with acute appendicitis. One hundred patients that met the inclusion criteria entered the study using census method. Demographic data of patients including age, gender were obtained.

Inclusion and exclusion criteria

Inclusion criteria include patients with the acute abdominal pain between the ages of 15 to 65 years that referred to the emergency department (ED). Also, written informed consent was obtained from the patients. Exclusion criteria were determined, including patients with age below 15 years and more than 65 years, symptoms less than 72 hours, immunocompromised patients, and patients with other diseases.

Clinical findings

The Alvarado score was initially used to diagnose acute appendicitis (Table 1). In the majority of investigations, a score of 1-4 rules out acute appendicitis, while a score of 7 or higher confirms the diagnosis. With a score of 5-6, the patient can be watched and may require further testing. In the current study we entered the patients with Alvarado score ≥ 7.[15]

Imaging protocol

A radiologist performed abdominal ultrasonography on all patients. Following ultrasonography, if a tentative diagnosis was made, treatment was initiated. The diagnostic criteria for appendicitis on ultrasonography were a dilated distal appendix measuring more than 6 mm in diameter with additional positive findings, including abscess, echogenic peri-appendicular fat, appendicolith, hyperemic appendiceal walls, or pericecal fluid, which was diagnostic of appendicitis. The ultrasonography report was read as negative, positive, or not visualized for acute appendicitis.

If the results of the ultrasonography were negative or unclear, a CT scan was performed using oral contrast. The radiologist reported the results of the CT scan. The diagnostic criteria for appendicitis on a CT scan were an appendix with a diameter greater than 6 mm and additional positive findings on a CT scan, such as cecal wall thickening, abscess, peri-appendicular fat stranding, appendicolith, or phlegmon, were considered diagnostic for appendicitis. The radiologist studied the CT data and deter- mined whether it was positive or negative for appendicitis. Finally, all CT scan data were reevaluated by an experienced radiologist and compared to the patient's final diagnosis in the case of surgery and pathology results.

Table 1: The Alvarado score for acute appendicitis[15]

Score	
Symptoms	
Migratory of pain	1
Anorexia	1
Nausea and vomiting	1
Signs	

Tenderness in RLQ	2
Rebound tenderness	1
Elevation of temperature > 37.3°C	1
Laboratory	
Leukocytosis	2
Shift to the left	1
Total	10

RESULTS

Table 2: The relationship of CT scan results and negative and positive appendectomy

Variables		**Appendectomy**		P Value
		Positive	Negative	
CT Scan				
	Positive	70 (93.34)	5 (6.66)	< 0.001
	Negative	8 (32)	17 (68)	

In 70 patients, the CT scan findings were favorable for acute appendicitis, and the diagnosis was confirmed by the post-appendectomy pathological testing. Among the individuals undergoing CT scans, 5 false positive and 8 false negative results were recorded. The CT scan revealed that the patients had reduced peritoneal fat as well as a retrocecal appendix. It appears that the anatomical position of the cecum and appendix and the lack of adequate fat around the cecum and appendix contributed to the absence of acute appendicitis symptoms and the occurrence of false-negative results. These patients may benefit from a more thorough assessment with the use of a CT scan with contrast material injection.

Table 3: Sensitivity, specificity, positive and negative predictive values of CT scan and ultra- sonography for diagnosis of appendicitis based on the pathological findings

Variables	CT Scan
Specificity	82.8%
Sensitivity	88.6%
Positive predictive value	95.5%
Negative predictive value	78.2%

The sensitivity, specificity, positive and negative predictive value of CT scans based on pathology results were 88.6%, 82.8%, 95.5%, and 78.2%, respectively, in patients with low clinical suspicion. We evaluated the CT scan and ultrasonography based on the gender of patients.

DISCUSSION

Acute appendicitis has a lifetime incidence frequency of approximately 7%. The annual incidence ranges from 96.5 to 100 incidences per 100,000 adult population worldwide, with adolescents and children facing the highest risk.[16] The most prevalent cause of emergency abdominal surgery is acute appendicitis, which must be differentiated from other sources of abdominal pain.[17] Perforation and inflammatory mass may complicate the diagnosis in 2-10% of cases when it is delayed.[18] Acute appendicitis is diagnosed using a history and physical examination, laboratory testing, and imaging.[19] With these diagnostic techniques, it is anticipated that more than 90% of patients can be diagnosed with acute appendicitis quickly and accurately, including premenopausal women for whom gynecologic diseases can mimic appendicitis and elderly patients for whom appendicitis can present with unusual clinical symptoms such as lack of leukocytosis, generalized instead of localized abdominal pain.[20]

In 70 patients, the CT scan findings were favorable for acute appendicitis, and the diagnosis was confirmed by the post-appendectomy pathological testing. Among the individuals undergoing CT scans,

5 false positive and 8 false negative results were recorded. The CT scan revealed that the patients had reduced peritoneal fat as well as a retrocecal appendix. The sensitivity, specificity, positive and negative predictive value of CT scans based on pathology results were 88.6%, 82.8%, 95.5%, and 78.2%, respectively, in patients with low clinical suspicion. We evaluated the CT scan and ultrasonography based on the gender of patients. The most frequent cause of emergency abdominal surgery globally is appendicitis, which is characterized as inflammation of the vermiform appendix. It is still difficult for emergency physicians and surgeons to make a clinical diagnosis of acute appendicitis.[18] As a result, imaging modalities have taken on a far more significant role in the diagnostic work-up of patients who may have acute appendicitis.[21] Both CT and ultrasonography have been shown to be useful in diagnosing cases of suspected acute appendicitis.[22] The decision between ultrasonography and CT is determined by avail- able competence and institutional preference.[18] Ultrasonography is also frequently used for appendicitis diagnosis due to its widespread availability, portability, cost-effectiveness, and lack of ionizing radiation.[23]

In 2022, Naidu and others[24] conducted a study on 200 patients to compare ultrasonography abdomen and CT scan for the diagnosis of acute appendicitis. In comparison to abdominal ultrasonography, they discovered that CT scan diagnosis of acute appendicitis had great- er sensitivity, positive predictive value, and a negative appendectomy. Despite this, they highly recommend that CT scans be used to review all negative ultrasonography results to rule out acute appendicitis, even though they are far faster to conduct and spare most patients from ionizing radiation and contrast. A "first-pass" strategy using ultrasonography first and subsequently CT, if the ultrasonography is not diagnostic, may be preferable to balance test performance with adverse effects and ED patient throughput times. . In another study[25], 69 and 18 patients were evaluated by ultrasonography and CT scan, respectively. In this study, it was discovered that CT scanning can alter the treatment plan in uncertain situations, minimize hospital stay duration and expenses, decrease the complication rate and negative laparotomy rate, and decrease conversion to open surgery. Also, the researchers thought that a CT scan (rather than ultrasonography) was a better way to detect and manage acute appendicitis and its consequences.

CONCLUSION

If acute appendicitis, nephrolithiasis, or ureterolithiasis is suspected, this research advises an abdominal CT using the following methodology. The CT treatment should begin with a low-dose pelvic CT scan of the cecum without contrast. Next, have a second CT scan with oral and IV contrast. We recommend an extra check to detect appendicoliths, which may predict appendiceal perforation.

REFERENCES

1. Livingston EH, Fomby TB, Woodward WA, Haley RW. Epidemiological similarities between appendicitis and diverticulitis suggesting a common underlying pathogenesis. Archives of Surgery. 2011 Mar 1;146(3):308-14.
2. Livingston EH, Woodward WA, Sarosi GA, Haley RW. Disconnect between incidence of nonperforated and perforated appendicitis: implications for pathophysiology and management. Annals of surgery. 2007 Jun;245(6):886.
3. Hansson J, Körner U, Khorram-Manesh A, Solberg A, Lundholm K. Randomized clinical trial of antibiotic therapy versus appendicectomy as primary treatment of acute appendicitis in unselected patients. Journal of British Surgery. 2009 May;96(5):473-81.
4. Salminen P, Paajanen H, Rautio T, Nordström P, Aarnio M, Rantanen T, Tuominen R, Hurme S, Virtanen J, Mecklin JP, Sand J. Antibiotic therapy vs appendectomy for treatment of uncomplicated acute appendicitis: the APPAC randomized clinical trial. Jama. 2015 Jun 16;313(23):2340-8.
5. Svensson JF, Patkova B, Almström M, Naji H, Hall NJ, Eaton S, Pierro A, Wester T. Nonoperative treatment with antibiotics versus surgery for acute nonperforated appendicitis in children: a pilot randomized controlled trial.
6. Styrud J, Eriksson S, Nilsson I, Ahlberg G, Haapaniemi S, Neovius G, Rex L, Badume I, Granström L. Appendectomy versus antibiotic treatment in acute appendicitis. a prospective multicenter randomized controlled trial. World journal of surgery. 2006 Jun;30:1033-7.
7. Vons C, Barry C, Maitre S, Pautrat K, Leconte M, Costaglioli B, Karoui M, Alves A, Dousset B, Valleur P, Falissard B. Amoxicillin plus

clavulanic acid versus appendicectomy for treatment of acute uncomplicated appendicitis: an open-label, non-inferiority, randomised controlled trial. The Lancet. 2011 May 7;377(9777):1573-9.
8. Harnoss JC, Zelienka I, Probst P, Grummich K, Mueller-Lantzsch C, Harnoss JM, Ulrich A, Buechler MW, Diener MK. Antibiotics versus surgical therapy for uncomplicated appendicitis: systematic review and meta-analysis of controlled trials (PROSPERO 2015: CRD42015016882). Annals of surgery. 2017 May 1;265(5):889-900.
9. Poprom N, Numthavaj P, Wilasrusmee C, Rattanasiri S, Attia J, McEvoy M, Thakkinstian A. The efficacy of antibiotic treatment versus surgical treatment of uncomplicated acute appendicitis: Systematic review and network meta-analysis of randomized controlled trial. The American Journal of Surgery. 2019 Jul 1;218(1):192-200.
10. Sallinen V, Akl EA, You JJ, Agarwal A, Shoucair S, Vandvik PO, Agoritsas T, Heels-Ansdell D, Guyatt GH, Tikkinen KA. Meta-analysis of antibiotics versus appendicectomy for non-perforated acute appendicitis. Journal of British Surgery. 2016 May;103(6):656-67.
11. Salminen P, Tuominen R, Paajanen H, Rautio T, Nordström P, Aarnio M, Rantanen T, Hurme S, Mecklin JP, Sand J, Virtanen J. Five-year follow-up of antibiotic therapy for uncomplicated acute appendicitis in the APPAC randomized clinical trial. Jama. 2018 Sep 25;320(12):1259-65.
12. Sippola S, Grönroos J, Tuominen R, Paajanen H, Rautio T, Nordström P, Aarnio M, Rantanen T, Hurme S, Salminen P. Economic evaluation of antibiotic therapy versus appendicectomy for the treatment of uncomplicated acute appendicitis from the APPAC randomized clinical trial. Journal of British Surgery. 2017 Sep;104(10):1355-61.
13. Karul M, Berliner C, Keller S, Tsui TY, Yamamura J. Imaging of appendicitis in adults. InRöFo-Fortschritte auf dem Gebiet der Röntgenstrahlen und der bildgebenden Verfahren 2014 Apr 23 (pp. 551-558). © Georg Thieme Verlag KG.
14. Löbrich M, Rief N, Kühne M, Heckmann M, Fleckenstein J, Rübe C, Uder M. In vivo formation and repair of DNA double-strand breaks after computed tomography examinations. Proceedings of the National Academy of Sciences. 2005 Jun 21;102(25):8984-9.
15. Awayshih MMA, Nofal MN and Yousef AJ. Eval- uation of Alvarado score in diagnosing acute appendicitis. Pan Afr Med J 2019; 34: 15.
16. Di Saverio S, Podda M, De Simone B, Ceresoli M, Augustin G, Gori A, Boermeester M, Sartelli M, Coccolini F, Tarasconi A, De' Angelis N, Weber DG, Tolonen M, Birindelli A, Biffl W, Moore EE, Kelly M, Soreide K, Kashuk J, Ten Broek R, Gomes CA, Sugrue M, Davies RJ, Damaskos D, Leppäniemi A, Kirkpatrick A, Peitzman AB, Fraga GP, Maier RV, Coimbra R, Chiarugi M, Sganga G, Pisanu A, De' Angelis GL, Tan E, Van Goor H, Pata F, Di Carlo I, Chiara O, Litvin A, Campa- nile FC, Sakakushev B, Tomadze G, Demetrash- vili Z, Latifi R, Abu-Zidan F, Romeo O, Segovia- Lohse H, Baiocchi G, Costa D, Rizoli S, Balogh ZJ, Bendinelli C, Scalea T, Ivatury R, Velmahos G, Andersson R, Kluger Y, Ansaloni L and Cat- ena F. Diagnosis and treatment of acute ap- pendicitis: 2020 update of the WSES Jerusalem guidelines. World J Emerg Surg 2020; 15: 27.
17. Krzyzak M, Mulrooney SM. Acute appendicitis review: background, epidemiology, diagnosis, and treatment. Cureus. 2020 Jun 11;12(6).
18. Moris D, Paulson EK, Pappas TN. Diagnosis and management of acute appendicitis in adults: a review. Jama. 2021 Dec 14;326(22):2299-311.
19. Podda M, Pisanu A, Sartelli M, Coccolini F, Damaskos D, Augustin G, Khan M, Pata F, De Simone B, Ansaloni L, Catena F. Diagnosis of acute appendicitis based on clinical scores: is it a myth or reality?. Acta Bio Medica: Atenei Parmensis. 2021;92(4).
20. Pogorelić Z, Domjanović J, Jukić M, Poklepović Peričić T. Acute appendicitis in children younger than five years of age: diagnostic challenge for pediatric surgeons. Surgical infections. 2020 Apr 1;21(3):239-45.
21. Depetris MA, Chamorro EM, Sanz LI, Merino JA, Cuellar ER, Nacenta SB. The usefulness and positive predictive value of ultrasonography and computed tomography in the diagnosis of acute appendicitis in adults: a retrospective study. Radiología (English Edition). 2022 Nov 1;64(6):506-15.
22. Fu J, Zhou X, Chen L, Lu S. Abdominal ultrasound and its diagnostic accuracy in

diagnosing acute appendicitis: a meta-analysis. Frontiers in Surgery. 2021 Jun 28;8:707160.

23. Hoffmann JC, Trimborn CP, Hoffmann M, Schröder R, Förster S, Dirks K, Tannapfel A, Anthuber M, Hollerweger A. Classification of acute appendicitis (CAA): Treatment directed new classification based on imaging (ultrasound, computed tomography) and pathology. International Journal of Colorectal Disease. 2021 Nov;36(11):2347-60.
24. Zisman A, Novi B, Gaughan J, Carr L. Factors affecting utilization of CT scan following ultrasound evaluation of suspected appendicitis. Journal of Osteopathic Medicine. 2022 Mar 3;122(6):313-8.
25. Karul M, Berliner C, Keller S, Tsui TY, Yamamura J. Imaging of appendicitis in adults. InRöFo-Fortschritte auf dem Gebiet der Röntgenstrahlen und der bildgebenden Verfahren 2014 Apr 23 (pp. 551-558). © Georg Thieme Verlag KG.