MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2021.6.147.150

Imaging of Acute Appendicitis in Children: A Systematic Meta Analysis

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ABSTRACT

When children come to the emergency room for a surgical consult it is many a times difficult to elicit a proper history, as the result of the agonising pain makes it difficult Ultrasound is the most common modality that is used in the outpatient in case of abdominal pain Therefore, the aim of this study was to do a meta-analysis to see the role of imaging in acute appendicitis in children with the purpose to see the sensitivity, specificity and diagnostic odds ratios of US, CT and MRI as imaging modalities after initial US for assessing acute appendicitis in children. A meta analytical study was done. A trough search of the literature was in Med line with the aim to recognize those articles that had either a clinical follow up, surgical or histopathological confirmation following imaging. The assessment of the quality of articles done by the use of Quality Assessment of Diagnostic Accuracy Studies-2 and the Standards for Reporting of Diagnostic Accuracy tools. For studies of children, the number of studies and patients were as follows: US, six studies and 548 children., CT, nine studies and 1498 children., MRI, five studies and 287 patients. it is very useful to use CT and MRI as second line imaging modalities when in doubt of diagnosis, they have a greater accuracy to USG have comparable and high accuracy in helping to diagnose appendicitis in children.

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Key Words
Appendicitis, children , US, CT, MRI

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Received: 20 September 2021
Accepted: 27 November 2021
Published: 30 December 2021

Citation: Prashanth G. Patil, 2021. Imaging of Acute Appendicitis in Children: A Systematic Meta Analysis. Res. J. Med. Sci., 15: 147-150, doi: 10.36478/makrjms. 2021.6.147.150

INTRODUCTION

Acute abdomen is the most widespread surgical complaint that is seen across all ages that present to the emergency room[1]. When children come to the emergency room for a surgical consult it is many a times difficult to elicit a proper history, as the result of the agonising pain makes it difficult[2]. Both Streptococcus milleri and Bacteroides fragilis, however, have been implicated in the pathogenesis of appendicitis by increased isolation rates in acute inflammation[3]. In adults anaerobic bacteria are more commonly found in than aerobic bacteria in acute inflammation and anaerobic bacteria, in particular Bacteroides species, have been quantified in acutely inflamed and normal appendices[4,5]. In terms of epidemiology., the cases of appendicitis constitute a third of all the cases who get hospitalized with the acute surgical abdomen in children[6,7]. The estimated incidence of appendicitis in children is found to be around 8.67 percent for the male child and 6.7% for percent for the female child[6]. The disease tends to occur in a higher rate in the older children and the adolescent age group with just over a third of all cases diagnosed with appendicitis being <18 years of age with the peak being around 11-12 years of age[8-11]. Appendicitis is caused by a blockage of the hollow portion of the appendix. This is most commonly due to impacted fecal matter which is referred to as fecolith[12-14]. Inflamed lymphoid tissue from a viral infection, parasites, gallstone, or tumors may also cause the blockage[12-14]. Obstruction leads to bacterial overgrowth which leads to an increase in intra luminal pressure which obstructs the blood flow and leads to congestion and ischemia in the appendix allowing the bacterial translocation and infection resulting in the inflammation of appendix[12-14]. The standard treatment for acute appendicitis is surgical removal of the appendix[15]. Antibiotics may be equally effective in certain cases of non-ruptured appendicitis[16,17]. Most often the diagnosis is a delayed presentation either because of the parents ignoring it to be a result of intestinal or worm colic and trying home remedies, or the treating pediatrician mis diagnosis it to be due to some other cause as often rebound tenderness may be difficult to be elicited. In children still the use of routine ultrasound for abdominal pain is not done and it also contributes to the delay in diagnosing children affected with appendicitis as a cause of abdominal pain[18-20]. In this meta analytical article we are planning to review the role imaging in acute appendicitis in children.

MATERIALS AND METHODS

This meta-analysis was complied with the Preferred Reporting Items for Systematic reviews and Meta-Analysis guidelines[21]. For our meta analysis we thoroughly searched the data bases from January 2018 till January 2022. We reached OVID, MEDLINE and Other Non-Indexed Citations. The following search terms were used to appendicitis, appendectomy, USG, ultrasound, computed tomography and magnetic resonance imaging . At first , the relevant studied were screened by exploring their abstracts. Once chosen those that were available as full texts for a fee download were chosen and further analyzed. We chose only those articles that had full texts available in English . We did not do any manual search of articles l, additional records and reference lists Article Selection Criteria for inclusion of articles were as follows: (a) the prospective article that evaluated the diagnostic accuracy US, CT and/or MRI for assessing acute appendicitis., (b) for alls imaging is compulsory., (c) all should have either a surgical or histopathological correlation (d) the article should have either consisted of children (≥18 years). Exclusion were case reports or series, review articles, pictorial essays, letters to editors, unpublished data, conference abstracts and proceedings on the topic of interest Statistical Analysis Interclass correlation coefficients were calculated for assessment of underwater agreement on scores on the meteorologic and reporting quality of articles. Statistical analysis was performed by using statistical software SPSS version 23.

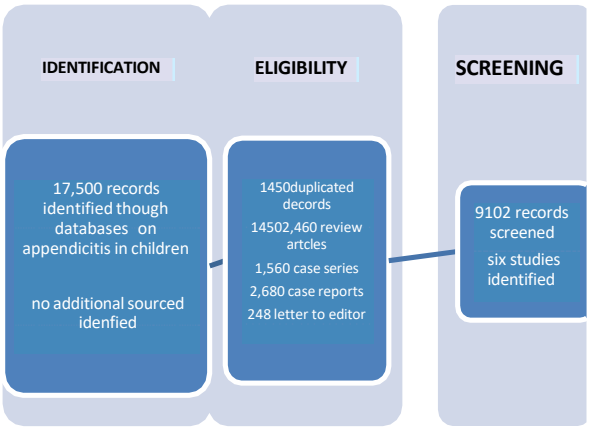

Fig. 1: Showing Flow Chart of Selection Studies for Meta Analysis

RESULTS AND DISCUSSIONS

We noted that there were 9102 records screened five studies identified[22-26] were chosen that met the search criteria. reported on CT, one study on ultrasound imaging alone and one studydescribed ultrasound imaging, ultrasonography with conditional CT (CT after negative or inconclusive ultrasound imaging) and MRI. Raza Mushtaq[22] on 402 pediatric patients noted sensitivity, specificity and accuracy of MRI was 97.9%, 99% 95% and 98.8% Anupam B Kharbanda[23] on 2,300 pediatric patients noted that there was no cost benefit for using ct over USG results provide support for US as the primary imaging modality for appendicitis. James D. Cov[24] on 528 pediatric patients noted that there

Sensitivity and specificity of MRI for appendicitis were 96.4% and 98.9%, respectively. Positive and negative predictive values were 91.2% and 99.6%. Ubaidullah khan[25] on 223 pediatric patients noted that 192 (sensitivity 86%, PPV 96%) were diagnosed by ultrasound. The histopathology of 8 was normal (3.6%), CT done in 11 and three was normal. The negative appendectomy rate was 3.6%. Komanchuk, Jelena[26] on 223 pediatric patients noted negative-predictive values for MRI were 94.9% 93.5, 90.2%, 96.7%. Based on currently available evidence, ultrasonography, CT, MRI alone, or a combination ultrasound imaging and CT (conditional CT) have limitations in discriminating between complicated and uncomplicated appendicitis. Imaging cannot reliably rule out a complicated presentation of acute appendicitis in need of urgent surgery, as a sensitivity of 90 per cent does not appear to be reached and there is high heterogeneity between studies. With respect to ruling in complicated appendicitis, CT seems to reach a specificity above 90 per cent but still is not perfect and ruling in is considered less important. In the absence of comparative studies, no head-to-head comparisons could be made between imaging techniques or strategies[27]. In a meta-regression comparing low-dose with normal-dose radiation CT, no significant difference that caused the heterogeneity in CT studies was found. Diagnostic accuracy was worse in prospective studies, which is important as these are the closest to daily clinical practice[28].

Recommendations: Given to above finding.

Funding: Nil.

Conflict of interest: There was no conflict of interest.

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