



**ESTIMATING THE SENSITIVITY, SPECIFICITY AND PREDICTIVE VALUE OF
ULTRASONOGRAPHY FOR SUSPECTED APPENDICITIS IN PEDIATRIC POPULATION,
COMING FOR ULTRASONOGRAPHY IN RADIOLOGY DEPARTMENT OF RAJENDRA
INSTITUTE OF MEDICAL SCIENCES (RIMS) IN RANCHI JHARKHAND.**

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ABSTRACT

Background Appendicitis is a common problem in Indian scenario specifically I children upto 14 years. Often they present in the OPDs as pain abdomen with or without vomiting and fever. Generally in most health centers either primary, secondary or tertiary the investigation of choice is Ultrasonography. Though the investigation is fairly capable of detecting Appendicitis or an inflamed appendix in majority there are enough instances where it fails to pick up the inflamed appendix. Keeping this gap in mind we in the radiology department decided to track coming pediatric population with suspected appendicitis for determining the efficacy of Ultrasonography for diagnosing Appendicitis

Methodology the present cross sectional observational study was done over a period of six months starting from Jan 2017 to June 2017 in the radiology department. A total of 128 cases were included. All suspected cases for appendicitis were included after consent from the parents. Cases who were not willing to participate and who were not admitted were excluded from the study. Once the USG was done patients, were tracked for the final outcome be it Surgery /Discharge or clinical confirmation based on the Discharge ticket. Axial Diameters largest >6mm on USG were considered to be diagnosed as Appendicitis .The findings thus found were compared with surgical and pathological findings and in cases where there was no surgery Discharge diagnoses was taken as the final diagnosis.

Results Appendix was identified in 65% (83)/128 of suspected cases . The overall sensitivity was 88.89% (95% CI 65.29% to 98.62) ,specificity 89.23 % (95% CI 79.06% to 95.56%) , Positive Predictive Value 69.57% (95% CI 52.70% to 82.42%) , negative predictive value 96.67 % (95% CI 88.67% to 99.08%) accuracy 89.16% (95% CI 80.41% to 94.92%) .

Conclusion With a fairly high accuracy Ultrasonography is choice of imaging for pediatric population presenting with suspected appendicitis and can help in preventing the morbidity due to appendicitis in children.

KEYWORDS :

Introduction: Acute appendicitis in children is often the most common emergency presenting in tertiary or other health care set ups which require surgical intervention more often at the earliest as delay in appropriate treatment might lead to appendicular perforation, leading to devastating complications like abscess, peritonitis, and partial bowel obstruction which can incur morbidity. Evidence suggests pediatric populations have a higher rate of perforation compared with adults. (1,2,3) . Under these circumstances it is but obvious, that apart from clinical acumen a fairly accurate diagnostic tool will help the treating physicians immensely to arrive at a conclusive treatment modality. Compounding the problem is the fact that classic signs and symptoms are generally found in only 70% of cases and the younger children are often having problems in communicating their symptoms accurately with an absent omental barrier and difficulty in examination (4,5,6) .

While choosing investigation to aid in management radiation hazard is also a major concern in pediatric age group which makes us to choose Ultrasonography. Ultrasonography (**USG**) is the imaging modality of choice in cases of suspected appendicitis across all age groups with an accuracy of 78%. (7)

Data from India suggest increase in the occurrence of appendicitis across the age group of 10-17 years. While the accuracy in Indian conditions had been assigned to same levels of 75%-80% in studies. (5, 6) Local data pertaining to Jharkhand is not available regarding the accuracy and benefits of the USG modality particularly among the pediatric age group. With an aim to generate evidence regarding these this study was undertaken.

Objectives of the study

To determine the sensitivity, specificity, positive predictive value

and accuracy of the USG in pediatric age group up to 14 years coming to attend the Rajendra Institute of Medical Sciences Radiology Department with suspected appendicitis .

Methodology

The present study was undertaken in the Department of Radiology after approval from IEC. The study period was from January 2017 to June 2017. Abdominal sonograms performed at the radiology department by radiologist for evaluation of acute appendicitis were reviewed, totaling to 128 USG. Patients included were children with age 0-14 years. Patients with history of appendectomy were excluded from the analysis.

The sonography thus obtained were retrospectively classified as - **Positive** if appendices were identified and had maximal outer diameter (MOD) >6mm. **Negative** if appendices were identified and had maximal outer diameter (MOD) <6mm and **non-visualized** appendix. The findings of USG was compared with surgical pathological findings for cases undergoing surgery. A negative diagnosis was confirmed on the basis of treatment for conditions other than appendix.

In case , the child was discharged with final diagnosis " **other diagnosis/not appendix**" but on the USG that child met the criterion "**Positive**" that child was categorized as false positive . All those cases where criterion Positive was met and the pathological results too confirmed the diagnosis as Appendix they were termed as **true positive**. **False negatives** were those where the USG criterion termed them as **Negative** but such cases either underwent surgery for appendectomy or on pathological exam they were found to be having appendicitis. **True Negatives** were those children where the USG criterion put them in Negative and no appendix was found on pathological exam or they were discharged

with diagnosis other than appendicitis. Data thus obtained was analysed using MS excel . Evaluation was done using standard statistical measure ; mean , standard deviation and chi square along with using the standard calculation for Sensitivity , specificity and other diagnostic values .p value of <.05 was considered to be of statistical significance.

Results

In our study we found majority of the children in the age group of 5-9 years (45%), with a mean age of 7.27±4.02 . (Table1) In our study we found 83 USGs (65%) in which we could visualize appendix out of 128 records reviewed. Out of those 83 USGs we further were able to classify 23 positives and 60 negatives. This gave us the diagnostic values of USG for all 83 USGs as Sensitivity88.89% with 95% CI (65.29% to 98.62%), Specificity89.23% with 95% CI (79.06% to 95.56%) Positive Predictive Value 69.57% with 95% CI (52.70% to 82.42%) Negative Predictive Value 96.67 % with 95% CI (88.67% to 99.08%) and an Accuracy of 89.16% with 95% CI (80.41% to 94.92%) (Table 2 and 3).

Age In Completed Years	Frequency	Percentage
1	11	8.6 %
2	12	9.4 %
3	7	5.5 %
4	4	3.1 %
5	14	10.9 %
6	12	9.4 %
7	4	3.1 %
8	11	8.6 %
9	13	10.2 %
10	5	3.9 %
11	10	7.8 %
12	12	9.4 %
13	4	3.1 %
14	9	7 %
Total	128	100 %

Males 65

Females 63

Mean Age 7.27

Standard Deviation 4.02

Table 1. Age (In completed years for the USG scans Reviewed in all suspected appendicitis children)

USG	Appendicitis		
	Yes	No	Total
Positive	16 (True Positive)	7 (False Positive)	23
Negative	2 (False Negative)	58 (True Negative)	60
	18	65	83

Table 4 Ultrasound findings and final diagnosis in all patients in whom Appendix was visualized on pathology or who underwent surgery for appendicitis (n=25)

Diagnostic Test Values		95% CI Intervals
Sensitivity	88.89%	65.29% to 98.62%
Specificity	57.14%	18.41% to 90.10%
Disease prevalence	72.00%	50.61% to 87.93%
Positive Predictive Value	84.21%	69.06% to 92.72%
Negative Predictive Value	66.67 %	31.81% to 89.56%
Accuracy	80.00%	59.30% to 93.17%

Table 5 Test Diagnostic Values using the standard formulas for calculating Sensitivity, specificity, accuracy etc.

Discussion

In old children and young adults appendicitis is a fairly common abdominal emergency (8) . In our study too we could see the numbers for cases on the rise as age increases from 5 completed years onwards. MENTRELS (Pain Migration , Anorexia, Vomiting and Nausea, Tenderness in Right Iliac Fossa, Rebound tenderness) score

≥ 5 relies purely on clinical signs to diagnose the appendicitis with a fair amount of diagnostic value across all age groups with PPV 93% and NPV 83.6% (9) but as said earlier children present with more difficulties for one to rely purely on MENTREL score . In our study we found appendix with USG in 65% of cases this is line with quoted wide range of identification ranging from 24.4% to 82% (10,11) . The criterion chosen to categorize USG findings as positive or negative based on the largest MOD>6mm was based on recent articles suggesting this to have highest specificity and sensitivity (12) .

In our study we had Negative Predictive value for all patients of 96.67 % which is similar to other available evidence (13), implying the clinical diagnostic importance. However this value of NPV fell to 66.67% for surgical patients implying the importance of USG as a good screening tool. This is also reported by other studies done in similar age group. (14).

Conclusion

We found in our study that USG remains a viable and reliable option for screening in Paediatric patients coming in health care facilities across our resource limited setting, for screening in all suspected cases of appendicitis . Though USG can not be used as definitive diagnostic imaging modality . If USG in not conclusive observation or other available modalities including CT should be used for reducing complications ,mortality or morbidities associated along with .

Limitations

The study was done without considering the real clinical scenario of the patient in a retrospective manner . With larger studies done concurrently the understanding regarding Appendicitis in pediatric population can be done in a better way .

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