International Journal of Medical Science and Education

An official Publication of Association for Scientific and Medical Education (ASME)

Original research Article

THE DIAGNOSIS OF ACUTE APPENDICITIS BY ULTRASONOGRAPHY IN PREGNANT AND NON-PREGNANT WOMEN: A COMPARATIVE STUDY

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Received:* 20*/05/2017 ***Revised:* 02*/09/2017*** ***Accepted: 16/09/2017***

ABSTRACT

Objective: To investigate whether the diagnosis of acute appendicitis by ultrasonography is affected by pregnancy or not. **Material & Methods**: In the present study a total of 50 pregnant and 150 non-pregnant women were included. After taking detailed history, clinical examination and hematological investigation was done as mentioned in Performa. The patients were divided into two groups according to whether they were pregnant or not during the surgery: group I, pregnant women, and group II, non-pregnant women. **Results:** The mean age of group I (pregnant women) and group II (non-pregnant women) was 28.29±5.63 and 29.09±6.47, respectively. In group I, 28 patients were diagnosed on USG as appendicitis and the histopathology showed 32 out of the 50 patients had confirmed inflammation either acute suppurative or complex form. The accuracy, sensitivity and specificity of USG in the diagnosis of appendicitis were found to be 92%, 100% and 81.8% respectively. In group II, 135 patients were diagnosed on USG as appendicitis and the histopathology showed 132 out of these 145 patients having an appendix with confirmed inflammation either acute suppurative or complex form. The accuracy, sensitivity and specificity of USG in group II were 98%, 97.7% and 100% respectively. **Conclusion:** Although the diagnosis of appendicitis in pregnant women is not delayed, but careful assessment of these patients suspected of having appendicitis should be encouraged when USG examination is normal or nondiagnostic.

KEYWORDS: appendicitis, pregnancy, ultrasonography, diagnosis.

INTRODUCTION:

Appendicitis is the most familiar non-obstetric surgical emergency during antenatal period, occurring in 1 in 1,000 deliveries reported by a large cohort study including 7,114 pregnant mothers with appendicitis (1). The diagnosis of appendicitis during antenatal period is challenging and it is reported that 25 to 50% of pregnancy had incorrect preoperative diagnosis for many reasons (2). Due to the sign & symptoms such as nausea, vomiting, loss of appetite and mild-lower abdominal pain are frequent in the normal pregnancy duration and also in acute appendicitis episode, it is rational to facilitate the early diagnosis and treatment (3).It has been also reported that any delay in diagnosis of acute appendicitis will finally result in complications like perforation or peritonitis, which is associated with high rates mortality, miscarriage, early delivery and fetal loss (4). In spite of the propensity to late diagnosis of acute appendicitis during antenatal period, it has reported up to 23% of false positive appendectomy rate (5). Nevertheless, a recent study stated that higher incidence of adverse

obstetric outcomes were reported amongst pregnant mothers with negative appendectomy (6). Ultrasonography (USG) is a non-invasive and comparatively less expensive diagnostic procedure, along with it does not expose the patient to radiation, and also it has reported to have high sensitivity and specificity of 86 and 81% for the early diagnosis of acute appendicitis (7). There are conjectures that the anatomical and physiological changes due to the gravidity, makes the diagnosis of acute appendicitis in pregnant mothers more difficult than in non-pregnant. The present study was to explore whether the detection of appendicitis is affected by pregnancy or not by the use of USG as an imaging procedure among pregnant and non-pregnant women.

MATERIALS & METHODS

The present study was conducted in our tertiary care hospital after obtaining approval from the institutional ethics committee. We retrospectively analyzed and reviewed all the medical record of pregnant mothers aged between 18-45 years who underwent appendectomy, during period of 5 years. Non-pregnant women were taken as controls for the pregnant group after obtaining written consent. Matching was done in both groups for age and reproductive period. The patients having chronic appendicitis and also who had undergone appendectomy during any intra-abdominal surgery were excluded from the study. The USG used as diagnostic procedure for appendicitis or normal/ unvisualized (nondiagnostic). Negative appendectomy considered in cases if resected appendix did not show any histologically proven inflammation. The data were analyzed using MS Excel 2010, Epi Info v7 and SPSS v22.

RESULTS

In the present study a total of 50 pregnant and 150 non-pregnant women who were consent for the study underwent appendectomy for being suspected of having appendicitis during the study period in our hospital. During this time, an overall incidence of appendicitis in pregnant women was 0.58%. The mean age of group I (pregnant women) and group II (non-pregnant women) was 28.29±5.63 and 29.09±6.47, respectively, it was not statistically significant. The total leukocyte count was statistically significant ($p=0.008$) in the non-pregnant group (13.68±4.08) than in the pregnant group (12.24±5.02). Among 50 patients in group I, 32 (64%) women had histologically proven appendicitis, of whom 22 (44%) had acute suppurative appendicitis and 10 (20%) had complex appendicitis. In group II, 132 out of 150 (88%) non-pregnant women had histologically proven appendicitis with a negative appendectomy rate of 2% (n=3). A hundred and four (102) women in group II had acute appendicitis and 30 women had complex appendicitis. This difference between two groups was highly statistically significant. The ultrasound examination was used as initial diagnostic modality for all patients in group I and II. There was a statistically significant rate of non-visualized appendix vermiformis on USG in the pregnant group compared with the non-pregnant group ($p < 0.001$). The USG findings and histopathology results of both pregnant and non-pregnant patients were examined and compared. In group I, 28 patients were diagnosed on USG as appendicitis and the histopathology showed 32 out of the 50 patients had confirmed inflammation either acute suppurative or complex form. The accuracy, sensitivity and specificity of USG in the diagnosis of appendicitis were found to be 92%, 100% and 81.8% respectively. In group II, 135 patients were diagnosed on USG as appendicitis and the histopathology showed 132 out of these 145

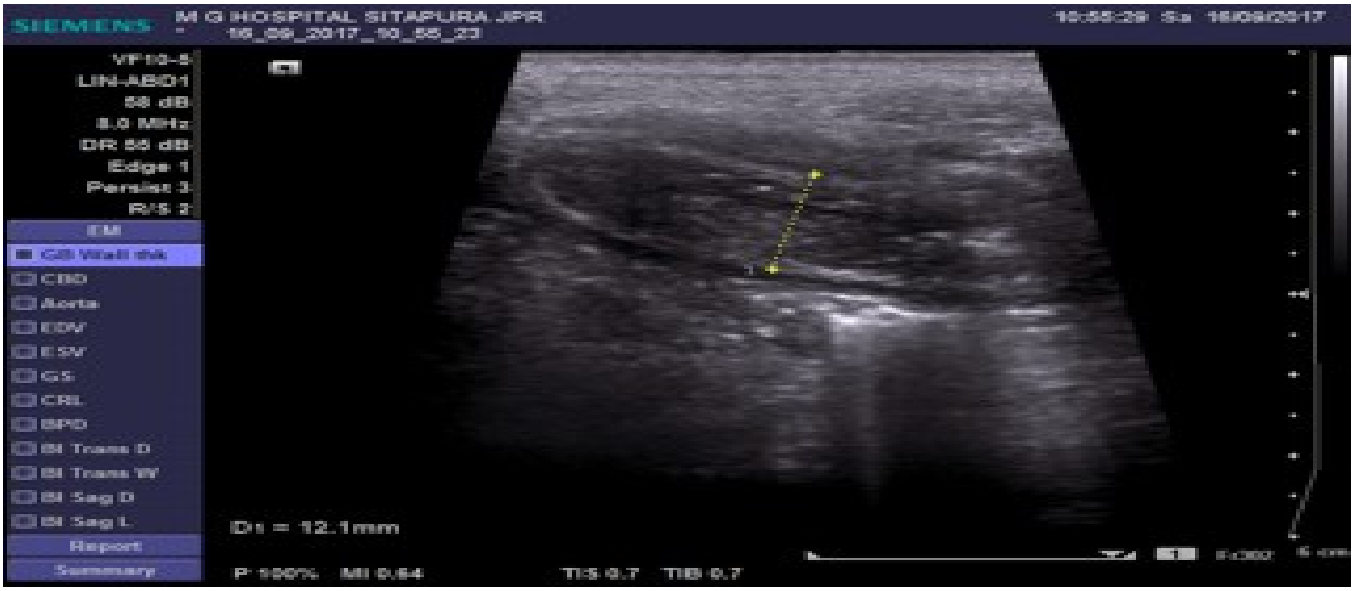
patients having an appendix with confirmed inflammation either acute suppurative or complex form. The accuracy, sensitivity and specificity of USG in group II were 98%, 97.7% and 100% respectively. (Table 2).

Table No.-1: diagnostic variables of pregnant and non-pregnant women who underwent appendectomy

USG results	Group I, pregnant (N=50)	Group II, non-pregnant (N=150)	p-value
Non-visualized/ normal, n (%)	22(44%)	15(10%)	<0.001
Acute appendicitis, n (%)	28(56%)	135(90%)	
Pathology results			
Normal, n (%)	18(36%)	18(12%)	<0.001
Acute appendicitis, n (%)	22(44%)	102(68%)	
Complex appendicitis, n (%)	10(20%)	30(20%)	

Table No.-2: Comparison of diagnostic accuracy of USG for appendicitis in pregnant and non-pregnant women undergoing appendectomy

		Pregnant (USG)		Non-pregnant (USG)	
		Normal	Inflammation	Normal	Inflammation
Pathology	Normal	18	0	15	03
	Inflammation	04	28	0	132
	Accuracy	92%		98%	
	Sensitivity	100%		97.7%	
	Specificity	81.8%		100%	



DISCUSSION

Appendicitis in pregnancy is associated with increased maternal mortality and morbidity along with fetal loss, abortion, and preterm birth. Early diagnosis of appendicitis is demanding and reported to be often erroneous during pregnancy (8). According to recent reports, it was shown high fetal and maternal complications in cases of complex appendicitis. It was also reported that pregnancy may hamper the early diagnosis, since anatomical and physiological changes associated with pregnancy masks the diagnosis (9).

In context to elaborate this, we conducted study among pregnant and non-pregnant women who underwent appendectomy for the suspected appendicitis. It is hypothesize that the diagnosis of appendicitis in pregnancy is delayed due to several factors such as nausea and vomiting as well as loss of appetite, which are presenting symptoms in both situations; the characteristic right lower quadrant pain seen in appendicitis, which is mask by pregnancy due to the upward and laterally shift of the appendix as the uterus grows and also leukocytosis, which is an important laboratory finding of appendicitis during pregnancy (10).

In our study, it was found that USG has the accuracy; sensitivity and specificity in the diagnosis of appendicitis were found to be 92%, 100% and 81.8% respectively in the pregnant women, respectively. However, the accuracy, sensitivity and specificity of USG in group II (non-pregnant women) were 98%, 97.7% and 100% respectively. The difference between our two groups was highly statistically significant (p value < 0.001). Hence the accuracy of ultrasonography is higher in non-pregnant women group than pregnant women group when diagnosing the acute appendicitis. Our study results show that when USG was confirmative for acute appendicitis, there is no need for further diagnostic test is required; however, if USG results are normal or negative, further clinical assessment and laboratory investigations should be done. It was also reported that USG has a high probability of non-visualization of the appendicitis during pregnancy. Similar study conducted by Aggenbach et al. in 2015, reported that 21 pregnant patients who underwent appendectomy, 75% of non-visualized appendix on USG (5). Present study results were inconsistent with the above stated study, since

we found non-visualized appendix in only 44% of the pregnant patients, less than the reported data. However, when comparing both the groups the non-visualization rate of appendix on USG, we observed that it was much higher in the pregnant women group than in the non-pregnant women group, which was statistically highly significant (p value <0.001). This was possibly related to the altered anatomic position of the appendix, enlarged and upward shift of uterus with viable fetus, overlying bowel gas, and experience of the investigator.

In present study we found other than women with negative appendicitis, there was 20% of the pregnant women had complex appendicitis. Several studies have reported that the higher negative appendectomy rates in pregnant women were associated with increases the risk of fetal loss and maternal mortality. Similar results were found in a study conducted by McGory et al. reported a negative appendectomy rate of 23% among pregnant women group compared to 18% in non-pregnant women group (11). In contrast to present study results Ito et al. reported that the negative appendectomy rate in the pregnant group was relatively higher than in the non-pregnant group and also statistically significant (36% *vs*. 14%; p<0.001) (12).

In contrary to present study Wallace et al. reported the negative appendectomy rates among pregnant women suspected of having appendicitis and compared them, 54% among who were clinically evaluated, 36% among who underwent ultrasonographic evaluation and 8% among who underwent CT evaluation. They also reported a significant decrease in negative appendectomy rate in the ultrasound/CT group compared to clinical evaluation group (8% *vs*. 54%, p<0.05) (13). The length of hospital stay of pregnant women who underwent appendectomy was not-surprisingly statistically longer than of the non-pregnant women, which may be related with the further evaluation of pregnant women in the obstetric unit with additional medical investigations and treatments which results into prolonged hospital stay. The main limitation of present study was characteristically attributable to its retrospective character and the data reviewed from medical records, hence may have some missing loose points because of manual record keeping. Also, we had small sample size which may limit interpretation of some of the outcomes to generalize then on general population. Another limitation is inter-observer bias means different radiologists evaluated the patients even though they all were experienced. The strength of present study may be attributed to this fact that it was conducted in a tertiary care hospital and it was a single centric study.

CONCLUSION

We concluded in the present study, there was no delay in the diagnosis of appendicitis among pregnant women group compared with non-pregnant women group. The present study shows that ultrasonography examination has a high diagnostic accuracy for acute appendicitis but low compared compared with non-pregnant women group. In order to avoid any lag in the accurate and timely diagnosis of acute appendicitis in pregnant women, other imaging modalities and histopathology with further clinical assessments should be kept in mind even if USG examination is negative for appendicitis.

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