

APPENDICITIS IN PREGNANCY: CLINICAL PRESENTATION AND PERINATAL OUTCOME

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ABSTRACT

Objective: to determine the clinical presentation and maternal and perinatal outcomes associated with appendicitis in pregnancy.

Methods: a retrospective chart review was conducted of women who underwent appendectomy during pregnancy between 1980 and 1994 at the Grace Maternity Hospital (GMH), Halifax, Nova Scotia. Presenting clinical characteristics, operative findings and maternal and perinatal outcomes were evaluated. Comparisons were made between patients with confirmed appendicitis and those with negative laparotomy. Fisher's exact and Rank sum tests were used for statistical analysis.

Results: among the 81,487 completed pregnancies during the study period there were 21 women who underwent appendectomy for suspected appendicitis. Appendicitis was confirmed by pathological evaluation in 14 patients (1 in 5,821) and nine of these (64%) were complicated by appendiceal perforation. The negative laparotomy rate was 33 percent. Presenting clinical characteristics were similar in patients with proven appendicitis and those with negative laparotomy. There were two perinatal losses (PMR = 9.5%), one associated with preterm birth and the other related to operative complications. The preterm birth rate associated with appendicitis was 36 percent. Patients with appendiceal perforation had a higher preterm birth rate (56%), longer hospital stay and increased incidence of postoperative complications.

Conclusions: appendicitis in pregnancy is complicated by a high perforation rate due to the atypical presentation and delayed diagnosis. Appendiceal perforation is associated with poor maternal and perinatal outcomes. Prompt diagnosis and early intervention are essential to improve pregnancy outcome.



RÉSUMÉ

Objectif : préciser les manifestations cliniques et les résultats maternels et périnataux associés à l'appendicite durant la grossesse.

Méthodes : on a fait une revue rétrospective des feuilles de température des femmes qui ont subi une appendicectomie durant la grossesse, de 1980 à 1994, au Grace Maternity Hospital (GMH) de Halifax, en Nouvelle-Écosse. On a évalué les caractéristiques des manifestations cliniques, les observations durant l'intervention et les résultats maternels et périnataux. On a comparé les patientes ayant eu une appendicite confirmée à celles ayant subi une laparotomie négative. On a fait l'analyse statistique au moyen des tests de la méthode exacte et du rang des sommes de Fisher.

Résultats : sur les 81 487 grossesses menées à terme pendant la période de l'étude, 21 femmes ont subi une appendicectomie à la suite d'une appendicite soupçonnée. L'évaluation pathologique a confirmé l'appendicite chez 14 patientes (1 sur 5 821) et 9 d'entre elles (64 %) ont été accompagnées de perforations appendiculaires. Le taux de laparotomie négative était de 33 pour cent. Les caractéristiques des manifestations cliniques étaient semblables chez les patientes ayant eu une appendicite confirmée et celles ayant subi une laparotomie négative. Il y a eu deux pertes périnatales (TMP = 9,5 %), l'une associée à une naissance prématurée et l'autre à des complications durant l'intervention. Le taux de naissances prématurées associées à l'appendicite était de 36 pour cent. Les patientes ayant souffert d'une perforation appendiculaire ont connu un taux plus élevé de naissances prématurées (56 %), des séjours hospitaliers plus longs et une incidence accrue de complications postopératoires.

Conclusions : l'appendicite durant la grossesse est compliquée par un taux élevé de perforations à cause des manifestations atypiques et des diagnostics tardifs. La perforation appendiculaire est associée à des résultats maternels et périnataux négatifs. Un diagnostic précoce et une intervention rapide sont des conditions essentielles à une réduction des conséquences indésirables sur la grossesse.

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KEY WORDS

Pregnancy, appendicitis, appendiceal perforation, preterm birth.

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INTRODUCTION

Appendicitis is the most common surgical complication of pregnancy, accounting for two-thirds of all gastrointestinal conditions requiring laparotomy.¹ The reported incidence (1 in 1,500 pregnancies) is similar to that for non-pregnant women of reproductive age.¹⁻⁵ Although appendicitis was believed to occur more commonly in the second trimester, it has been reported with equal frequency in all trimesters.^{1,2,4,5} Accurate diagnosis is more likely to be made in the first trimester.^{2,4}

Because of the physiological and anatomical changes in pregnancy, the diagnosis of appendicitis can be difficult. The classic clinical criteria of nausea and vomiting, anorexia, right lower quadrant pain and leucocytosis may be confused with other non-specific conditions of pregnancy. This often leads to a delay in diagnosis and treatment which may be associated with poor maternal and perinatal outcomes. This study was undertaken to review the regional experience with appendicitis in pregnancy with

the following objectives: 1) to identify the presenting clinical characteristics associated with appendicitis in pregnancy; and 2) to determine the effects of appendicitis on maternal and perinatal outcomes.

METHODS

All women who underwent appendectomy in pregnancy from 1980 to 1994 at the Grace Maternity Hospital (currently Women's and Maternity Site, IWK Grace Health Centre) were identified through the H. B. Atlee Perinatal Database (currently the Nova Scotia Atlee Perinatal Database). The H. B. Atlee Perinatal Database contained information on all hospital births at the Grace Maternity Hospital after 1980. During the study period, the Grace Maternity Hospital provided primary and tertiary perinatal care to the Halifax metropolitan area of approximately 350,000 people and a regional population of about one million. On average there were approximately 5,500 deliveries per year.

Maternal and neonatal charts were reviewed to obtain clinical details including: presenting symptoms and signs; laboratory findings; time interval between admission and laparotomy; operative findings; and maternal and perinatal outcomes. Comparisons were made between patients with confirmed appendicitis and those with negative laparotomy. Statistical analysis was performed using Fisher's exact and Rank sum tests where indicated, and significance was defined as $p \leq 0.05$.

RESULTS

Between 1980 and 1994, 23 pregnant women underwent appendectomy. All pregnancies evaluated were greater than 20 weeks gestation, as the Grace Maternity

Hospital provided obstetrical care only. Surgical complications of pregnancy occurring prior to 20 weeks were managed by the gynaecology services of two general hospitals. The mean gestational age at which appendectomy was performed was 28 weeks; 12 cases (52%) in the second trimester and 11 (48%) in the third trimester. The mean age of the study group was 26 years, with a range of 16 to 34 years.

Twenty-one of the women who underwent appendectomy had a pre-operative diagnosis of suspected appendicitis. Two appendectomies were performed at the time of laparotomy for other indications. One patient with active Crohn's disease underwent laparotomy for fetal distress and was found to have an intra-abdominal abscess. Another patient who underwent laparotomy for a suspected pelvic mass was found to have a dermoid cyst which had undergone torsion. Of the 21 patients with suspected appendicitis, 14 (67%) were confirmed to have appendicitis by histological criteria. The incidence of appendicitis in pregnancy after 20 weeks gestation during the 15-year study period was one in 5,820. Appendiceal perforation was diagnosed in nine (64%) of these women at the time of laparotomy. Seven patients who underwent laparotomy were found to have normal appendices by pathological evaluation.

There was no difference in the presenting clinical characteristics between patients with confirmed appendicitis and those with negative laparotomy (Table 1). The majority of patients with suspected appendicitis had either generalized abdominal pain (100%) or right lower quadrant tenderness (75%) to palpation. The degree of leukocytosis was not helpful in making the diagnosis of appendicitis.

Two patients with appendicitis were assessed elsewhere and discharged home. The median time interval between admission and laparotomy was one day (range 1 to 5 days). Eighteen patients (86%) underwent laparotomy within one day while three patients (14%) were observed for more than one day.

Perinatal outcomes are shown in Table 2. There were two perinatal losses. One neonatal death resulted from a preterm delivery at 24 weeks gestation following laparotomy for an appendiceal

TABLE 1 PRESENTING CLINICAL CHARACTERISTICS

	Negative Laparotomy (n=7)	Appendicitis (n=14)
Abdominal pain	7 (100%)	14 (100%)
Nausea/vomiting	6 (86%)	14 (100%)
Median duration of symptoms (days)	6	2
Delay in referral	0	2 (14%)
Abdominal tenderness		
RUQ	0	2 (14%)
RLQ	6 (86%)	9 (64%)
generalized	1 (14%)	3 (21%)
Peritoneal signs	2 (29%)	7 (50%)
Fever (37.5 to 39°C)	4 (57%)	8 (57%)
Leucocytosis		
>11	6 (86%)	13 (93%)
>15	3 (43%)	7 (50%)
left shift	4 (57%)	9 (64%)

TABLE 2 PERINATAL OUTCOME

	Negative Laparotomy (n = 7)	Appendicitis		
		Perforated (n = 9)	Non-perforated (n = 5)	Total (n = 14)
Preterm birth	2 (29%)	5 (56%)	0	5 (36%)
Acute fetal distress	0	2 (22%)	0	2 (14%)
5 min Apgar score <7	0	1 (11%)	0	1 (7%)
NICU admission	1 (14%)	3 (33%)	2 (40%)	5 (36%)
Mean hospital stay (days)	3	10*	9*	
Perinatal mortality	1 (14%)	1 (11%)	0	1 (7%)

* $p < 0.05$ Rank sum test.



	Negative Laparotomy (n = 7)	Appendicitis		
		Perforated (n = 9)	Non-perforated (n = 5)	Total (n = 14)
Mean hospital stay (days)	6	12*	6	9
Wound infection	0	4 (44%)	0	4 (29%)
Post-operative fever	0	3 (33%)	1 (20%)	4 (29%)
Tranfusion	1 (14%)	1 (11%)	0	1 (7%)
Post-operative bleed	1 (14%)	0	0	0

*p<0.05 Rank sum test.

abscess. The other perinatal loss was an intra-uterine fetal death at 28 weeks gestation associated with a postoperative intra-abdominal bleed after a negative laparotomy. The perinatal mortality rate (PMR) associated with appendicitis was 7.1 percent (1/14), and the PMR associated with laparotomy for suspected appendicitis was 9.5 percent (2/21). The preterm birth rate associated with appendicitis was 36 percent, while that following negative laparotomy was 29 percent. The preterm birth rate associated with appendiceal perforation was even higher (56%), accounting for all the preterm deliveries in patients with confirmed appendicitis.

Maternal outcomes are shown in Table 3. There were no maternal deaths. Patients with appendiceal perforation experienced increased postoperative morbidity, including longer hospital stay (p=0.02) and a higher incidence of wound infection and postoperative fever.

DISCUSSION

The reported incidence of appendicitis in pregnancy is one in 1,500.^{1,6} The incidence in this series was lower, but this may be explained by the fact that only pregnancies complicated by appendicitis diagnosed after 20 weeks gestation were included. The incidence of appendicitis in pregnancy is believed to be similar to that in non-pregnant women of reproductive age. Although it had been suggested that the occurrence of appendicitis was greater in the second trimester, more recent evidence indicates that its frequency is similar in each trimester.^{1,2,4}

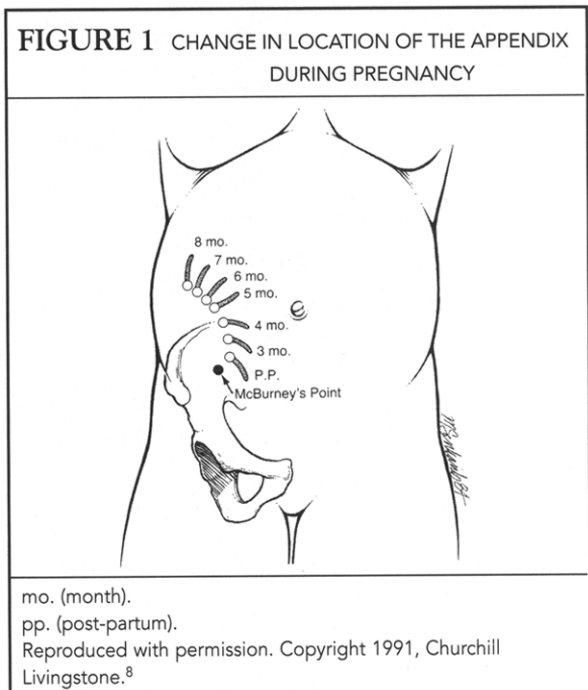
The diagnosis of appendicitis in pregnancy may be difficult, due to the normal physiological and anatomical changes in pregnancy. The classic features of appendicitis,

including right lower quadrant abdominal pain, anorexia, nausea and vomiting and leucocytosis, may not be as useful as these findings are common, non-specific complaints of pregnancy, particularly in the first trimester. Anorexia and/or nausea and vomiting occurring after the first trimester may indicate an underlying disease process, and should raise the suspicion of appendicitis.

As the uterus enlarges, the appendix moves upwards and outwards towards the flank, so that abdominal pain associated

with appendicitis is often not localized to the right lower quadrant after the first trimester. The displacement of the appendix during pregnancy has been previously documented using barium enema examinations (Figure 1).^{7,8} The lifting of the abdominal wall by the enlarged uterus may also delay the onset of pain associated with appendicitis.¹

The normal leukocytosis associated with pregnancy makes this laboratory finding less helpful. Only neutrophil counts of greater than 80 percent have been found to be a reliable predictor of acute appendicitis in pregnancy.⁹ As in other studies,^{2,3,5,9} classic signs and symptoms were



found in only a minority of patients in our series, and no specific diagnostic criteria were identified which predicted acute appendicitis accurately.

The reported negative laparotomy rate in pregnancy is 30 to 50 percent compared to 20 to 25 percent in the nonpregnant population.^{1,2-5,9,10} This finding can be explained by the lack of specific symptoms and signs of appendicitis in pregnancy and also other common complications of pregnancy, including adnexal torsion, placental abruption, pyelonephritis, degenerating fibroids, round ligament pain and preterm labour, which may have presenting symptoms similar to acute appendicitis. Approximately two-thirds of the pregnant women with a pre-operative diagnosis of acute appendicitis in our review actually had confirmed appendicitis at the time of surgery. In a retrospective review by Tamir *et al.*,³ 18 percent of patients with a pre-operative diagnosis of appendicitis were found to have other organic diseases, for example mesenteric adenitis or abdominal adhesions.³ Unanticipated causes for acute surgical abdomen in our study included intra-abdominal abscess and adnexal torsion which accounted for less than 10 percent of the appendectomies performed.

The rate of appendiceal perforation tends to be higher in pregnancy, especially in the third trimester, than in the general population. Perforation rates as high as 70 percent have been reported in the third trimester compared to only 10 to 15 percent in non-pregnant patients.¹ The high perforation rate may be due to a delay in presentation or diagnosis. A delay in diagnosis was not seen in this series, as 85 percent of patients underwent laparotomy within 24 hours. Maternal recognition of symptoms may be delayed because of the physiological changes of pregnancy, particularly in the third trimester. In addition, the high concentration of circulating steroids may also play a role in suppressing the inflammatory response, allowing rapid development of appendiceal inflammation and perforation to occur.¹

The major perinatal complication of appendicitis in pregnancy is preterm birth. Delays related to difficulties in diagnosis predispose to more advanced disease at the time of surgical treatment, with increased risk of perforation and premature labour. In one study, preterm labour occurred in 100 percent of patients in which the interval from the onset of symptoms to laparotomy was more than 40 hours.¹¹ In contrast, none of the patients who had opera-

tive treatment within 20 hours of symptoms experienced premature labour. The preterm birth rate in this study was high; 36 percent in uncomplicated appendicitis and 56 percent when complicated by appendiceal perforation. Our data also demonstrate that a negative laparotomy still carries an increased risk of preterm delivery.

The reported perinatal mortality is 4.8 percent in uncomplicated appendicitis and 27.8 percent when complicated by perforation.¹ Recent series have reported even lower perinatal mortality rates approaching 1.5 percent.^{1,3,12-14} In contrast, the perinatal mortality rate for uncomplicated appendicitis in this series was zero percent, whereas the perinatal mortality rate in pregnancies with appendiceal perforation was 11 percent.

Maternal outcome associated with appendicitis in pregnancy has improved markedly during the last 20 years. No maternal deaths have been reported in several recent series.^{3,12-14} Patients with perforated appendicitis are prone to significant postoperative morbidity as shown in this review.

Because of the physiological and anatomical changes in pregnancy, the presentation of appendicitis in pregnancy is often atypical, which makes prompt diagnosis more difficult and often results in a higher perforation rate. Perforated appendicitis is associated with an increased risk of perinatal loss, premature birth and maternal morbidity. Early clinical suspicion and prompt surgical intervention are essential to optimize maternal and perinatal outcomes in pregnancies complicated by appendicitis.

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