Incidence of Acute Appendicitis during Pregnancy and Outcome of Appendectomy in Ramathibodi Hospital

Nuttapon Arpornsujaritkun MD*, Weerapat Suwanthanma MD**

** Division of Vascular and Transplant, Department of Surgery, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*
*** Division of General Surgery, Department of Surgery, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*

Background: *Acute appendicitis is the most common surgical problem during pregnancy. This review study investigates clinical presentation, risk, outcome in pregnancy patient who have the diagnosis of acute appendicitis and outcome of appendectomy in Ramathibodi Hospital in the past 10 years.*
Objective: *To investigate clinical outcome of appendectomy in pregnancy patient who have the diagnosis of appendicitis.*
Material and Method: *The record data of 45 women with diagnosis of acute appendicitis that underwent appendectomy between January 2006 and December 2016 in Ramathibodi Hospital were reviewed.*
Results: *Forty-five pregnant women received a diagnosis of acute appendicitis. Incidence of acute appendicitis during pregnancy was 0.13%. Median gravida was 1. Mean gestational age was second trimester (18.53±8.48 weeks). All cases presented with right lower quadrant pain, but no specific signs or symptoms (no fever 88.7%, nausea and vomiting 60%, anorexia 60%, rebound tenderness 60%, or migratory pain 51.1%). Complete blood count revealed leukocytosis in 97.78% with PMN predominate of patient. Diagnosis was made by ultrasonography 88.9%, which could identify appendix in only 42.5%. All identified appendix were confirmed to be acute appendicitis by pathologist. The rate of perforation was 20%. The fetus was delivered full term in 84.44%. Significant perforated appendicitis was found in late second trimester (17.11±7.53 vs. 24.22±10.08 weeks, p = 0.023). The patient in the perforated group had prolonged hospital stay of about two days 4 (3 to 5) vs. 6 (4 to 8) days, p = 0.015). No significant difference in operative time, or morbidity and mortality of fetus in patient with delayed time to surgery after diagnosis.*
Conclusion: *No specific signs and symptoms of acute appendicitis were found in pregnant women. Leukocytosis alone cannot be used to diagnose acute appendicitis. Ultrasonography remains the first choice modality for diagnosis. Second choice modality is MRI. Third trimester showed increase risk of perforated appendicitis. Perforated appendicitis results in prolonged hospital stay and operative time.*

Keywords: *Acute appendicitis, Pregnancy, Outcome appendectomy*

J Med Assoc Thai 2017; 100 (Suppl. 9): S80-S85
Full text. e-Journal: *http://www.jmatonline.com*

Acute appendicitis is the most common acute abdominal pain requiring surgery in pregnancy women[1-6]. Incidence is 0.1 to 0.2%[7-9] and it could occur in all trimesters and all age groups. The most frequent incidences were found in second trimesters[7,10,11]. However, acute appendicitis is associated with increased risk of fetal loss[6,12]. Diagnosis is difficult due to anatomical and physiological changes, resulting in higher chance of delayed diagnosis, especially in third trimesters[1,7].

The aims of this study were to review and analyze incidences, clinical, and complications associated with appendectomy during pregnancy at the department of surgery, general surgery unit, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand.

Correspondence to:
Arpornsujaritkun N, Vascular and Transplant Unit, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, 270 Rama 6 Road, Ratchathewi, Bangkok 10400, Thatland.
Phone: +66-2-2011315, Fax: +66-2-2011316
E-mail: arpornsujaritkunn@gmail.com

Material and Method

This was a retrospective single center study. Records data of all pregnant women with appendicitis who underwent appendectomy between January 2006 and December 2016 were reviewed.

All patients in study underwent appendectomy by resident or staff in Ramathibodi Hospital.

Thirty appendectomies were performed during the study period. Collecting data included age, gravida, gestational age, signs and symptoms on presentation, laboratory parameter, diagnosis modality,

tocolytic drug use, hospital stay, type appendicitis, morbidity and mortality of maternal and fetus, duration time from diagnosis to operating room, and duration time of operation.

All appendectomy specimens were pathologically confirmed by pathologist.

Statistical analysis

Analysis in contingency tables were performed by Fisher's exact test, t-test and Wilcoxon rank-sum test. Level of significant was *p* level smaller than 0.05.

Results

Clinical feature

Forty-five pregnant women with appendectomy specimens that were pathologically proved to be appendicitis by pathologist were included in this study. There were 33,406 deliveries during the study period, corresponding to appendicitis during pregnancy rate of 0.13%.

Characteristics of pregnant women included mean age of 29.31±6.18 years, median Gravida 1, median parity 0 and mean gestational age 18.53 (±8.48) weeks.

The most common presenting symptoms and physical findings were right lower quadrant pain (100%). Eighty-eight point seven percent of pregnant women with appendicitis had no fever on admission. The other signs and symptoms included nausea and vomiting in 60%, anorexia in 60%, rebound tenderness in 60% and classic migratory pain in 51.1% (Table 1).

The migratory pain was associated with gestational age of less than 15.09±6.58 weeks ($p = 0.004$) (Table 2)

Investigation

An abnormal white cell count (greater than 10,000 cells/mm^3) was present in 44 cases (97.78%) and polymorph nuclear cells (PMNs) were predominated (neutrophil more than 80%) in 38 cases (84.44%).

Mostly, pregnant women with suspected appendicitis were sent to be investigated by ultrasonography in 40 cases (88.9%). Of these 40 cases, the appendix could be identified and confirmed as acute appendicitis in 17 cases (42.5%). All 17 cases (42.5%) of identified appendix after appendectomy were pathologically proven appendicitis (Table 3).

Pathology of appendicitis

Pathologically reported type appendicitis was divided into four characteristics (normal, non-perforated, perforated, and other).

Perforation occurred in nine of 45 cases (20%). There was no normal appendix or other pathology (Table 4).

Table 1. Presenting symptoms, physical findings

Item	Pt., n (%)
Temperature (°C)	
<37.8°C	39 (88.67)
≥37.8°C	6 (13.33)
Nausea and vomiting	27 (60)
Anorexia	27 (60)
Right lower quadrant pain	45 (100)
Rebound tenderness	27 (60)
Migratory pain	23 (51.11)

Table 2. Association between migratory pain and gestational age

Item	Migratory pain		
	Yes	No	*p*-value
Gestational age (weeks)	15.09±6.58	22.14±8.87	0.004

Table 3. Laboratory and diagnosis modality

Item	Pt., n (%)
White blood cells (x10^9 /L)	
<10	1 (2.22)
≥10	44 (97.78)
PMN predominate (neutrophil ≥80%)	38 (84.44)
Diagnostic modality	
Ultrasonography	40 (88.89)
CT scan	0
No imaging	5 (11.11)
Characteristic of U/S finding	
Identified appendix	17 (42.5)
Confirmed appendicitis by pathologist	17 (100)

Table 4. Characteristic pathology of appendicitis

Item	Pt., n (%)
Normal appendix	0
Non-perforated appendicitis	36 (80)
Perforated appendicitis	9 (20)
Other	0

Outcome of fetus

Outcome of fetus was reported as term, preterm delivery with more than 30 days after appendectomy, preterm delivery with less than 30 days after appendectomy, abortion, and dead.

Outcome of fetuses were full term in 28 cases (84.4%). Three cases were of associate morbidity and mortality (6.67%). There were two cases with abortion or dead and one case abortion at days 28 after admission.

There was one case of preterm delivery with more than 30 days (2.2%), which was probably not associated with appendectomy. Three cases (6.67%) were loss data (Table 5).

Perforated appendix and risk

This study investigated the risk associated with perforation of appendix.

Most perforated appendicitis patients were in late second trimester compared to early second trimester (17.11±7.53 vs. 24.22±10.08 weeks, $p = 0.023$). Other significant risk is the prolong hospital stay, such as four (3 to 5) or six (4 to 8) days, $p = 0.015$).

There was no significant difference in operative time or rate of wound infection between perforated and non-perforated groups. There was also no significant difference in morbidity and mortality between two groups (Table 6).

Table 5. Outcome fetus delivery

Item	Pt., n (%)
Term delivery	28 (84.44)
Preterm >30 days delivery	1 (2.22)
Preterm <30 days delivery	1 (2.22)
Abortion or dead	2 (4.44)
Loss data	3 (6.67)

Time versus outcome of fetus

Outcome fetuses were classified into two categories, no morbidity and mortality group (delivery full term or preterm with more than 30 days after appendectomy), and morbidity and mortality group (delivery preterm with less than 30 days after surgery, abortion, or dead).

The outcome of fetus was not associated with operative time or time between diagnosis to surgery (Table 7).

Discussion

Incidence of acute appendicitis during pregnancy in this article was 0.13% or 1 in 742 pregnancies. This does not agree with other studies including the Danish study, which had 1 in 3,714[13] or the Mazze study from Sweden, which had 1 in 1,440[10]. The explanation for this difference might be that our health insurance is different as appendectomies can be performed at both primary or secondary hospitals. Therefore, the rate of this study might not represent the country rate.

Most studies found that acute appendicitis during pregnancy occurred mostly in the second trimester[7,10,11,14]. Our study revealed the same result (18.53±8.48 weeks). Interestingly, the most common physical finding was right lower quadrant pain in 100% of the cases. Nausea and vomiting was present in 60% of the cases, anorexia in 60%, rebound tenderness in

Table 6. Perforate or non-perforate appendix and outcome, risk

Item	Non-perforate (n = 36)	Perforate (n = 9)	$p<0.05$*
GA (weeks)	17.11±7.53	24.22±10.08	0.023
Uterine contraction (n)**	6/36 (16.67%)	2/9 (2.22%)	0.651
Rebound tenderness (n)	22/36 (61.11%)	5/9 (55.56%)	0.999
Morbidity and mortality (n)	3/36 (8.57%)	0/9 (0%)	0.999
Wound infection (n)	4/36 (11.11%)	2/9 (22.22%)	0.583
Hospital stay (days), median (IQR)	4 (3 to 5)	6 (4 to 8)	0.015
Operative time (minute)	74.44±30.22	89.44±39.72	0.216
White blood cells ($x10^9$)	14,823±3,401.46	17,172±4,270.62	0.085
Time Dx to surgery (hour), median (IQR)	10 (7.5 to 12)	10 (10 to 16)	0.608

* The *p*-value significant <0.005, ** Uterine contraction mean women who pregnancy GA >28 weeks

Table 7. Morbidity and mortality of fetus vs. operative time, time to surgery

Item	Morbidity and mortality		
	No	Yes	*p*-value
Operative time (minute)	90±30.29	90±24.49	1.000
Time to surgery (minute)	11.51±7.97	12.33±4.5	0.423

60%, and migratory pain 51.1%, which were the same as with the other study. The right lower quadrant pain physical findings seem to be the only clue to suspect and diagnose appendicitis during pregnancy.

Laboratory and diagnosis modality found that in an appendices pregnancy, leukocytosis cannot be used as a clue for diagnosis because it is physiologically present in pregnancy[15]. PMN predominate was found only in pregnancy women with appendicitis, which is similar to the study from Zhang yan et al[16]. Some studies use neutrophil to lymphocyte ratio and platelet to lymphocyte ratio to diagnosis with high sensitivity and specificity[14,17]. Most diagnostic modality used for diagnosis appendicitis in pregnant women was ultrasonography[18]. The ultrasonography has limitations due to operator dependence. In our study, appendix was identified by ultrasound in 17 of 40 cases (42.5%). In another study from the USA, it was found that chance positive ultrasound was 11.6%[19]. Another study revealed the role of MRI in pregnant women with suspected appendicitis. The American College of Radiology criteria recommended that Ultrasonography be used in initial imaging and MRI be used as the next imaging modality when the ultrasound cannot identify the appendicitis[20-22].

We have not found normal appendix or other pathology in pregnancy with appendicitis. The perforation of appendicitis was confirmed by pathological report. Significant perforated appendicitis was found in third trimester (GA at 28 weeks or more to birth) in our study. The increased size of uterus may deviate the inflamed appendix away from the abdominal wall resulting in less symptoms and signs detected by clinicians. A Denmark study found that second trimester had the highest incidence of perforated appendicitis[23], which is similar to our study.

Perforation of appendix can prolong hospital stay by about two days from four (3 to 5) to six (4 to 8), $p = 0.015$, but operative time not significant. Rate of wound infection did not increase significantly because all wound of our perforated appendicitis patients were managed by delayed wound closure.

Perforated appendicitis resulted in prolonged operative time, which may increase morbidity and mortality of fetus. However, in our study, this was not significantly seen. It may be due to small sample size. Other literature reviews show that pregnancy with appendicitis was related to lower birth weight, small for gestational age, preterm labor, fetal loss[14,24,25]. Time from diagnosis to surgery is not significant different between perforate and non-perforate appendicitis. Furthermore, morbidity and mortality of the fetus in either groups of appendicitis are not significantly different. However, this may be due to our small sample size. Other studies have considerable fetal loss during appendicitis in pregnancy[1,10,15,26,27].

In general, delivery at gestational age of less than 28 weeks mean abortion. Five of nine cases (55.5%) had uterine contraction. Of these women who had uterine contraction, four of them (90%) needed tocolytic drug.

What is already known on this topic?

The most common surgical procedure during pregnancy is acute appendicitis. No specific signs and symptoms assist in the diagnosis of acute appendicitis. One non-invasive investigation procedure assisting diagnosis of acute appendicitis is ultrasonography, but it is low in sensitivity.

What this study adds?

After a review, this topic shows that ultrasonography is low in sensitivity to diagnose acute appendicitis during pregnancy.

Acknowledgements

The authors acknowledge Ms. Nipapan Choonu for assistance in the study.

Potential conflicts of interest

None.

References

1. Lindau ST, Schumm LP, Laumann EO, Levinson W, O'Muircheartaigh CA, Waite LJ. A study of sexuality and health among older adults in the United States. N Engl J Med 2007; 357: 762-74.
2. Kongkanand A. Prevalence of erectile dysfunction in Thailand. Thai Erectile Dysfunction Epidemiological Study Group. Int J Androl 2000; 23 (Suppl 2): 77-80.

3. An epidemiological study of erectile dysfunction in Thailand (Part 1: Prevalence). Thai Erectile Dysfunction Epidemiologic Study Group (TEDES). J Med Assoc Thai 2000; 83: 872-9.
4. Mulhall JP, Goldstein I, Bushmakin AG, Cappelleri JC, Hvidsten K. Validation of the erection hardness score. J Sex Med 2007; 4: 1626-34.
5. Mykletun A, Dahl AA, O'Leary MP, Fossa SD. Assessment of male sexual function by the Brief Sexual Function Inventory. BJU Int 2006; 97: 316-23.
6. Rosen RC, Catania J, Pollack L, Althof S, O'Leary M, Seftel AD. Male Sexual Health Questionnaire (MSHQ): scale development and psychometric validation. Urology 2004; 64: 777-82.
7. Rosen RC, Riley A, Wagner G, Osterloh IH, Kirkpatrick J, Mishra A. The international index of erectile function (IIEF): a multidimensional scale for assessment of erectile dysfunction. Urology 1997; 49: 822-30.
8. Rosen RC, Cappelleri JC, Smith MD, Lipsky J, Pena BM. Development and evaluation of an abridged, 5-item version of the International Index of Erectile Function (IIEF-5) as a diagnostic tool for erectile dysfunction. Int J Impot Res 1999; 11: 319-26.
9. Rosen RC, Cappelleri JC, Gendrano N, III. The International Index of Erectile Function (IIEF): a state-of-the-science review. Int J Impot Res 2002; 14: 226-44.
10. Nontakaew K, Kochakarn W, Kijvika K, Viseshsindh W, Silpakit C. Reliability of a Thai version of the International Prostate Symptom Score (IPSS) for the Thai population. J Med Assoc Thai 2014; 97: 615-20.
11. Fleiss JL. Statistical methods for rates and proportion. 2nd ed. New York: John Wiley & Sons; 1981.
12. Terwee CB, Bot SD, de Boer MR, van der Windt DA, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 2007; 60: 34-42.
13. Cappelleri JC, Siegel RL, Glasser DB, Osterloh IH, Rosen RC. Relationship between patient self-assessment of erectile dysfunction and the sexual health inventory for men. Clin Ther 2001; 23: 1707-19.
14. Hatzichristou D, Kirana PS, Banner L, Althof SE, Lonnee-Hoffmann RA, Dennerstein L, et al. Diagnosing sexual dysfunction in men and women: sexual history taking and the role of symptom scales and questionnaires. J Sex Med 2016; 13: 1166-82.
15. Utomo E, Blok BF, Pastoor H, Bangma CH, Korfage IJ. The measurement properties of the five-item International Index of Erectile Function (IIEF-5): a Dutch validation study. Andrology 2015; 3: 1154-9.
16. Mahmood MA, Rehman KU, Khan MA, Sultan T. Translation, cross-cultural adaptation, and psychometric validation of the 5-item International Index of Erectile Function (IIEF-5) into Urdu. J Sex Med 2012; 9: 1883-6.
17. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet 1986; 1: 307-10.

อุบัติการณ์ไส้ติ่งอักเสบระหว่างตั้งครรภ์และผลการผ่าตัดไส้ติ่งในโรงพยาบาลรามาธิบดี

ณัฐพล อาภรณ์สุจริตกุล, วีรพัฒน์ สุวรรณธรรมา

ภูมิหลัง: ไส้ติ่งอักเสบเป็นภาวะฉุกเฉินทางศัลยกรรมที่พบมากที่สุดในระหว่างการตั้งครรภ์ การศึกษานี้เป็นการศึกษาข้อมูลย้อนหลังเกี่ยวกับอาการแสดง ความเสี่ยง ผลของการเกิดไส้ติ่งอักเสบระหว่างตั้งครรภ์ ผลการผ่าตัดไส้ติ่งในโรงพยาบาลรามาธิบดีย้อนหลัง 10 ปี

วัตถุประสงค์: เพื่อศึกษาผลทางคลินิกไส้ติ่งอักเสบในระหว่างการตั้งครรภ์

วัสดุและวิธีการ: เป็นการศึกษาเก็บข้อมูลย้อนหลังผู้ป่วยไส้ติ่งอักเสบระหว่างการตั้งครรภ์ที่ได้รับการผ่าตัดไส้ติ่งในโรงพยาบาลรามาธิบดีระหว่างเดือนมกราคม พ.ศ. 2549 ถึงเดือนธันวาคม พ.ศ. 2559

ผลการศึกษา: พบหญิงตั้งครรภ์ที่มีไส้ติ่งอักเสบและได้รับการผ่าตัดจำนวน 45 ราย อุบัติการณ์ไส้ติ่งอักเสบระหว่างการตั้งครรภ์ร้อยละ 0.13 โดยหญิงตั้งครรภ์ที่มีไส้ติ่งอักเสบมีลักษณะจำนวนครั้งที่ตั้งครรภ์เฉลี่ย 1 ครั้ง อายุครรภ์เฉลี่ย 18.53±8.48 สัปดาห์ โดยส่วนใหญ่ทุกรายจะมีอาการแสดงปวดท้องน้อยขวาล่าง แต่ไม่พบอาการหรืออาการแสดงใดที่จำเพาะ (ไม่พบไข้ร้อยละ 88.7, คลื่นไส้อาเจียนร้อยละ 60, เบื่ออาหารร้อยละ 60, อาการแสดงเยื่อบุช่องท้องอักเสบร้อยละ 60, ปวดเคลื่อนที่ร้อยละ 51) ผลการตรวจเลือดพบเม็ดเลือดขาวสูงร้อยละ 97.78 และมีเม็ดเลือดขาวชนิด PMN สูงร้อยละ 80 ผู้ป่วยถูกตรวจวินิจฉัยด้วยอัลตราซาวด์ร้อยละ 88.9 สามารถตรวจพบไส้ติ่งได้เพียงร้อยละ 42.5 อย่างไรก็ตามผู้ป่วยที่สามารถตรวจพบไส้ติ่งจากอัลตราซาวด์จะเป็นไส้ติ่งอักเสบจริงโดยการตรวจยืนยันจากผลพยาธิ อัตราการแตกทะลุของไส้ติ่งร้อยละ 20 การตั้งครรภ์ครบกำหนดแล้วคลอดร้อยละ 84.44 พบความสัมพันธ์การแตกทะลุของไส้ติ่งอักเสบกับการตั้งครรภ์ปลายระยะที่สองอย่างมีนัยสำคัญ (17.11±7.53 vs. 24.22±10.08 สัปดาห์, p = 0.023) ผู้ป่วยที่มีไส้ติ่งแตกทะลุจะมีระยะการนอนโรงพยาบาลนานกว่าประมาณ 2 วัน (3 ถึง 5) vs. 6 (4 ถึง 8) วัน, p = 0.015) ไม่พบความแตกต่างระหว่างระยะเวลาการผ่าตัดกับภาวะทุพพลภาพและการเสียชีวิตของทารก

สรุป: ไม่มีอาการและอาการแสดงที่จำเพาะในผู้ป่วยไส้ติ่งอักเสบระหว่างตั้งครรภ์ ภาวะเม็ดเลือดขาวสูงอย่างเดียวไม่สามารถใช้วินิจฉัยภาวะไส้ติ่งอักเสบ อัลตราซาวด์ยังเป็นเครื่องมือที่นิยมใช้ในการวินิจฉัยแต่ MRI เป็นทางเลือกรองที่สามารถนำมาใช้ได้ การตั้งครรภ์ระยะที่สาม เพิ่มความเสี่ยงต่อการแตกทะลุของไส้ติ่ง การที่มีไส้ติ่งแตกทะลุจะเพิ่มระยะการนอนโรงพยาบาล