Journal of Social Research

E-ISSN: 2828-335x
Vol. 5, No. 11, October 2026, pp. 2983-2991
DOI: 10.55324/josr.v5i11.3537
Journal of Social Research

Spinal Anesthesia for Emergency Open Appendectomy During Pregnancy at 22 Weeks with Perforated Appendicitis: A *Case Report*

Bramanthya Reinhart Purnomo*, Victor Pulpa Seda
Level IV Military General Hospital, Indonesia
Email: bramanthyareinhart21@gmail.com*

Keywords:
appendicitis; pregnancy; spinal anesthesia; nonobstetric surgery; laparotomy case report.

This is an open access article under the CC BY-SA license.

Copyright © 2026 by Author. Published by
International Journal Labs

Abstract

Neuraxial anesthesia can avoid airway instrumentation in selected patients; however, its use in emergency open abdominal surgery is uncommon and requires a clearly established plan for conversion to general anesthesia. Clinical examination revealed focal signs of peritoneal irritation, with an Alvarado score of 7–8. The patient presented with tachycardia but remained normoxemic and hemodynamically stable. Laboratory investigations revealed neutrophilic leukocytosis and ketonuria. An emergency open appendectomy was planned for suspected perforated appendicitis. The patient was classified as American Society of Anesthesiologists (ASA) Physical Status II E. Given the incomplete fasting period, pregnancy-related airway changes and an increased risk of aspiration were considered in preparing a contingency plan for general anesthesia. Following intravenous fluid resuscitation, single-shot spinal anesthesia was administered at the L2–L3 interspace using a 27-gauge Quincke needle, with 10 mg of bupivacaine and 25 µg of fentanyl administered intrathecally. A sensory block extending to the T4–T6 dermatomes was targeted. The patient remained awake without sedation, received supplemental oxygen via nasal cannula at 3 L/min, and was positioned supine with a slight left lateral tilt to minimize aortocaval compression. Transient hypotension occurred following spinal anesthesia, with a lowest recorded systolic blood pressure of 90 mmHg, and was managed with 10 mg of intravenous ephedrine. No episodes of bradycardia or oxygen desaturation were documented. The surgical procedure lasted 90 minutes, during which a perforated appendix with peritonitis was confirmed. Fetal cardiac activity remained stable on Doppler assessment before and after surgery. Postoperative recovery was uneventful, with a pain score of 1/10 in the postanesthesia care unit, and the patient was discharged on postoperative day 3. Single-shot spinal anesthesia provided adequate surgical conditions for a 90-minute emergency open appendectomy in this carefully selected, hemodynamically stable patient at 22 weeks of gestation. However, this favorable outcome does not establish the superiority of spinal anesthesia over general anesthesia.

INTRODUCTION

Nonobstetric surgery is occasionally required during pregnancy, with appendectomy remaining one of the most common emergency abdominal surgical procedures in this population (Tolcher et al., 2018; Haataja et al., 2023). Pregnancy should not delay medically necessary surgical interventions, as progression of the underlying condition may pose greater risks to both maternal and fetal health (American College of Obstetricians and Gynecologists,

2019). In patients with acute appendicitis, perforation and peritonitis are associated with increased maternal infectious morbidity and adverse pregnancy outcomes, emphasizing the importance of timely surgical intervention and effective source control (Abbasi et al., 2014; Cusimano et al., 2023).

Nonobstetric surgical procedures are estimated to be required in approximately 1 in 500 pregnancies worldwide, with appendectomy accounting for a substantial proportion of emergency abdominal interventions. These procedures present unique anesthetic challenges because pregnancy-related physiological changes, including increased oxygen consumption, reduced functional residual capacity, altered airway anatomy, and an increased risk of aspiration in certain clinical circumstances, may complicate perioperative management. Consequently, anesthetic planning requires careful consideration of maternal physiological stability, fetal well-being, and the urgency of surgical intervention.

The selection of an anesthetic technique should be individualized according to surgical requirements, maternal clinical condition, gestational age, institutional expertise, and available resources. General anesthesia, neuraxial anesthesia, peripheral regional techniques, and sedation-based approaches have been employed in selected nonobstetric procedures during pregnancy. However, high-quality evidence demonstrating the superiority of a particular anesthetic technique in improving maternal or fetal outcomes across different surgical procedures remains limited (Reitman & Flood, 2011) antages by avoiding airway instrumentation and limiting exposure to systemic anesthetic agents. Nevertheless, its application in open abdominal surgery presents challenges, including the need for an adequate thoracic sensory block, the potential for sympathectomy-induced maternal hypotension, and the limited duration of single-shot spinal anesthesia. These considerations necessitate careful patient selection, vigilant hemodynamic monitoring, and readiness to convert to general anesthesia when clinically indicated.

Published evidence specifically addressing single-shot spinal anesthesia for emergency open appendectomy in pregnant patients, particularly those with perforated appendicitis and peritonitis, remains limited. Evidence from the Indonesian clinical setting is also insufficiently documented. This case report describes the successful use of spinal anesthesia for emergency open appendectomy in a primigravida at 22 weeks of gestation with perforated appendicitis. Particular emphasis is placed on patient selection, maternal hemodynamic management, airway and aspiration risk assessment, infection-related considerations, and perioperative fetal assessment. The case was reported in accordance with the CARE (CAse REport) guidelines to support transparent and standardized clinical reporting (Gagnier et al., 2013).

METHOD

This study employed a descriptive clinical case report design to document the perioperative anesthetic management and clinical outcomes of a pregnant patient undergoing emergency open appendectomy for perforated appendicitis under spinal anesthesia. The patient was a 24-year-old primigravida at 22 weeks of gestation who underwent emergency surgery at a Level IV Military General Hospital in Indonesia in September 2026. The case was reported in accordance with the CARE (CAse REport) guidelines (Gagnier et al., 2013).

Clinical data were retrospectively obtained from medical records, including the patient's medical and obstetric history, physical examination findings, laboratory results, preoperative anesthetic assessment, intraoperative management, surgical findings, and postoperative observations. The extracted information included maternal and obstetric characteristics, clinical manifestations of appendicitis, American Society of Anesthesiologists (ASA) physical status classification, anesthetic technique, intrathecal medications, maternal hemodynamic responses, fetal heart activity, surgical duration, postoperative pain scores, and perioperative complications.

Single-shot spinal anesthesia was administered at the L2–L3 intervertebral space using a 27-gauge Quincke spinal needle. The intrathecal medications consisted of 10 mg of bupivacaine and 25 μg of fentanyl, with a targeted sensory block extending from T4 to T6. Perioperative management included intravenous fluid administration, supine positioning with a slight left lateral tilt to minimize aortocaval compression, supplemental oxygen, and pharmacological management of hypotension when indicated. Fetal cardiac activity was assessed using Doppler ultrasonography before and after surgery.

Clinical data were analyzed descriptively through chronological reconstruction of the perioperative course and narrative assessment of maternal and fetal outcomes. The analysis focused on the adequacy of spinal anesthesia for the surgical procedure, maternal hemodynamic responses, perioperative safety measures, and any requirement for conversion to general anesthesia. The clinical findings were interpreted in the context of existing literature on anesthetic management for nonobstetric surgery during pregnancy. No inferential statistical analysis was performed because the report involved a single patient.

RESULTS AND DISCUSSION

Patient information and clinical findings

A 24-year-old woman, gravida 1 para 0, with a documented gestational age of 22 weeks presented to the emergency department on 23 September 2026. She reported four days of intermittent right lower-quadrant abdominal pain, with pain intensity of 8-9 on a 10-point visual analog scale. She had nausea, four episodes of vomiting on the day of presentation, reduced appetite, and weakness. She denied fever, and bowel and urinary function were reported as normal. She had recently been hospitalized for hyperemesis gravidarum. No other medical history was reported.

She was alert and appeared moderately unwell. Blood pressure was 114/95 mmHg, heart rate 102 beats per minute, respiratory rate 20 breaths per minute, temperature 36.6 degrees Celsius, and peripheral oxygen saturation 99% on room air. Chest and cardiovascular examinations were unremarkable. Abdominal examination elicited tenderness at McBurney's point, rebound tenderness, and positive Rovsing and obturator signs. The Alvarado score was documented as 7-8. Surgical and obstetric assessments supported suspected perforated appendicitis with peritonitis. An ultrasound report confirming gestational age or evaluating the appendix was not available in the records supplied for this report.

Diagnostic assessment

Laboratory testing showed leukocytosis with granulocyte predominance, preserved platelet count, and normal measured renal function and random glucose. Urinalysis showed ketonuria and inflammatory findings. These results were interpreted in the clinical context of vomiting, reduced intake, dehydration, and possible urinary inflammation; no urine culture result was available. Electrolytes, liver tests, prothrombin time, international normalized ratio, and activated partial thromboplastin time were not obtained because of local equipment limitations. Available laboratory results are summarized in Table 1.

Table 1 Preoperative laboratory findings on 23 September 2026

Test	Result	Laboratory reference
Hemoglobin	11.8 g/dL	12.8-16.8 g/dL
Hematocrit	35.7%	37-48%
Leukocyte count	13.4 x 10^3/microliter	4.0-10.5 x 10^3/microliter
Granulocytes	83.6%	30.0-70.0%

Test	Result	Laboratory reference
Platelet count	297 x 10^3/microliter	150-450 x 10^3/microliter
Clotting time	7 minutes	5-15 minutes
Bleeding time	3 minutes	1-5 minutes
Urea	18.2 mg/dL	10-50 mg/dL
Creatinine	0.5 mg/dL	0.5-1.0 mg/dL
Random glucose	93 mg/dL	Less than 200 mg/dL
Urine specific gravity	1.025	1.005-1.030
Urine nitrite	Positive	Negative
Urine ketones	2+	Negative
Urine leukocyte esterase	1+	Negative
Urine leukocytes	15-20 per high-power field	2-4 per high-power field
Urine erythrocytes	10-20 per high-power field	0-5 per high-power field

A 12-lead electrocardiogram showed sinus tachycardia at 100 beats per minute, a PR interval of 162 ms, a QRS duration of 82 ms, and a corrected QT interval of 408 ms. The automated tracing described a nonspecific anteroseptal T-wave abnormality. No clinically significant arrhythmia was documented.

Preoperative anesthetic assessment

Emergency open appendectomy via laparotomy was scheduled for 24 September 2026. The patient was classified as American Society of Anesthesiologists physical status II E. Airway examination showed Mallampati class I-II, mouth opening greater than three fingerbreadths, thyromental distance greater than 6 cm, and unrestricted neck movement. Although a difficult airway was not predicted, pregnancy-related airway edema and the risk of aspiration were considered. Fasting was incomplete. An 18-gauge intravenous cannula was in place, and 1,000 mL of crystalloid was administered for rehydration. Cefazolin was administered perioperatively; the dose was not recorded in the source information. The anesthetic plan was spinal anesthesia with immediate readiness to convert to general anesthesia if the block was inadequate, surgery was prolonged, maternal condition deteriorated, or operative requirements changed.

Anesthetic management

Single-shot spinal anesthesia was performed at the L2-L3 interspace using a 27-gauge Quincke needle. Intrathecal medication consisted of bupivacaine 10 mg in 2 mL and fentanyl 25 micrograms. The baricity of the bupivacaine was not documented. A T4-T6 sensory level was targeted. The patient was positioned supine with slight left lateral tilt to reduce aortocaval compression. She remained awake without sedative medication and received oxygen through a nasal cannula at 3 L/minute.

Transient hypotension occurred after spinal anesthesia. The lowest recorded systolic blood pressure was 90 mmHg, and intravenous ephedrine 10 mg was administered. Phenylephrine was not administered. No bradycardia or oxygen desaturation was recorded. The operation proceeded without conversion to general anesthesia. Exact serial blood pressure values other than the recorded nadir were not available. Total intraoperative crystalloid administration was 1,000 mL. Estimated blood loss was 250 mL, and urine output was approximately 0.5 mL/kg/hour.

Surgical and obstetric course

Emergency open appendectomy via laparotomy lasted 90 minutes. Operative findings confirmed a perforated appendix with peritonitis. Fetal heart activity was assessed by Doppler before and after surgery and remained stable. Continuous intraoperative fetal monitoring was not performed. No prophylactic tocolytic was documented.

Postoperative course

In the post-anesthesia care unit, pain intensity was 1 of 10 and was managed with paracetamol. No nausea or vomiting occurred. No anesthetic, surgical, or obstetric complication was documented during the three-day admission, after which the patient was discharged. A longer-term pregnancy and neonatal outcome was not available for this report.

Table 2 Clinical timeline

Time	Event
Before admission	Recent admission for hyperemesis gravidarum; subsequently developed four days of intermittent right lower-quadrant pain and reduced intake.
23 September 2026	Emergency presentation with pain, vomiting, peritoneal signs, Alvarado score 7-8, tachycardia, neutrophilic leukocytosis, and ketonuria.
24 September 2026	ASA II E assessment, intravenous rehydration, and emergency open appendectomy under single-shot spinal anesthesia.
Intraoperative	Perforated appendicitis with peritonitis confirmed; 90-minute procedure; post-spinal hypotension with systolic blood pressure nadir of 90 mmHg treated with ephedrine 10 mg; no bradycardia, desaturation, or conversion to general anesthesia.
Postoperative days 0-3	Fetal heart activity stable after surgery; PACU pain score 1 of 10; no nausea, vomiting, or documented complication; discharged after three days.

Discussion

Urgency and maternal fetal risk

Perforated appendicitis requires prompt source control. ACOG advises that medically necessary surgery should not be denied or delayed because of pregnancy, regardless of trimester (American College of Obstetricians and Gynecologists, 2019). Cohort studies and systematic reviews show that adverse pregnancy outcomes after nonobstetric surgery reflect a combination of the underlying disease, surgical urgency, inflammation, and perioperative physiological disturbance rather than anesthetic exposure alone (Cohen-Kerem et al., 2005; Balinskaite et al., 2017; Devroe et al., 2019; Tolcher et al., 2018; Cusimano et al., 2023). Appendicitis complicated by peritonitis carries greater maternal infectious morbidity than uncomplicated disease, and nonoperative management is inappropriate for perforation requiring source control (Abbasi et al., 2014; Podda et al., 2026). The emergency indication in this case therefore outweighed the risks of proceeding during pregnancy.

Choice of spinal anesthesia

Anesthetic selection for nonobstetric surgery in pregnancy should be individualized. Commonly used anesthetic agents have not been shown to be teratogenic in humans at standard clinical concentrations, and current evidence does not support delaying necessary surgery to avoid anesthetic exposure (American College of Obstetricians and Gynecologists, 2019; Brakke & Sviggum, 2023). General anesthesia remains appropriate when required by the procedure or patient condition. Its practical concerns in pregnancy include reduced oxygen reserve, increased mucosal vascularity and airway edema, and the consequences of regurgitation or aspiration. These concerns were especially relevant here because fasting was

incomplete, even though the bedside airway assessment was reassuring (Haggerty & Daly, 2021; Bleeser et al., 2022).

Spinal anesthesia avoided airway instrumentation and enabled the patient to remain awake without sedative medication. However, single-shot spinal anesthesia for open abdominal surgery has important limitations: cephalad spread can be less predictable during pregnancy, a T4-T6 block may cause substantial sympathetic blockade, visceral discomfort may occur, and block duration cannot be extended. Combined spinal-epidural or epidural anesthesia may offer titration and extension for procedures of uncertain duration, while general anesthesia may provide more reliable conditions when extensive exploration is expected (Okeagu et al., 2020; Brakke & Sviggum, 2023). In this case, the 90-minute operation remained within the effective period of the chosen intrathecal regimen, and no conversion was needed. This successful result should be interpreted as feasibility in a selected patient, not evidence that spinal anesthesia is superior for perforated appendicitis.

Infection and neuraxial risk

Peritonitis also complicates the decision to perform neuraxial anesthesia. Untreated systemic infection, hemodynamic instability, coagulopathy, and infection at the puncture site raise concern for poor tolerance of sympathectomy or infectious neuraxial complications. Evidence is limited, and infection distant from the puncture site is generally treated as a relative rather than universal contraindication; published reviews emphasize individual risk-benefit assessment, prior antimicrobial therapy, hemodynamic stability, and avoidance of neuraxial techniques when severe sepsis or coagulopathy is present (Gimeno & Errando, 2018). The patient was afebrile, normoxemic, hemodynamically stable, and had a platelet count of 297 x 10^3/microliter. Antibiotic therapy had been initiated, and a single-puncture technique rather than an indwelling neuraxial catheter was used. Nevertheless, the absence of modern coagulation testing and inflammatory biomarkers is a meaningful limitation in assessing this choice.

Hemodynamic management and positioning

Maternal oxygenation and arterial pressure are central determinants of fetal oxygen delivery because uteroplacental blood flow is pressure dependent. Spinal sympathectomy may reduce systemic vascular resistance and venous return, while the gravid uterus can worsen venous compression from the second trimester onward. Left uterine displacement, correction of dehydration, close blood pressure surveillance, and immediate vasopressor availability are therefore essential (American Society of Anesthesiologists Task Force on Obstetric Anesthesia and Society for Obstetric Anesthesia and Perinatology, 2016; Kinsella et al., 2018; Haggerty & Daly, 2021). Despite crystalloid rehydration and slight left lateral tilt, this patient developed transient post-spinal hypotension, with a systolic blood pressure nadir of 90 mmHg. Intravenous ephedrine 10 mg was administered. The event illustrates that vasopressor availability remains necessary even in a young patient who is stable before neuraxial blockade. The absence of complete serial hemodynamic data prevents a more detailed analysis of the magnitude and duration of hypotension or the response relative to baseline.

Fetal assessment

Fetal monitoring should reflect gestational age, fetal viability, surgical access, maternal preferences, and the capacity to act on an abnormal tracing. For a fetus considered previable, ACOG states that Doppler confirmation of fetal heart activity before and after surgery is generally sufficient; continuous intraoperative monitoring may be considered selectively when it could guide maternal positioning or cardiorespiratory intervention (American College of Obstetricians and Gynecologists, 2019). Evidence supporting intraoperative monitoring is limited largely to case reports and case series, and anesthetic effects can complicate interpretation (Po' et al., 2019; McCurdy, 2020). At 22 weeks, viability is institution dependent. In this case, Doppler assessment before and after surgery showed stable fetal heart activity,

while intraoperative monitoring was not performed. This approach should be understood in the context of gestational age and local resources rather than applied as a universal rule.

Postoperative management

Postoperative priorities include adequate analgesia, prevention of nausea and vomiting, surveillance for sepsis and preterm labor, and reassessment of fetal well-being. Paracetamol provided satisfactory analgesia in this case, with a pain score of 1 of 10 and no postoperative nausea or vomiting. Routine prophylactic tocolysis is not supported in the absence of signs of preterm labor, although obstetric evaluation remains important (Kumar et al., 2024). A related report of regional anesthesia for open appendectomy in later pregnancy described postoperative uterine contractions and pulmonary edema during ritodrine therapy, illustrating that postoperative obstetric interventions and fluid therapy also carry risks (Kotera, 2023). No comparable complication was documented in the present case.

Case limitations

This report has several limitations. The ultrasound report, exact achieved sensory level, serial intraoperative blood pressure values, bupivacaine baricity, antimicrobial dose, pathology report, and long-term pregnancy and neonatal outcomes were unavailable. Electrolytes, liver tests, and contemporary coagulation studies were not performed because of equipment limitations. The report describes one favorable course and cannot determine whether spinal anesthesia was safer than general anesthesia. Its value lies in defining the clinical conditions, safeguards, and uncertainties surrounding an uncommon anesthetic choice.

CONCLUSION

Single-shot spinal anesthesia with 10 mg of intrathecal bupivacaine and 25 µg of fentanyl provided adequate surgical anesthesia for a 90-minute emergency open appendectomy in a hemodynamically stable patient at 22 weeks of gestation. (Kumar et al., 2024; Kinsella et al., 2018) This technique avoided airway instrumentation in a patient with incomplete preoperative fasting and anticipated pregnancy-related airway management challenges. Successful perioperative management involved intravenous fluid resuscitation, left uterine displacement to minimize aortocaval compression, maintenance of maternal hemodynamic stability, antibiotic therapy, and assessment of fetal cardiac activity before and after surgery, with preparedness for conversion to general anesthesia if necessary. However, given the potential for systemic infection associated with perforated appendicitis and the possibility that surgical duration may exceed the effective duration of a single-shot spinal block, neuraxial anesthesia should be considered on an individualized basis following careful assessment of maternal condition, surgical requirements, and available resources. The favorable outcome in this case supports the feasibility of spinal anesthesia in selected patients but does not establish its superiority over general anesthesia or justify its routine use in similar emergency procedures.

FUNDING

The authors declare that no financial support was received for the conduct of this study and/or the publication of this article.

CONFLICT OF INTEREST

The authors declare that this study was conducted without any commercial or financial relationships that could be interpreted as a potential conflict of interest.

AUTHORS' CONTRIBUTIONS

Bramanthya Reinhart Purnomo: research conceptualization, methodology design, experiment execution, data collection, data analysis, manuscript drafting, and manuscript revision. Victor Pulpa Seda: research supervision, validation of research results, provision of scientific input,

and manuscript review and revision. All authors have read and approved the final version of the manuscript.

STATEMENT ON THE USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors declare that generative artificial intelligence (AI) was used in the preparation of this manuscript to help improve linguistic clarity, correct grammar, and refine the writing structure. Generative AI was not used to generate, manipulate, or analyze research data. The entire content of the manuscript has been reviewed and verified by the author(s). The author(s) are fully responsible for the accuracy, integrity, and final content of the manuscript.

REFERENCE

Balinskaite, V., Bottle, A., Sodhi, V., Rivers, A., Bennett, P. R., Brett, S. J., & Aylin, P. (2017). The Risk of Adverse Pregnancy Outcomes Following Nonobstetric Surgery during Pregnancy. *Annals of Surgery*, *266*(2), 260–266. https://doi.org/10.1097/SLA.0000000000001976

Bleeser, T., Vally, J. C., Van de Velde, M., Rex, S., & Devroe, S. (2022). General anaesthesia for nonobstetric surgery during pregnancy. *European Journal of Anaesthesiology Intensive Care*, *1*(2), e003. https://doi.org/10.1097/ea9.0000000000000003

Brakke, B. D., & Sviggum, H. P. (2023). Anaesthesia for non-obstetric surgery during pregnancy. *BJA Education*, *23*(3), 78–83. https://doi.org/10.1016/j.bjae.2022.12.001

Cohen-Kerem, R., Railton, C., Oren, D., Lishner, M., & Koren, G. (2005). Pregnancy outcome following non-obstetric surgical intervention. *American Journal of Surgery*, *190*(3), 467–473. https://doi.org/10.1016/j.amjsurg.2005.03.033

Cusimano, M. C., Liu, J., Azizi, P., Zipursky, J., Sajewycz, K., Sussman, J., Kishibe, T., Wong, E., Ferguson, S. E., D'Souza, R., & Baxter, N. N. (2023). Adverse fetal outcomes and maternal mortality following nonobstetric abdominopelvic surgery in pregnancy: a systematic review and meta-analysis. *Annals of Surgery*, *278*(1), e147–e157. https://doi.org/10.1097/SLA.0000000000005362

Devroe, S., Bleeser, T., Van de Velde, M., Verbrugge, L., De Buck, F., Deprest, J., Devlieger, R., & Rex, S. (2019). Anesthesia for non-obstetric surgery during pregnancy in a tertiary referral center: a 16-year retrospective, matched case-control, cohort study. *International Journal of Obstetric Anesthesia*, *39*, 74–81. https://doi.org/10.1016/j.ijoa.2019.01.006

Gagnier, J. J., Kienle, G., Altman, D. G., Moher, D., Sox, H., & Riley, D. (2013). The CARE guidelines: Consensus-based clinical case reporting guideline development. *Forschende Komplementarmedizin*, *20*(5), 385–386. https://doi.org/10.7453/gahmj.2013.008

Gimeno, A. M., & Errando, C. L. (2018). Neuraxial regional anaesthesia in patients with active infection and sepsis: A clinical narrative review. *Turk Anesteziyoloji ve Reanimasyon Dernegi Dergisi*, *46*(1), 8–14. https://doi.org/10.5152/TJAR.2018.12979

Haataja, A., Kokki, H., Uimari, O., & Kokki, M. (2023). Non-obstetric surgery during pregnancy and the effects on maternal and fetal outcomes: A systematic review. *Scandinavian Journal of Surgery*, *112*(3), 187–205. https://doi.org/10.1177/14574969231175569

Haggerty, E., & Daly, J. (2021). Anaesthesia and non-obstetric surgery in pregnancy. *BJA Education*, *21*(2), 42–43. https://doi.org/10.1016/j.bjae.2020.11.002

Kinsella, S. M., Carvalho, B., Dyer, R. A., Fernando, R., McDonnell, N., Mercier, F. J., Palanisamy, A., Sia, A. T. H., Van de Velde, M., & Vercueil, A. (2018). International consensus statement on the management of hypotension with vasopressors during caesarean section under spinal anaesthesia. *Anaesthesia*, *73*(1), 71–92. https://doi.org/10.1111/anae.14080

Kotera, A. (2023). Pulmonary edema developed after open appendectomy under regional anesthesia in a pregnant woman at 29 weeks' gestation. *Journal of Japan Society for Clinical Anesthesia*, *43*(5), 411–415. https://doi.org/10.2199/jjsca.43.411

Kumar, S. S., Collings, A. T., Wunker, C., Athanasiadis, D. I., DeLong, C. G., Hong, J. S., Ansari, M. T., Abou-Setta, A., Oliver, E., Berghella, V., Alli, V., Hassan, I., Hollands, C., Sylla, P., Slater, B. J., & Palazzo, F. (2024). SAGES guidelines for the use of laparoscopy during pregnancy. *Surgical Endoscopy*, *38*(6), 2947–2963. https://doi.org/10.1007/s00464-024-10810-1

Abbasi, N., Patenaude, V., & Abenhaim, H. A. (2014). Management and outcomes of acute appendicitis in pregnancy - Population-based study of over 7000 cases. *BJOG: An International Journal of Obstetrics and Gynaecology*, *121*(12), 1509–1514. https://doi.org/10.1111/1471-0528.12736

McCurdy, R. J. (2020). Intraoperative Fetal Monitoring for Nonobstetric Surgery. *Clinical Obstetrics and Gynecology*, *63*(2), 370–378. https://doi.org/10.1097/GRF.0000000000000526

Okeagu, C. N., Anandi, P., Gennuso, S., Hyatali, F., Stark, C. W., Prabhakar, A., Cornett, E. M., Urman, R. D., & Kaye, A. D. (2020). Clinical management of the pregnant patient undergoing non-obstetric surgery: Review of guidelines. *Best Practice and Research: Clinical Anaesthesiology*, *34*(2), 269–281. https://doi.org/10.1016/j.bpa.2020.04.004

Po', G., Olivieri, C., Rose, C. H., Saccone, G., McCurdy, R., & Berghella, V. (2019). Intraoperative fetal heart monitoring for non-obstetric surgery: a systematic review. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, *238*, 12–19. https://doi.org/10.1016/j.ejogrb.2019.04.033

Podda, M., Ceresoli, M., De Simone, B., Fugazzola, P., Pata, F., Balla, A., Gerardi, C., Allocati, E., Salminen, P., Coimbra, R., Kelly, M., Boermeester, M., Segovia Lohse, H., Tan, E., Pisanu, A., Abu-Zidan, F., Flum, D., Sakakushev, B., Ansaloni, L., … Catena, F. (2026). Diagnosis and Treatment of Acute Appendicitis: 2025 Edition of the World Society of Emergency Surgery Jerusalem Guidelines. *JAMA Surgery*, *161*(3), 283–295. https://doi.org/10.1001/jamasurg.2025.6218

Reitman, E., & Flood, P. (2011). Anaesthetic considerations for non-obstetric surgery during pregnancy. *British Journal of Anaesthesia*, *107*(SUPPL. 1). https://doi.org/10.1093/bja/aer343

Tolcher, M. C., Fisher, W. E., & Clark, S. L. (2018). Nonobstetric surgery during pregnancy. *Obstetrics and Gynecology*, *132*(2), 395–403. https://doi.org/10.1097/AOG.0000000000002748