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Chapter 13

Acute Cholecystitis in Pregnancy: Current Update on Management: Review

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Abstract

Acute cholecystitis during pregnancy represents a prevalent non-obstetric cause of acute abdominal pain. Management strategies can be categorized into conservative and surgical approaches. Conservative management typically involves the administration of intravenous fluids and antibiotics; however, patients may experience recurrent symptoms. Surgical intervention entails performing a cholecystectomy, which can be executed via open or laparoscopic techniques. Given the lack of consensus regarding the optimal management of acute cholecystitis in pregnancy, this review article has been conducted to examine the roles of conservative treatment and laparoscopic cholecystectomy, as well as to determine the most appropriate timing for surgical intervention. Additionally, the review addresses the role of percutaneous cholecystostomy.

Keywords: Acute Cholecystitis, Gallstone Disease, Conservative Treatment, Laparoscopic Cholecystectomy, Pregnancy, and Percutaneous Cholecystostomy.

1. Introduction

Acute cholecystitis represents the second most prevalent cause of non-obstetric abdominal pain in pregnant patients. The incidence of acute cholecystitis during pregnancy is approximately 0.2 to 0.5 per 1,000 pregnancies. The global prevalence of gallstone disease in pregnancy is estimated at 3.6%. During pregnancy, elevated serum levels of estrogen and progesterone predispose individuals to gallstone formation. Estrogen is associated with increased bile viscosity and cholesterol crystal aggregation, while progesterone is linked to gallbladder smooth muscle relaxation and bile stasis [1–3]. The clinical presentation mirrors that of non-pregnant women, including pain in the right hypochondrium and associated symptoms such as nausea and vomiting. Additional symptoms may include dyspepsia and abdominal distension postprandially. Diagnosis is typically confirmed through blood investigations, including full blood count, liver function tests, and serum amylase, alongside abdominal ultrasound imaging. Ultrasound demonstrates high sensitivity and specificity in diagnosing acute cholecystitis during pregnancy [4].

The anatomical and physiological alterations that occur during pregnancy complicate the diagnosis and management of acute cholecystitis. The position of the gravid uterus throughout the various trimesters of pregnancy poses challenges for clinical examination. Additionally, the presence of leukocytosis and elevated serum alkaline phosphatase levels during pregnancy complicates the use of blood investigations for diagnosing acute cholecystitis [5]. The management of acute cholecystitis in pregnant patients can be categorized into medical and surgical approaches. Medical management involves hospital admission, fasting, initiation of intravenous antibiotics and analgesics, and planning for cholecystectomy during the postpartum period once the patient's condition has stabilized. If cholecystectomy is required during pregnancy, it is typically performed in the second trimester, as surgery is generally avoided in the first and third trimesters due to the risks of threatened abortion and the enlarged gravid uterus [6–8].

Patients who receive conservative management for acute cholecystitis during pregnancy frequently experience a high rate of readmission due to recurrent episodes, which can adversely impact maternal and fetal well-being. Consequently, early cholecystectomy is often performed to address this condition [9]. In cases where cholecystectomy is considered during the third trimester, it is essential to assess the severity of acute cholecystitis. Should the clinical condition worsen, laparoscopic cholecystectomy may be necessary. Conversely, if symptoms improve, the procedure may be deferred until the postpartum period [10]. The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) advocates for laparoscopic cholecystectomy in the management of acute cholecystitis during pregnancy, as it provides benefits

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comparable to open surgery and can be safely conducted in any trimester if surgical intervention is required. Key technical considerations include patient positioning, port placement, the use of low-pressure insufflation, and intraoperative monitoring of carbon dioxide levels [11].

Currently, there is no consensus regarding the management of acute cholecystitis during pregnancy, and the role of conservative treatment remains inadequately defined. The optimal timing for performing a laparoscopic cholecystectomy is also unclear; it can be conducted during any trimester of pregnancy, yet the implications of postponing the procedure until the postpartum period are not well understood. This review article aims to address these factors in the management of acute cholecystitis in pregnancy. We conducted a comprehensive literature review utilizing PUBMED, the Cochrane Database of Systematic Reviews, Google Scholar, and Semantic Scholar, focusing on randomized controlled trials, non-randomized trials, observational and cohort studies, clinical reviews, systematic reviews, case reports, and meta-analyses from 1980 to 2025. The search employed the following keywords: "Acute cholecystitis," "Gallstone disease," "Conservative treatment," "Laparoscopic cholecystectomy," "Pregnancy," and "Percutaneous cholecystostomy." All articles were in English and were assessed through manual cross-referencing of the literature. Commentaries and editorials were excluded from this review. Only pregnant patients presenting with symptoms of non-obstetric abdominal pain were included in this study.

2. Discussion

Conservative treatment of acute cholecystitis in pregnancy

Pregnant patients presenting with symptoms of acute cholecystitis are frequently managed through conservative treatment. This approach typically involves the administration of intravenous antibiotics and analgesics, supplemented by intravenous fluids if the patient experiences persistent nausea and vomiting. The selection of antibiotics is constrained by pregnancy considerations, with second and third-generation cephalosporins being commonly employed due to their safety profile [12–14]. Analgesia is generally provided using opioids and paracetamol, while non-steroidal anti-inflammatory drugs (NSAIDs) are contraindicated due to potential fetal complications, such as oligohydramnios and premature closure of the patent ductus arteriosus. Conservative management is associated with a high recurrence rate, ranging from 40% to 77%, which may adversely affect both maternal and fetal well-being [15–17].

A retrospective study conducted by [18] on the conservative treatment during pregnancy concluded that patients who underwent conservative management exhibited a higher frequency of emergency department visits and elevated readmission rates [18]. Additionally, a nationwide analysis by [19] examined the morbidity associated with the conservative management of acute cholecystitis in pregnancy. This study included a total of 6390 patients and concluded that conservative treatment was linked to increased fetal-maternal complications, premature labor, elevated caesarean section rates, and poor fetal health [19].

A review conducted by [20] on the management of complicated gallstone disease during pregnancy concluded that up to 27% of patients did not respond to conservative treatment, with maternal and fetal mortality rates being comparable between those who underwent conservative and surgical interventions. Similarly, a review by [21] comparing conservative and surgical treatments for acute cholecystitis in pregnancy reported a recurrence rate of 38%, with the highest recurrence observed in patients during the second trimester [20, 21]. Furthermore, a retrospective study by [22]. examined decision-making in cases of acute cholecystitis in pregnancy, specifically whether clinical guidelines were adhered to. Among the 220 patients who received conservative treatment, the recurrence rate was 77%; however, there were no maternal-fetal complications reported [22].

Surgical management of acute cholecystitis in pregnancy

The surgical management of acute cholecystitis during pregnancy involves cholecystectomy, which may be conducted as either an open or laparoscopic procedure. The timing of the surgery is crucial, with the second trimester being the optimal period for achieving the most favorable outcomes. The risk of spontaneous abortion is elevated during the first trimester, while the likelihood of premature labor increases if the surgery is performed in the third trimester. Laparoscopic cholecystectomy is not contraindicated for pregnant patients, and the second trimester is the most suitable time for its execution, as trocar placement can be accomplished without interference from the uterine size [23–31].

A meta-analysis conducted by [32] examined the safety of surgical intervention for symptomatic gallstone disease during pregnancy. This study encompassed a total of 470 patients, revealing a pre-term delivery rate of 6.8%, with no significant differences observed in maternal and fetal mortality rates. The meta-analysis concluded that cholecystectomy can be safely performed during pregnancy [32]. Additionally, a systematic review and meta-analysis by [33] compared laparoscopic versus open cholecystectomy in the surgical management of acute cholecystitis in pregnant patients. This analysis included 10,632 patients and found that laparoscopic cholecystectomy was associated with reduced maternal and fetal complications. The conversion rate was 3.8%, and the average length of hospital stay was three days. The study concluded that laparoscopic cholecystectomy is safe to perform, although it did not determine the optimal timing for surgery, as most procedures were conducted during the first and second trimesters [33]. Furthermore, a systematic review by [34] focused on laparoscopic cholecystectomy during pregnancy, including 590 patients. The majority of operations were performed in the second trimester, with postoperative complication rates at 4% and a conversion rate to open cholecystectomy of 2.2%. The preterm delivery rate was 5.7%, indicating that laparoscopic cholecystectomy can be safely performed in cases of acute cholecystitis during pregnancy [34].

Laparoscopic cholecystectomy during pregnancy should be conducted with the patient in the supine position, utilizing the open Hassan technique for port placement. Pneumoperitoneum should be maintained at a pressure of 8-12 mmHg. Additionally, tocolytics should be administered, and fetal heart rate monitoring should be performed [35, 36]. This procedure has been demonstrated to be safe during pregnancy, as it is associated with reduced short-term fetal adverse effects, shorter operative time, decreased length of hospital stay, and a diminished need for blood transfusion. Furthermore, there is a reduced risk of miscarriage. Other factors that may influence the outcome include independent variables such as age over 35 years, the presence of jaundice, and biliary peritonitis [37–41].

Table 1: The conversion rates, preterm delivery rates, and complication rates of patients who underwent laparoscopic cholecystectomy in pregnancy

Study	Year	Study type	N=numbers	Conversion rate (%)	Preterm delivery rate (%)	Complication rate (%)
Sedaghat et al [33]	2016	Systemic review and meta-analysis	10,632	3.8%	8.7%	9.6%
Nasioudis et al [34]	2016	Meta-analysis	590	2.2%	5.7%	4%

Percutaneous cholecystostomy in acute cholecystitis in pregnancy

Percutaneous cholecystostomy is a viable intervention for stabilizing pregnant patients presenting with acute cholecystitis. This procedure can be effectively combined with conservative management strategies to address acute cholecystitis in pregnant individuals. In the first trimester, percutaneous cholecystostomy may facilitate an elective cholecystectomy in the second trimester. For those presenting in the third trimester, it serves as a temporary measure until a postpartum cholecystectomy can be performed. The literature on the application of percutaneous cholecystostomy in the context of acute cholecystitis during pregnancy is limited, consisting mainly of case reports and series. Consequently, large-scale studies are warranted to evaluate its efficacy, as there is currently no consensus on its management [42–46].

3. Conclusion

The management of acute cholecystitis during pregnancy has increasingly favored early laparoscopic cholecystectomy due to the high recurrence rate associated with conservative treatment. Laparoscopic cholecystectomy is not contraindicated in pregnant patients. However, the positioning of the gravid uterus complicates port placement, necessitating that surgeons possess a certain level of expertise in performing this procedure. Despite evidence supporting the safety of surgery during pregnancy, many general surgeons remain hesitant to operate in such cases. Conservative treatment remains a prevalent therapeutic approach for acute cholecystitis in pregnancy, largely because many hospitals lack the necessary fetal and maternal monitoring capabilities, which discourages the performance of laparoscopic cholecystectomy during pregnancy. Consequently, most patients undergo cholecystectomy in the postpartum period. Percutaneous cholecystostomy may serve as a bridging procedure to stabilize patients, but it is not widely favored due to the challenges of catheter insertion and the contraindication of tube cholangiography, given the radiation risk to the fetus. It is advisable to perform laparoscopic cholecystectomy during the second trimester, as the risks to both mother and fetus are minimized. Pregnant patients with cholelithiasis should be counseled regarding the risks of gallstone disease complications and the available treatment options. Further large-scale studies are necessary to determine whether surgery is the optimal treatment for acute cholecystitis in pregnancy.

Article Information

Conflict of interest: There is no conflict of interest.

References

[1] B. O. Ibitoye, A. O. Adisa, O. N. Makinde, and A. O. Ijarotimi. Prevalence and complications of gallstone disease among pregnant women in a nigerian hospital. *International Journal of Gynecology and Obstetrics*, 125(1):41–43, 2014. doi:10.1016/j.ijgo.2013.09.022.

[2] N. Salari, R. Hasheminezhad, P. Heidarisharaf, A. A. Khaleghi, A. H. Azizi, S. Shohaimi, and M. Mohammadi. The global prevalence of gallstones in pregnancy: A systematic review and meta-analysis. *European Journal of Obstetrics and Gynecology and Reproductive Biology: X*, 19, 2023. doi:10.1016/j.eurox.2023.100237. Elsevier Ireland Ltd.

[3] J. Y. Tseng, M. J. Yang, C. C. Yang, K. C. Chao, and H. Y. Li. Acute cholecystitis during pregnancy: What is the best approach? *Taiwanese Journal of Obstetrics and Gynecology*, 48(3):305–307, 2009. doi:10.1016/S1028-4559(09)60311-9.

[4] S. J. Schwulst and M. Son. Management of gallstone disease during pregnancy. *JAMA Surgery*, 155(12):1162–1163, 2020. doi:10.1001/jamasurg.2020.3683. American Medical Association.

[5] J. Bouyou, S. Gaujoux, L. Marcellin, M. Leconte, F. Goffinet, C. Chapron, and B. Dousset. Abdominal emergencies during pregnancy. *Journal of Visceral Surgery*, 152(6):S105–S115, 2015. doi:10.1016/j.jviscsurg.2015.09.017. Elsevier Masson s.r.l.

[6] B. Barut, F. Gönültaş, A. F. K. Gök, and T. T. Şahin. Management of acute cholecystitis during pregnancy: A single-center experience. *Ulusal Travma ve Acil Cerrahi Dergisi*, 25(2):154–158, 2019. doi:10.5505/tjtes.2018.82357.

[7] B. M. Casey and S. M. Cox. Cholecystitis in pregnancy. *Infectious diseases in obstetrics and gynecology*, 4(5):303–309, 1996. doi:10.1155/S1064744996000592.

[8] C. Grigoriu, C. Lutic, I. Scurtu, G. Calinescu, C. M. Gheorghe, A. M. Balan, T. A. Georgescu, V. Dima, R. M. Grigoriu, and R. E. Bohiltea. Management of biliary lithiasis in pregnancy – an updated overview. *Romanian Medical Journal*, 68(4):433–436, 2021. doi:10.37897/RMJ.2021.4.2.

[9] J. Hedström, J. Nilsson, R. Andersson, and B. Andersson. Changing management of gallstone-related disease in pregnancy–a retrospective cohort analysis. *Scandinavian Journal of Gastroenterology*, 52(9):1016–1021, 2017. doi:10.1080/00365521.2017.1333627.

[10] W. Zhang, H. Yi, M. Cai, and J. Zhang. Management strategies for acute cholecystitis in late pregnancy: a multicenter retrospective study. *BMC Surgery*, 23(1), 2023. doi:10.1186/s12893-023-02257-3.

[11] J. P. Pearl, R. R. Price, A. E. Tonkin, W. S. Richardson, and D. Stefanidis. Sages guidelines for the use of laparoscopy during pregnancy. *Surgical endoscopy*, 31(10):3767–3782, 2017. doi:10.1007/s00464-017-5637-3.

[12] G. Augustin and M. Majerovic. Non-obstetrical acute abdomen during pregnancy. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, 131(1):4–12, 2007. doi:10.1016/j.ejogrb.2006.07.052. Elsevier Ireland Ltd.

[13] A. El-Messidi, G. Alsarraj, N. Czuzoj-Shulman, D. S. Mishkin, and H. A. Abenhaim. Evaluation of management and surgical outcomes in pregnancies complicated by acute cholecystitis. *Journal of Perinatal Medicine*, 46(9):998–1003, 2018. doi:10.1515/jpm-2017-0085.

[14] I. Ibiebele, M. Schnitzler, T. Nippita, and J. B. Ford. Outcomes of gallstone disease during pregnancy: a population-based data linkage study. *Paediatric and Perinatal Epidemiology*, 31(6):522–530, 2017. doi:10.1111/ppe.12406.

[15] N. B. Gilo, D. Amini, and H. J. Landy. Appendicitis and cholecystitis in pregnancy. *Clinical obstetrics and gynecology*, 52(4):586–596, 2009. doi:10.1097/GRF.0b013e3181c11d10.

[16] A. M. Jorge, R. N. Keswani, A. Veerappan, N. J. Soper, and A. J. Gawron. Non-operative management of symptomatic cholelithiasis in pregnancy is associated with frequent hospitalizations. *Journal of Gastrointestinal Surgery*, 19(4):598–603, 2015. doi:10.1007/s11605-015-2757-8.

[17] D. J. Selzer and D. Stefanidis. Surgical emergencies in the pregnant patient. In *Advances in Surgery (Vol. 53)*, pages 161–177. Academic Press Inc, 2019. doi:10.1016/j.yasu.2019.04.008.

[18] M. O. Othman, E. Stone, M. Hashimi, and G. Parasher. Conservative management of cholelithiasis and its complications in pregnancy is associated with recurrent symptoms and more emergency department visits. *Gastrointestinal Endoscopy*, 76(3):564–569, 2012. doi:10.1016/j.gie.2012.04.475.

[19] A. J. Rios-Diaz, E. A. Oliver, L. A. Bevilacqua, D. Metcalfe, C. J. Yeo, V. Berghella, and F. Palazzo. Is it safe to manage acute cholecystitis nonoperatively during pregnancy?: A nationwide analysis of morbidity according to management strategy. *Annals of Surgery*, 272(3):449–456, 2020. doi:10.1097/SLA.0000000000004210.

[20] R. S. Date, M. Kaushal, and A. Ramesh. A review of the management of gallstone disease and its complications in pregnancy. *American Journal of Surgery*, 196(4):599–608, 2008. doi:10.1016/j.amjsurg.2008.01.015.

[21] E. J. Lu, M. J. Curet, Y. Y. El-Sayed, and K. S. Kirkwood. Medical versus surgical management of biliary tract disease in pregnancy. *American Journal of Surgery*, 188(6):755–759, 2004. doi:10.1016/j.amjsurg.2004.09.002.

[22] M. Hassanesfahani, B. Villavarajan, I. Otusile, B. S. Williams, J. Tian, A. Miele, M. A. Louis, and N. Mandava. Between guidelines and reality; the complex decision-making of acute cholecystitis in pregnancy. *Langenbeck's Archives of Surgery*, 410(1), 2025. doi:10.1007/s00423-025-03768-8.

[23] S. Barber-Millet, J. Bueno Lledó, P. Granero Castro, I. Gómez Gavara, N. Ballester Pla, and R. García Domínguez. Update on the management of non-obstetric acute abdomen in pregnant patients. *Cirugía Española (English Edition)*, 94(5):257–265, 2016. doi:10.1016/j.cireng.2016.05.001.

[24] V. Cheng, K. Matsushima, K. Sandhu, M. Ashbrook, K. Matsuo, K. Inaba, and D. Demetriades. Surgical trends in the management of acute cholecystitis during pregnancy. *Surgical Endoscopy*, 35(10):5752–5759, 2021. doi:10.1007/s00464-020-08054-w.

[25] L. C. Chiedozi, F. N. Al Hadi, M. M. Salem, F. A. Al Moaidi, and E. E. Okpere. Management of symptomatic cholelithiasis in pregnancy. *Annals of Saudi medicine*, 21(1-2):38–41, 2001. doi:10.5144/0256-4947.2001.38.

[26] G. N. Costantino, G. J. Vincent, G. G. Mukalian, and W. L. Kliefoth. Jr (1994). laparoscopic cholecystectomy in pregnancy. *Journal of laparoendoscopic surgery*, 4(2):161–164. doi:10.1089/lps.1994.4.161.

[27] R. E. Glasgow, B. C. Visser, H. W. Harris, M. G. Patti, S. J. Kilpatrick, and S. J. Mulvihill. Changing management of gallstone disease during pregnancy. *Surgical endoscopy*, 12(3):241–246, 1998. doi:10.1007/s004649900643.

[28] J. Hedström, J. Nilsson, and B. Andersson. Cholecystectomy and ercp in pregnancy: a nationwide register-based study. *International Journal of Surgery (London, England)*, 110(1):324–331, 2024. doi:10.1097/JS9.0000000000000812.

[29] G. R. Mazza, A. C. Youssefzadeh, L. S. Aberle, Z. S. Anderson, R. S. Mandelbaum, J. G. Ouzounian, K. Matsushima, and K. Matsuo. Pregnant patients undergoing cholecystectomy: nationwide assessment of clinical characteristics and outcomes. *AJOG Global Reports*, 4(1), 2024. doi:10.1016/j.xagr.2024.100310.

[30] A. Paramanathan, S. Z. Walsh, J. Zhou, and S. Chan. Laparoscopic cholecystectomy in pregnancy: An australian retrospective cohort study. *International Journal of Surgery*, 18:220–223, 2015. doi:10.1016/j.ijsu.2015.05.005.

[31] B. M. Quesada, L. T. Chiappetta Porras, E. D. Nápoli, C. M. Canullán, H. E. Roff, J. Alvarez Rodríguez, and A. S. Oría. *Minimally invasive management of acute biliary tract disease during pregnancy*. HPB Surgery, 2009. doi:10.1155/2009/829020.

[32] R. Athwal, R. H. Bhogal, J. Hodson, and S. Ramcharan. Surgery for gallstone disease during pregnancy does not increase fetal or maternal mortality: a meta-analysis. *Hepatobiliary Surgery and Nutrition*, 5(1):53–57, 2016. doi:10.3978/j.issn.2304-3881.2015.11.02.

[33] N. Sedaghat, A. M. Cao, G. D. Eslick, and M. R. Cox. Laparoscopic versus open cholecystectomy in pregnancy: a systematic review and meta-analysis. *Surgical Endoscopy*, 31(2):673–679, 2017. doi:10.1007/s00464-016-5019-2.

[34] D. Nasioudis, D. Tsilimigras, and K. P. Economopoulos. Laparoscopic cholecystectomy during pregnancy: A systematic review of 590 patients. *International Journal of Surgery*, 27:165–175, 2016. doi:10.1016/j.ijsu.2016.01.070. Elsevier Ltd.

[35] N. Halkic, A. A. Tempia-Caliera, R. Ksontini, M. Suter, J. F. Delaloye, and H. Vuilleumier. Laparoscopic management of appendicitis and symptomatic cholelithiasis during pregnancy. *Langenbeck's Archives of Surgery*, 391(5):467–471, 2006. doi:10.1007/s00423-006-0069-x.

[36] M. D. Rollins, K. J. Chan, and R. R. Price. Laparoscopy for appendicitis an d cholelithiasis during pregnancy: A new standard of care. *Surgical Endoscopy and Other Interventional Techniques*, 18(2):237–241, 2004. doi:10.1007/s00464-003-8811-8.

[37] A. Itaimi, I. Abbassi, O. Baraket, A. Kotti, W. Triki, and S. Bouchoucha. Safety of laparoscopic cholecystectomy for cholecystitis during pregnancy. *Gynecology and Minimally Invasive Therapy*, 12(3):166–169, 2023. doi:10.4103/gmit.gmit_57_22.

[38] X. Nan, E. Chan, K. S. Chole Wong, J. Ng, S. Izwan, M. Cooper, and R. Damodaran. *Laparoscopic Cholecystectomy in Pregnancy: A Seven-Year Retrospective Study From an Australian Tertiary Center*. Cureus, 2023. doi:10.7759/cureus.50034.

[39] C. Palanivelu, M. Rangarajan, S. Senthilkumaran, and R. Parthasarathi. Safety and efficacy of laparoscopic surgery in pregnancy: Experience of a single institution. *Journal of Laparoendoscopic and Advanced Surgical Techniques*, 17(2):186–190, 2007. doi:10.1089/lap.2006.0037.

[40] D. Shigemi, S. Aso, H. Matsui, K. Fushimi, and H. Yasunaga. Safety of laparoscopic surgery for benign diseases during pregnancy: A nationwide retrospective cohort study. *Journal of Minimally Invasive Gynecology*, 26(3):501–506, 2019. doi:10.1016/j.jmig.2018.06.008.

[41] J. Vujic, K. Marsoner, A. H. Lipp-Pump, P. Klaritsch, H. J. Mischinger, and P. Kornprat. Non-obstetric surgery during pregnancy - an eleven-year retrospective analysis. *BMC Pregnancy and Childbirth*, 19(1), 2019. doi:10.1186/s12884-019-2554-6.

[42] W. Greer and S. McSwine. Acs case reviews in surgery and ahrq safety program for eras: New acs programs enhance quality patient care. *Bulletin of the American College of Surgeons*, 102(4):64–65, 2017.

[43] N. Allmendinger, M. J. Hallisey, S. K. Ohki, and J. J. Straub. Percutaneous cholecystostomy treatment of acute cholecystitis in pregnancy. *Obstetrics and gynecology*, 86(4):653–654, 1995. doi:10.1016/0029-7844(95)00087-8. Pt 2.

[44] K. Caliskan. The use of percutaneous cholecystostomy in the treatment of acute cholecystitis during pregnancy. *Clinical and Experimental Obstetrics and Gynecology*, 44(1):11–13, 2017. doi:10.12891/ceog3088.2017.

[45] Y. Hojberg, K. Patel, and S. Shebrain. Utilizing percutaneous cholecystostomy tube as a temporary minimally invasive approach for acute cholecystitis during third trimester of a high-risk pregnancy. *Case Reports in Gastroenterology*, 16(1):49–54, 2022. doi:10.1159/000522060.

[46] M. W. Little, J. H. Briggs, C. R. Tapping, M. J. Bratby, S. Anthony, J. Phillips-Hughes, and R. Uberoi. Percutaneous cholecystostomy: The radiologist's role in treating acute cholecystitis. *Clinical Radiology*, 68(7):654–660, 2013. doi:10.1016/j.crad.2013.01.017.