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Case Report

Anesthesia Considerations in the Management of a Ruptured Giant Angiomyolipoma in a Pregnant Patient. Case Report and Review of Literature

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Abstract

Angiomyolipoma is a rare, benign tumor composed of smooth muscle fibers, thickened-walled blood vessels, and mature adipose tissue in varying proportions with an overall prevalence rate of 0.13% - 0.6%. Most patients are asymptomatic and diagnosis are most often an incidental finding during examination. Females, especially pregnant women are affected more often due to hormonal changes, which drives the growth of the tumor. The primary diagnostic method is renal ultrasound (US), which is supplemented by magnetic resonance imaging (MRI) if necessary. Angiomyolipoma can cause severe pregnancy complications, such as spontaneous renal rupture, which poses a danger to both mother and fetus. Most don't require treatment. However, if symptomatic, treatment includes embolization, or surgical treatment.

Keywords: Renal Angiomyolipoma; Pregnancy; Ruptured Giant Angiomyolipoma; Anesthesia.

Introduction

Renal Angiomyolipoma (AML) is a rare benign tumor that affects women predominantly. They are known to grow in size during pregnancy and rarely rupture leading to potential maternal fetal death. We report a 34-yr-old pregnant patient with a ruptured renal AML who presented to us on three different occasions with three different clinical scenarios illustrating the natural history of disease and the challenges encountered during the multidisciplinary management.

Case Report

This is a case of a healthy 34-year-old pregnant patient (14 weeks age of gestation) who two years prior to the most recent presentation developed what appeared to be a three-week long urinary tract infection. Due to the refractory nature of her symptoms, additional investigational imaging studies were conducted. A CT scan of the abdomen revealed a large exophytic round mass likely originating from the upper pole of the left kidney, measuring 9.9 x 8.4 x 9.9 cm, most likely consistent with a Renal Angiomyolipoma.

The patient was seen by Urology and after extensive counseling regarding the potential for growth and rupture in a childbearing woman, she was advised to either consider starting contraception or undergo elective surgical resection vs trans arterial embolization of the angiomyolipoma.

Unfortunately, due to financial constraints, the patient was lost to follow up. Two years later, in July 2025, she returned with complaints of worsening abdominal pain. On imaging, the left renal angiomyolipoma had increased in size to 10.0 x 9.2 x 10.2 cm with no evidence of rupture with an incidental positive pregnancy test at 7 weeks age of gestation.

At this point, due to the potential risk of rupture during pregnancy,

she was strongly counseled to consider elective surgical resection vs trans arterial embolization in the second trimester in order to minimize the risk of radiation on the fetus and surgical complications during the gestational phase of pregnancy.

As she was being observed and prepared for elective surgery, she presented to the emergency room with severe abdominal and left flank pain. Her vital signs were Temp 37.1 C, HR 121, BP 110/80, RR 24. Her Hgb was 6.8g/dl with a viable pregnancy at 14 weeks age of gestation, no vaginal bleeding or gross hematuria was noted. MRI of the abdomen revealed a 11.9 x 13.6 x 13.8cm left renal exophytic angiomyolipoma with retroperitoneal rupture (Figure 1).

After a multidisciplinary evaluation of the patient by Urology, Anesthesia and OB/GYN, the patient was adequately resuscitated with two PRBC, adequate fetal heart tones were confirmed and she was taken to the operating room for emergent left open nephrectomy.

A pre-induction epidural catheter was inserted at L1-L2 uneventfully. In preparation for General Endotracheal Anesthesia, the following Induction agents were administered: Midazolam 0.02mg/kg, Fentanyl 1mcg/kg, Propofol 1.5mg/kg, Rocuronium 1mg/kg.

She was placed in a supine position, no intraoperative fetal heart monitoring was conducted and she was maintained on Sevoflurane at MAC 1.2%. Intraoperatively, she had three brief episodes of hypotension rapidly responsive to phenylephrine 100mcg boluses. The nephrectomy (Figure 2) was completed uneventfully with an estimated blood loss of 2 L, requiring 2 PRBC typed and crossmatched transfusion.

In the immediate post-operative phase, fetal heart tones were checked by OB/GYN and they were found to be within normal limits. The post-operative analgesia consisted of Ropivacaine 0.2% + Fentanyl 2 mcg/ml PCEA, and Paracetamol 1g IV every 8 hr successfully transitioning to oral pain medication and removal of the epidural catheter.

After an uneventful post-operative course, she was discharged home on post operative day 3. The pathology result of the surgical specimen confirmed the diagnosis of a ruptured angiomyolipoma (Figure 3,4).

She was followed as an outpatient in a multidisciplinary fashion by OB/GYN and Urology and she delivered a healthy boy weighing 2574g via C-Section on her 37th week age of gestation (Figure 5).

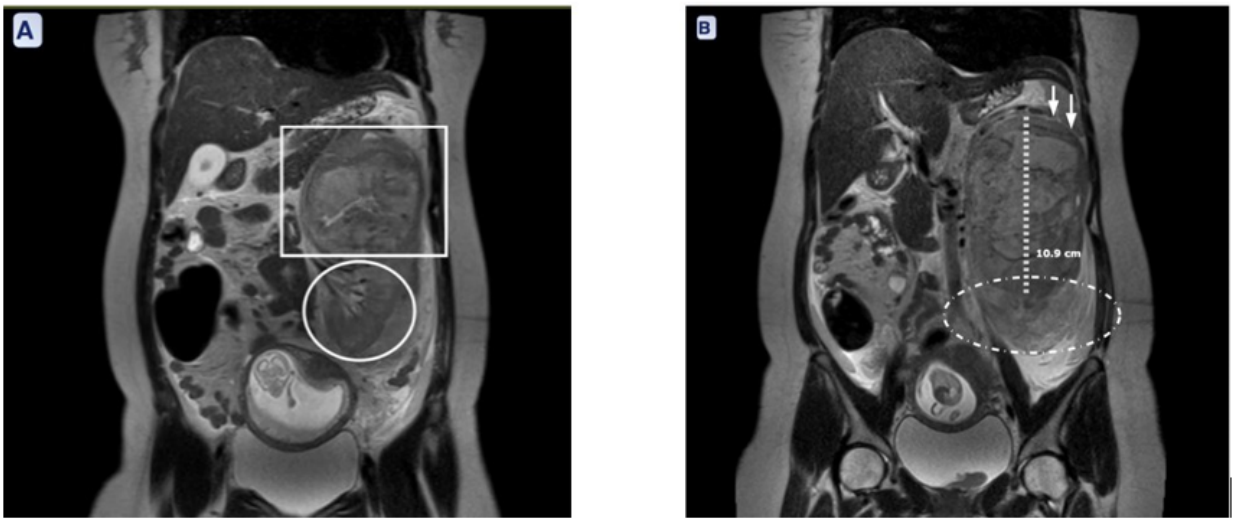


Figure 1: Radiologic View of the Renal Tumor: T2W Whole Abdomen MRI using 1.5 Tesla: Coronal Cut

A. Large heterogenous, predominantly fat-attenuating mass with soft tissue components (Box), seen in the upper pole of the left kidney (circle).

B. Angiomyolipoma in its widest diameter (broken vertical lines); with fairly large heterogenous ipsilateral subcapsular hematoma, predominantly hyperintense on T2, with surrounding inflammatory changes (broken circle)-suggestive of ruptured angiomyolipoma.

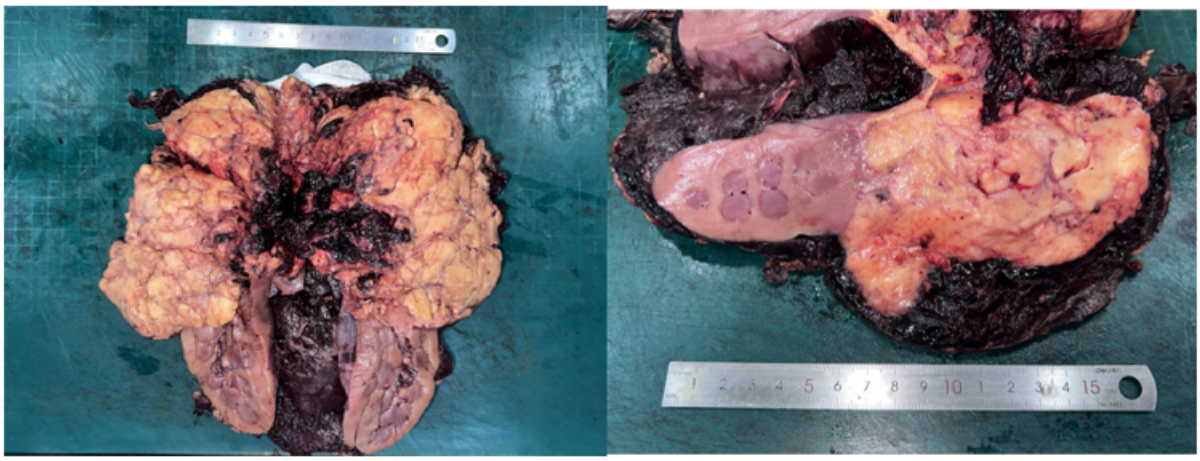
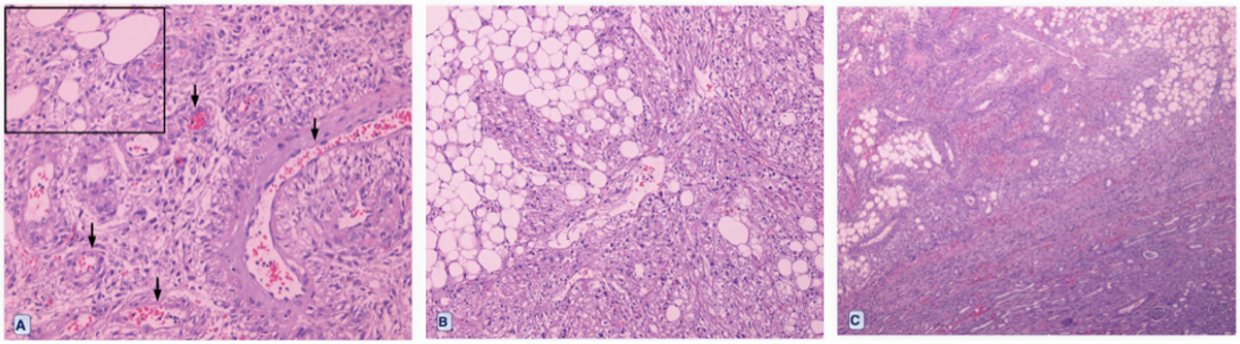


Figure 2: Gross Specimen.



Figures 3,4: Microscopic View of Renal Tumor

A. X 20 magnification, Lipoma in the upper part (box), Vascular proliferations (arrows).

B. X 10 magnification showing lipoma.

C. X 4 magnification Renal Tumor with adjacent normal Renal Parenchyma.



Figure 5: The patient with her newborn 6 months after the surgery.

Discussion

Renal Angiomyolipoma (AML) is a rare benign renal tumor composed of blood vessels, fat, connective tissue, and smooth muscle accounting for 13%-52% of all benign renal lesions and affecting 0.2%-0.6% of total worldwide population [1], with significant higher incidence in women (78%) [2]. Although most angiomyolipomas are located in the kidneys, they can also be diagnosed in other organs like liver, spleen or uterus as they arise from epithelioid cells around blood vessels [3].

Renal AML presents sporadically 80% of the time, while the remaining 20% are associated with a genetic predisposition such as Tuberous Sclerosis Complex (TSC) and Lymphangioleiomyomatosis (LAM). Most commonly, greater than 80% of the patients with AML are asymptomatic while 15% may rupture [2]. However, 80% of pregnant women with AML will eventually rupture during the later stages of pregnancy [4]. The mean gestational diagnostic age is 27.7 weeks [4]. Therefore, pregnancy is a significant risk factor for rupture in women with AML.

Several factors have been described as potential pathophysiologic contributors to the AML tumor growth and potential rupture during pregnancy. A hormonal influence for growth appears to be significant since more than 25% of the tumor displays estrogen and progesterone receptors [5]. Hydronephrosis caused by the relaxation of the ureter, the increased blood volume and blood pressure during pregnancy contribute to the growth of the tumor and the development of intratumoral aneurysms [6]. In addition, a rupture during labor may be induced by the increased intra-abdominal pressure, hemodynamic changes and increased muscle sensitivity to oxytocin [7]. Other factors found to increase the risk for rupture are tumor size >4cm, the presence of an aneurysm >5mm, hormonal therapy and association with TSC/LAM [7].

In a review of 45 cases of ruptured AML in pregnancy [8], the average tumor size was 9.6 cm, occurring around the 26th week of gestation. In the stable group, 20 cases (91%) completed pregnancy and term delivery. Conversely, 45% of the patients presented hemodynamically unstable in shock or requiring continuous blood transfusions and/or displayed signs of fetal distress. In the unstable group, 45% required emergency C-section and 30% resulted in fetal death underscoring the need to prevent the growth and eventual rupture of the tumor in these patients and the urgent need to provide definitive care in the setting of rupture.

There is no specific consensus in how to manage AML during pregnancy since there are multiple variables that need to be considered. The health of the mother, complications of the pregnancy, gestational stage, the local medical/surgical resource availability, size of the tumor, presence of aneurysms and association with TSC/LAM are all factors that need to be factored in.

In childbearing patients with AML, the risk of rupture and the potential serious consequences on the fetal /maternal lives as well as all the treatment options have to be explained in detail. Pre pregnancy counseling on contraception should be considered.

A conservative approach may be offered for asymptomatic pregnant patients only if they are willing to continue their pregnancy after counselling on the potential high risk of AML rupture. In this setting, definitive treatment is completed after delivery. Conservative management is also recommended for AML sized <4 cm or for a larger but stable tumor [7].

Patients with AML >4cm in size and/or intratumoral aneurysms >5mm are advised to undergo prophylactic treatment regardless of symptoms due to a higher risk of rupture [9].

At the time of evaluation for treatment of a pregnant patient with renal AML, attempts should be made to pursue some objectives. Preventing acute episodes such as rupture, hematuria, preserving as much renal parenchyma as possible, enhancing long-term renal function, minimizing anesthesia complications and radiation exposure [10].

Historically, a total nephrectomy has been considered the standard of care for renal AML in the prophylactic and emergency setting with its subsequent potential anesthesia and surgical complications [10]. However, more recently, transarterial renal embolization

(TAE) has become the first line of treatment for prophylactic as well as emergency management of renal AML in pregnant patients [11, 12]. Relegating partial or total nephrectomy for larger tumors, emergency cases where interventional radiology capabilities are not available or acute presentations during the first trimester where radiation exposure to the fetus is avoided. Prophylactic TAE has also been shown to be very effective in inhibiting tumor growth and preventing rupture in childbearing patients who subsequently got pregnant with hyper vascular AMLs associated with TSC and LAM [15].

TAE achieves complete occlusion of feeding arteries supplying to the AML in 93.9% and 85% of bleeding AMLs were successfully embolized on the first attempt [13] while avoiding general anesthesia. However, tumor regrowth and rebleeding after embolization remain a concern specially in pregnant patients. Recurrence rates of AMLs after TAE varies from about 11% to 40% [14]. Re-embolization or subsequent partial / total nephrectomy is sometimes required.

Radiation exposure to the fetus caused by TAE during organogenesis and the completion of the neuronal cell proliferation phase (first trimester) is of serious concern and therefore it should be avoided. The transfemoral artery approach for TAE is known to expose the pelvis to a significant amount of radiation [16]. An alternative approach to femoral access in pregnant patients with AML with more versatility for positioning and reduction of radiation exposure to the fetus has been described by gaining access via the radial artery [17].

In addition, when considering the strategy of treatment for ruptured AML during pregnancy, hemodynamic stability of the mother and fetus must be prioritized. In the setting of hemodynamic instability and a viable pregnancy, active treatment including cesarean section should be carried out immediately to avoid fetal death.

As the management of renal AMLs during pregnancy has evolved during the past two decades so have the anesthesia considerations. These patients should be evaluated and treated in a multidisciplinary fashion in very close coordination between Urology, Interventional Radiology, OB/GYN and anesthesiology.

Our patient presented to us at three different times displaying three different clinical scenarios with three potential treatment modalities.

At her initial presentation, she was symptomatic from a renal AML that measured 9.9 x 8.4 x 9.9 cm but she was not pregnant at the time. Her symptoms, the size (>4cm) and being childbearing warranted treatment. She was counseled regarding contraception and she was advised to consider TAE vs total nephrectomy due to the large size. The TAE could have been accessed either via femoral or radial artery with standard local anesthesia and IV sedation without concerns regarding pelvic radiation exposure. The left total nephrectomy would have been done with standard General Anesthesia with or without regional anesthesia in a right lateral decubitus position. Unfortunately, the patient was lost to follow up.

At her second presentation, she was symptomatic and the tumor was already increasing in size (10.0 x 9.2 x 10.2 cm). Incidentally, she was 7 weeks pregnant. At this point, she had an additional risk factor for rupture (pregnancy) that warranted treatment. In this clinical scenario, TAE would expose the fetus to significant radiation during the organogenesis phase, therefore, it was ruled out. Considering that the rate of miscarriage during a non-obstetric surgery during the first trimester is approximately 10% vs<1% in the second trimester [20], an elective total nephrectomy in the early stages of the second trimester was offered instead.

The pregnancy with its physiologic changes raises concerns for increased risk of pulmonary aspiration, coagulopathy, different pharmacological distribution and metabolism of anesthetic drugs, inducing pre-term labor, potential teratogenicity of anesthetic drugs, and long-term risk to the health of the fetus or the mother.

As we counsel the patient regarding perioperative anesthesia prior to her elective nephrectomy, there are no currently used anesthetic agents which have been shown to be teratogenic regardless of gestational age. Additionally, there is no evidence that exposure to anesthetic or sedative drugs in utero has any effect on the developing fetal brain and there is no animal data to support an effect on fetal brain development when exposures are less than 3 h in duration [18].

Despite the common concerns about the risk of aspiration in pregnant patients, the reported data has shown gastric emptying in pregnant patients to only be delayed during active labor and that gastric volumes in pregnant patients are like the non-pregnant patients otherwise [19]. In the pregnant patient without obesity who has met the current nil per os guidelines for surgery, the risk of pulmonary aspiration is low.

Pregnancy increases the risk of thromboembolic events in the mother especially in the perioperative phase. The risk is 5-10 times higher than nonpregnant patients [21] and remains elevated until the postpartum [22]. Therefore, appropriate discussions regarding thromboprophylaxis should take place with the surgical team.

When considering non-obstetric surgery in a pregnant patient, the gestational age and viability are important. A fetus is generally considered viable at 24 weeks age of gestation with the peri-viable period typically referring to 20 weeks through 25 weeks and 6 days gestation [23]. Our patient presented at 7 weeks with the intent to undergo the elective surgery anytime between 15-20 weeks of gestation. Therefore, a pre-viable pregnancy at that point

and fetal well-being should be confirmed with the use of fetal heart rate detection via Doppler prior to the procedure.

Preoperative anxiolysis could be beneficial in decreasing stress response and catecholamine release in pregnant patients. This is usually achieved with the administration of Midazolam. Older studies showing a possible link between maternal diazepam use and the development of cleft palate in the fetus have discouraged some anesthesiologists from using it. However, recent and larger studies have failed to demonstrate an association between the two although it could not be excluded [24]. In addition, midazolam specifically has not been associated with any congenital malformations [25].

The surgery would have been conducted with General anesthesia with or without regional anesthesia in a right lateral decubitus position since the size of the fetus would not be large enough to compromise venous return from the IVC.

Unfortunately, the team was unable to follow the proposed elective plan since she presented in the ER at 14 weeks of gestation with sudden onset of abdominal pain and a ruptured enlarging AML prompting the third clinical scenario.

While TAE has become the first line treatment for ruptured renal AML, due to the proximity to the first trimester, the size of the tumor and the ongoing bleeding (Hgb 6.8 g/dl), the decision was made to perform an open total nephrectomy.

Due to the demands of a potential life-threatening situation, general anesthesia is the most used anesthetic technique for non-obstetric surgery in pregnant patients with or without neuraxial anesthesia. In this setting there are some factors that need to be considered.

A multidisciplinary approach has to be maintained where the OB/GYN team is able to monitor the fetal heart tones as needed while in the operating room to identify any potential uteroplacental malperfusion.

Normothermia should be maintained for pregnant patients specially in the setting of hemorrhagic shock since hypothermia can cause a decreased heart rate. The use of a forced air warming blanket is most effective, other adjuncts are warm blankets, fluid warmers, and increasing operating room temperature [27].

Due to physiologic changes during pregnancy, these patients will have a reduction in the functional residual capacity without a change in closing capacity in the setting of increased oxygen consumption, leading to rapid desaturation during apnea. Given this risk for apnea, effective preoxygenation with 100% fraction inspired oxygen to ideally an end-tidal oxygen percentage of >80% prior to induction of general anesthesia should be used [26]. Despite the low risk for aspiration, some providers recommend Rapid Sequence Intubation (RSI) from the 12th week of pregnancy,13th week of pregnancy,18th week of pregnancy, and 27th week of pregnancy [28, 29, 30].

For the purpose of neuromuscular blockade either Succinylcholine or Rocuronium can be used as these drugs do not cross the placenta and are not known to induce muscle weakness or paralysis in the neonate. However, attention should be paid at the time of reversal of nondepolarizing neuromuscular blockade. Due to an increase in plasma volume in pregnant patients, this leads to a decreased relative concentration of plasma cholinesterases potentially causing an increase in circulating acetylcholine which may trigger uterine contractions [31]. Sugammadex is usually avoided in the pregnant population due to its binding and encapsulation of progesterone which plays a major role in the maintenance of the pregnancy [32]. Instead, Neostigmine is the most commonly used agent for neuromuscular blockade reversal in this patient population. It is not uncommon to encounter bradycardia after the administration of neostigmine and that is why it is usually administered in conjunction with glycopyrrolate. However, glycopyrrolate does not cross the placenta and there have been some reports of fetal bradycardia of no significant consequence [33]. As an alternative, atropine can be used with neostigmine since it readily crosses the placenta helping treat fetal bradycardia.

Maintenance of anesthesia in the pregnant population is commonly accomplished by inhalational or intravenous anesthetic which have been shown to be safe and effective with proper dosing and monitoring. Sevoflurane is a volatile anesthetic that is not considered to be teratogenic but can cause dose dependent uterine smooth muscle relaxation and maternal hypotension due to decrease in systemic vascular resistance and cardiac output. Maternal hypotension can lead to uterine / fetal hypoperfusion. This effect is easily reversible with dose adjustment and the addition of sympathomimetics such as ephedrine.

Nitrous oxide is usually avoided during the first trimester based on some reports in animal studies that revealed some teratogenicity during organogenesis. No negative outcomes have been reported in humans with a short duration of exposure to nitrous oxide [34, 35].

In regard to intravenous anesthetics, opioids have been shown to be safe in the pregnant population. Ketamine is usually avoided due to the potential fetal neurotoxicity [36]. Dexmedetomidine can be safely used in pregnant patients specially in the setting of tachycardia and hypertension. However, careful monitoring is required in the setting of potential hypovolemia, hypotension, bradyarrhythmias and renal/hepatic dysfunction [37]. Propofol is widely used in pregnant patients and has not shown to have any teratogenic fetal effects when administered within the clinically recommended doses. It can cause dose dependent maternal hypotension which could lead to fetal hypoperfusion and close monitoring is required.

Regardless of the type of anesthesia that is used neuraxial or general, anesthesia will often lead to vasodilatation and potential hypotension. Uterine blood flow is dependent on maternal blood pressure since the uterine perfusion lacks autoregulation. It is imperative to monitor maternal blood pressure and optimize uteroplacental perfusion with fluid resuscitation, vasopressors and blood products in the case of hemorrhagic shock [38].

Conclusion

Renal AML is a rare benign tumor that is mostly asymptomatic. It is known to grow in size during pregnancy and potentially rupture in the late stages of pregnancy with an inherent risk of maternal fetal death. There are about 50 cases reported worldwide of ruptured AMLs during pregnancy and our case seems to be the first reported in the Philippines. The management of ruptured AMLs during pregnancy has to be tailored to gestational age, maternal medical conditions, size of the tumor, genetic predisposition, available medical resources and clinical presentation. TAE is the first line of treatment reserving surgery for large tumors, hemodynamic instability, first trimester presentation and lack of interventional radiology resources. In order to achieve the best outcomes, the care should be multidisciplinary among urologists, interventional radiologists, OB/GYN and anesthesia. Regardless of the type of anesthesia used, it is of paramount importance to avoid maternal hypotension specially in the setting of hemorrhagic shock so that fetal hypoperfusion is avoided. For that reason, it is imperative to be familiar with all the pharmacokinetic effects and safety profiles of all the current anesthesia drugs as it applies to the physiology of a pregnant patient in acute distress.

References

1. Fittschen A, Wendlik I, Oeztuerk S, Kratzer W, Akinli AS, et al. (2014) Prevalence of sporadic renal angiomyolipoma: a retrospective analysis of 61,389 in- and outpatients. Abdom Imaging. 39:1009-1013.
2. Flum AS, Hamoui N, Said MA, Yang XJ, Casalino DD, et al. (2016) Update on the diagnosis and management of renal angiomyolipoma. J Urol. 195:834-846.
3. Hawxby AM, Torbenson M, Fishman E, Lawler L, Arrazola LM, et al. (2003) Juxta-caval hepatic angiomyolipoma masquerading as hepatocellular carcinoma. Hepatobiliary Pancreat Dis Int. 2:617-21.
4. Çetin C, Büyükkurt S, Demir C, Evrüke C (2015) Gebelikte renal anjiomyolipom: olgu sunumu ve literatürün gözden geçirilmesi. Turk Jinekoloji ve Obstet Dern Derg 12: 118-121.
5. Liu Z, Zou Y, Lv T, Guan H, Fan Z, et al. (2020) Spontaneous rupture of enormous renal angiomyolipoma in a pregnant tuberous sclerosis patient: a rare case. BMC Nephrol. 21:455.
6. Kluiving MW, Peeters E, Lely TA, Oorschot NV, de Ranitz- Greven WL, et al. (2024) The Effect of Pregnancy on Renal Angiomyolipoma; a World of Knowledge to Gain, Specifically in Women With TSC. BMC Nephrology 25: 113.
7. Wang C, Li X, Peng L, Gou X, Fan J, et al. (2018) An update on recent developments in rupture of renal angiomyolipoma. Medicine (Baltimore). 97:e0497.
8. Myoen S, Mitsuzuka K, Saito H, Ota H, Takase K, et al. (2015) Spontaneous rupture of a renal angiomyolipoma at 25 weeks of pregnancy treated with transarterial embolization: A case report and review of the literature. International Journal of Urology. 22: 710-712.
9. Seyam RM, Alkhudair WK, Kattan SA, Alotaibi MF, Alzahrani HM, et al. (2017) The Risks of Renal Angiomyolipoma: Reviewing the Evidence. J Kidney Cancer VHL. 4:13-25.
10. Sayuti KA, Mat Rasid SA, Abdullah MS, Muhammad SJ, (2024) Angiomyolipoma During Pregnancy: A Forgotten Risk Factor for Rupture and Massive Haemorrhage—A Case Report. Malaysian Family Phy- sician 19: 27.
11. Abouelkheir RT, El- Ksas M, Abdel Fattah S, Amer T, El-Diasty T, et al. (2022) Efficacy and Safety of Selective Renal Arterial Embolization in Renal Angiomyolipoma: A Prospective Single- Center Study. Egyptian Journal of Radiology and Nuclear Medicine 53: 165.
12. Wang C, Yang M, Tong X, Wang J, Guan H, et al. (2017) Transarterial Embolization for Renal Angiomyolipomas: A Single Centre Experience in 79 Patients. Journal of International Medical Research. 45: 706-713.
13. Chan CK, Yu S, Yip S, Lee P. (2011) The efficacy, safety and durability of selective renal arterial embolization in treating symptomatic and asymptomatic renal angiomyolipoma. Urology.77: 642-648.
14. Flum AS, Hamoui N, Said MA, Yang XJ, Casalino DD, et al. (2016) Update on the diagnosis and management of renal angiomyolipoma. J Urol. 195: 834-846.
15. Toei H, Zhang X, Seyama K, Yashiro D, Kuwatsuru Y, et al. (2022) Prophylactic renal artery embolization before pregnancy in patients with lymphangioleiomyomatosis and renal angiomyolipoma. J Int Med Res. 50: 3000605221123897.
16. Moon EK, Wang W, Newman JS, Pilar Bayona-Molano MD. (2013) Challenges in Interventional Radiology: The Pregnant Patient. Seminars in Interventional Radiology, 30: 394-402.
17. Scharf Z, Momah I, Kim AY. (2019) Trans-Radial Embolization of Bleeding Renal Angiomyolipoma in Pregnant 30-Year-Old Female - A Case Report. J Radiol Case Rep. 13: 34-42.
18. ACOG Committee Opinion No. 775 Summary: Nonobstetric Surgery During Pregnancy. Obstet. Gynecol. 133: 844-845.
19. Neelakanta G, Chikyarappa A. (2006) A review of patients with pulmonary aspiration of gastric contents during anesthesia reported to the Departmental Quality Assurance Committee. J Clin Anesthesia. 18: 102-107.
20. Erekson EA, Brousseau EC, Dick-Biascoechea MA, Ciarleglio MM, Lockwood CJ, et al. (2012) Maternal postoperative complications after nonobstetric antenatal surgery. J Matern -Fetal Neonatal Med. 25: 2639-2644.
21. Devis P, Knuttinen MG. (2017) Deep venous thrombosis in pregnancy: Incidence, pathogenesis and endovascular management. Cardiovasc Diagn Ther. 7: S309-S319.
22. Kamel H, Navi BB, Sriram N, Hovsepian DA, Devereux RB, et al. (2014) Risk of a Thrombotic Event after the 6-Week Postpartum Period. N Engl J Med. 370: 1307-1315.
23. Brakke B, Sviggum H. (2023) Anaesthesia for non-obstetric surgery during pregnancy. BJA Educ. 23: 78-83.
24. Rosenberg L, Mitchell AA, Parsells JL, Pashayan H, Louik C, et al. (1983) Lack of Relation of Oral Clefts to Diazepam Use during Pregnancy. N Engl J Med. 309: 1282-1285.
25. Midazolam. Mother To Baby | Fact Sheets. 2023.

26. Russell IF, Chambers WA. (1981) Closing volume in normal pregnancy. Br J Anaesth. 53: 1043-1047.

27. Park FD, Park S, Chi SI, Kim HJ, Seo KS, et al. (2015) Clinical considerations in the use of forced-air warming blankets during orthognathic surgery to avoid postanesthetic shivering. J. Dent. Anesthesia Pain Med. 15: 193-200.

28. Bartusch O, Finkl M, Jaschinski U. (2008) Aspiration syndrome: Epidemiology, pathophysiology, and therapy. Anaesthesist. 57: 519-530.

29. Nejdlova M, Johnson T. (2012) Anaesthesia for non-obstetric procedures during pregnancy. Contin. Educ Anaesth Crit Care Pain. 12: 203-206.

30. Eichelsbacher C, Ilper H, Noppens R, Hinkelbein J, Loop T, et al. (2018) Rapid sequence induction and intubation in patients with risk of aspiration: Recommendations for action for practical management of anesthesia. Anaesthesist. 67: 568-583.

31. Bucklin B, Gambling DR, Wlody DJ. (2009) A Practical Approach to Obstetric Anesthesia. Lippincott Williams & Wilkins.

32. Willett AW, Butwick AJ, Togioka B, Bensadigh B, Hofer J, et al. (2019) Statement on Sugammadex During Pregnancy and Lactation. Society for Obstetric Anesthesia and Perinatology.

33. Clark RB, Brown MA, Lattin DL. (1996) Neostigmine, atropine, and glycopyrrolate: Does neostigmine cross the placenta? Anesthesiology. 84: 450-452.

34. Mazze R. (1986) Nitrous oxide during pregnancy. Anaesthesia. 41: 897-899.

35. Feghali M, Venkataramanan R, Caritis S. (2015) Pharmacokinetics of drugs in pregnancy. Semin. Perinatol. 39: 512-519.

36. Shin J. (2021) Anesthetic Management of the Pregnant Patient: Part 2. Anesth. Prog. 68: 119-127.

37. Abhijit S, Nair, Sriprakash K. (2013) Dexmedetomidine in pregnancy: review of literature and possible use. J Obstet Anesth Crit Care. 3: 3-6.

38. Aguree S, Gernand AD. (2019) Plasma volume expansion across healthy pregnancy: A systematic review and meta-analysis of longitudinal studies. BMC Pregnancy Childbirth. 19: 508.