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CASE REPORT

Peripartum rupture of renal artery aneurysm

Hynek Heřman[1,2], Alena Holá[1], Adéla Faridová[1], Noble Ayayee[1], Klára Trojanová[1], Martina Kundrátová[1], Jindřich Mareš[1], Petr Křepelka[1,2], Václav Báča[3], Jiří Hanáček[1,2], Jaroslav Feyereisl[1,2], Karel Jelen[4]

1 Institute for the Care of Mother and Child, Prague, Czech Republic
2 3rd Medical Faculty, Charles University, Prague, Czech Republic
3 Department of Anatomy, 3rd Medical Faculty, Charles University, Prague, Czech Republic
4 Department of Anatomy and Biomechanics, Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic

Correspondence to: Petr Křepelka
Institute for the Care of Mother and Child, Podolské nábřeží 157, Prague, 147 00
tel: +420296511849, e-mail: petr.krepelka@upmd.eu

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Abstract

OBJECTIVES: We present a case of silent rupture of the renal artery aneurysm in a pregnant woman brought to the maternity hospital in shock. The diagnosis was made during the operation and both mother and fetus were saved. Renal artery aneurysms (RAA) are rare and account for 0.01-0.5% of all aneurysms with an incidence of approximately 0.09%.

METHODS: Description of the observations of the original case report of spontaneous rupture of the renal artery aneurysm with the review of the literature of the last 10 years was generated based on MEDLINE research, selecting some specific keywords.

RESULTS: In the described case, we based on the literature data and the whole course confirms the similarity of the described symptoms, but it is important to note the fundamental difference in the time of gestation. We assume different hemodynamic conditions in pregnancy. The whole case is exceptional in its very rapid management and subsequent extensive surgery with maternal and neonatal survival without serious short-term complications.

CONCLUSION: Rupture of the renal artery aneurysm is a rare and severe complication associated with extremely high morbidity and mortality in both mother and fetus. Thanks to the improvement and effectiveness of medical care in the 21st century, fetal mortality decreased by 70-80 % and 60-70 % for the mother. The essence of successful management of this serious, life-threatening condition is close interdisciplinary cooperation.

INTRODUCTION

Peripartum haemorrhage is still the leading cause of maternal mortality worldwide (Ostró, 2013; Pařízek, 2012). According to available data, bleeding is the cause of death in more than 500,000 cases per year (Berg, 2005). Although the case report described below with rupture of a renal aneurysm in pregnancy is not a classic case of haemorrhage, this pregnancy complication must always be considered in cases of acute shock after delivery. Rupture of the renal artery aneurysm is a rare but severe complication associated with extremely high morbidity and mortality

in both mother and fetus. Thanks to the improvement and effectiveness of medical care in the 21st century, fetal mortality decreased by 70-80% and 60-70% for the mother. Renal artery aneurysms (RAA) are rare and account for 0.01-0.5% of all aneurysms with an incidence of approximately 0.09 %. It is most often located on the proximal bifurcation of the renal artery (Henke, 2001). In pregnant women, 88% of renal artery aneurysm rupture occurs on the left. We present a case of silent rupture of the renal artery aneurysm in a pregnant woman brought to the maternity hospital in shock (Middleton, 1980). The essence of successful management of this serious, life-threatening condition is close cooperation between obstetricians, midwives, anesthesiologists, general surgeons, and vascular surgeons (Barron, 1984).

Vascular supply of the kidney

The renal arteries originate from the abdominal aorta at the level of L1 - L2 inferior to the origin of the superior mesenteric artery. Both arteries branch into the ramus anterior a ramus posterior before entering the renal hilum. The right renal artery courses inferiorly and passes posterior to the inferior vena cava and the right renal vein to reach the renal hilum. The left renal artery is much shorter and arises slightly more superior to the right main renal artery. The left renal artery courses more horizontally, posterior to the left renal vein to enter the renal hilum. Renal arteries are between 4-6 cm in length and usually 5-6 mm in diameter. The renal veins drain into the inferior vena cava (Standring, 2015) (Fig. 1)

Physiological changes in pregnancy

In pregnancy, physiological changes are observed in all organs systems. Cardiac output is increased up to 40 %, which results in increased renal blood flow by 400 ml/min. Peripheral resistance is reduced by up to 50 % (Hájek, 2004). Pregnancy is associated with adaptive changes in maternal hemodynamics (Balajewicz-Nowak, 2016). Pregnancy status and mechanical properties of the vaginal wall – endopelvic fascia complex, focused on optimizing approaches aimed at dealing with defects in the stability of the pelvic floor. There is a quite broad interindividual variability of the mechanical properties of the vaginal wall-endopelvic fascia complex. It appears that the mechanical properties of the tissue complex change with the number of pregnancies, and are affected by diseases, by physical load or by the presence of other factors, e.g. obesity (Jelen, 2010). The last trimester is the most hazardous period for this acute event (Čech, 2014).

Renal vascular aneurysm - types and risk factors

True aneurysms are caused by congenital changes in the vessel wall, atherosclerosis, trauma and fungal arteritis. Focal fibrotic stenosis of the renal arteries and syphilis may also be involved in the development of a renal vascular aneurysm (Klausner, 2014). False aneurysms (pseudoaneurysms) are always post-traumatic. Repaired vessel wall becomes weak, and therefore it is highly likely that an aneurysm will form here (Boss, 2006). Other types of aneurysms, but not typical of the renal arteries, include dissecting aneurysms and arteriovenous aneurysm (Fig. 2). Aneurysms are further divided according to their anatomical shape into sac-like (saccatum), boat-like (naviculare), spindle-shaped (fusiforme), diffuse (diffusum), serpentine (serpentinum) (Fig. 3) (Zeman, 2006). The most common type of renal aneurysm is a true uncalcified sac-like aneurysm as later seen in case-report.

Fig. 1. Anatomical findings of renal vascular supply (cadaver)

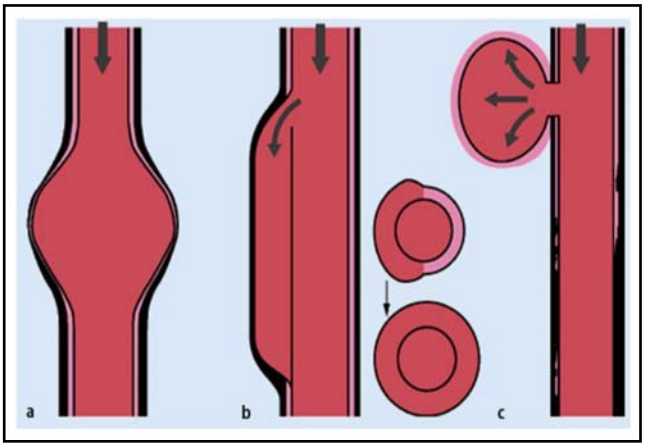

Fig. 2. Types of aneurysms:
a) true (*verum*); b) false (*falsum*); c) dissecting (*dissecans*)

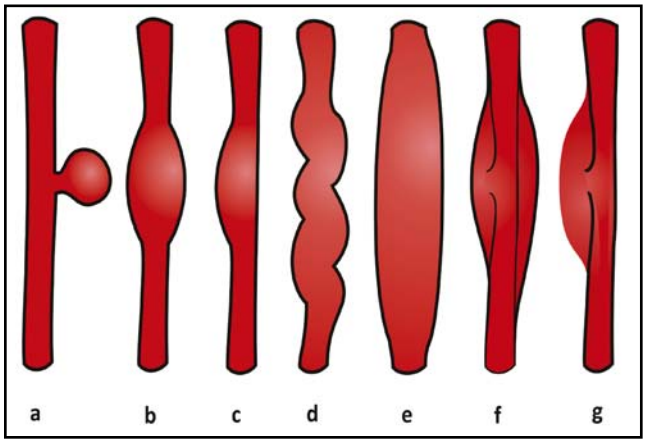

Fig. 3. Anatomical types of aneurysms:
a) sac-like (*saccatum*); b) boat-like (*naviculare*); c) spindle-shaped (*fusiforme*);
d) diffuse (*diffusum*); e) serpentine (*serpentinum*)

The most common reasons for the development of renal aneurysms include hypertension and atherosclerosis in elderly patients (Titze, 2015). Other risk factors include polyarteritis nodosa, inflammatory processes, fungal embolization, cystic medionecrosis, traumas, hereditary connective tissue diseases - aneurysma congenitum - e.g. Marfan's syndrome and Ehlers-Danlos syndrome (Chen, 2020). In pregnancy, in addition to renal aneurysms, we can also encounter a dissecting aortic aneurysm, cerebral artery aneurysm and splenic artery aneurysm or coronary artery aneurysm. In the latter situation, there is a chance to establish the diagnosis of aortic cystic medionecrosis, preferably prior to conception. However, warning manifestations, if any, are frequently very nonspecific, which frequently leads the obstetrician to not consider them within the scope of differential diagnostics (Velemínský, 2011).

Symptoms of renal aneurysm rupture and diagnosis

Although rupture of the aneurysm is always an exceedingly rare diagnosis. In pregnant women, there is a sudden onset of pulsating abdominal pain - more to the left, with propagation to the lumbar region, hypotension, confusion, and collapse (Wason. 2010). Similarly, CTG recording is pathological, and there is a risk of intrauterine fetal death (Askari, 2011). Renal artery aneurysm rupture can be mistaken for placental abruption or) rupture of the uterus. In the differential diagnosis, it is necessary to consider nephrolithiasis, pyelonephritis, adnexal torsion, or other diseases associated with bleeding into the retroperitoneum. Diagnosis of an aneurysm is exceedingly difficult and, in most cases, is found by doctors as accidental secondary finding in some imaging methods - CT, angio CT, MRI, ultrasound (Donati, 1976).

CASE REPORT – RUPTURE OF RENAL ARTERY ANEURYSM IN PREGNANCY

The case report describes a case of acute abdomen in pregnancy managed at the Institute for the Care of Mother and Child, Prague, Czech Republic. The case of a silent rupture of the renal artery aneurysm in a pregnant woman in the third trimester of pregnancy was promptly diagnosed, managed successfully, saving the patient's life and the newborn and preserving renal function.

We observed a 36-year-old primipara in the 38th week of pregnancy with an insignificant personal and family history. She was brought to the labour ward emergency room for collapse, which had occurred suddenly without any prodromes in a shopping mall. She complained of significant pain in the left hip. Patient's initial blood pressure on admission was 110/78 mmHg, the temperature was 36,6°C. The patient was immediately connected to a CTG monitor (cardiotocographic report of fetal heart rate and uterine contractions), where deep decelerations were recorded with subsequent fetal bradycardia (Fig. 4). Another collapse occurred with vomiting and loss of consciousness. An acute caesarean section was indicated for fetal distress, breech presentation and maternal pre collapsed stage.

Within 10 minutes of the indication for the acute caesarean section in general anesthesia, a baby girl was delivered. The newborn weighed 3130 g. Apgar scores were 3-6-8, umbilical artery pH: 7.038, umbilical vein pH: 7.08. Postpartum adaptation of the newborn was adequate. The lower segment uterine incision was sutured. During the inspection (revision) of the abdominal cavity, the increasing resistance was visualized in the retroperitoneum above the area of the left kidney, characteristic of a hematoma. The patient's shock worsened. A general surgeon was immediately called. Later two vascular surgeons were referred. The surgeon extended

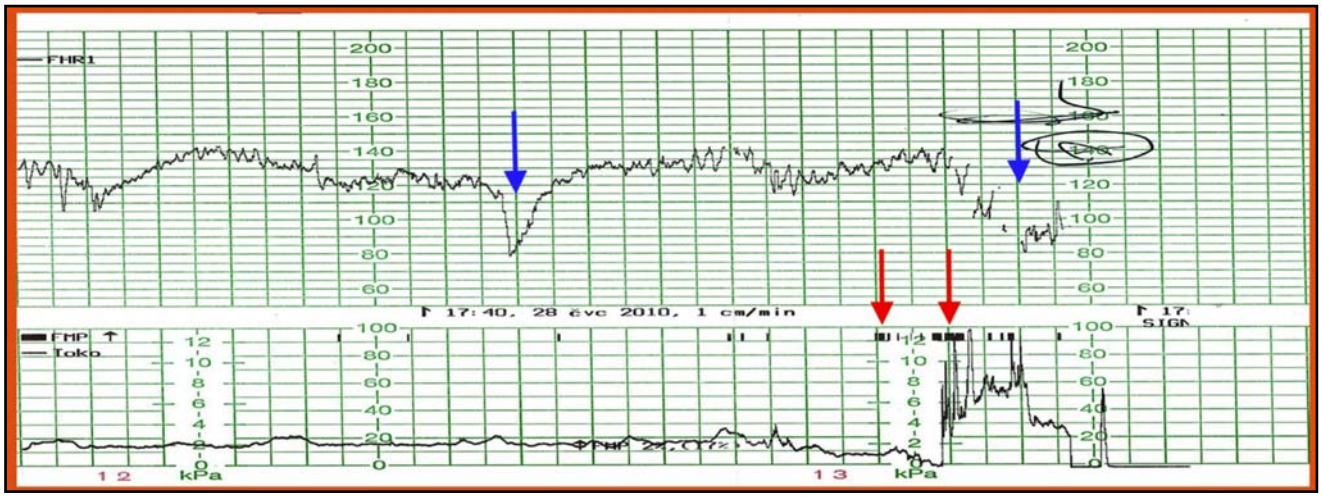

Fig. 4. Pathological CTG record of fetal bradycardia:
- fetal heart rate (FHR) = cardiography, normal fetal heart rate values 110-160 bpm, ↓↓ blue arrows show bradycardia
- fetal movement profile (FMP ↑) = actography, ↓↓ red arrows show active fetal moves
- tocography (Toko) = uterine contractions, contraction pressure (kPa)

Comments:
1. *paper speed 1 cm/min*
2. *cardiography = normal fetal heart rate values 110 - 160 bpm*
3. *tocography = normal uterine pressure is 0 - 2,7 kPa (0 - 20 mmHg)*
4. *MVU (Montevideo unit) equals pressure change in mmHg summed over a ten-minute record. Peaks of all uterine contraction pressure during a ten-minute record are counted in total. The total number is assessed for managing the labour. Above 200 MVUs is considered necessary for the active phase of labor, above 300 is harmful for fetal circulation(Donati,1976)*

the laparotomy cranially in the midline up to the xiphoid process. During the six-hour-long operation, a ruptured left renal artery aneurysm about 5 cm from its junction was identified. The size sac-like aneurysm was about 3 cm in diameter with a neck up to 1 cm long. Resection of the aneurysm was performed, followed by direct suturing of the renal artery. Renal perfusion was maintained throughout. The kidney shows no signs of oedema or ischemia. The bleeding suprarenal vein was ligated. At the end of the procedure, abdominal drains were put in place, Traumacel was applied on the suture, and the abdominal cavity was closed respectively to an anatomical layer. Total blood loss was estimated at 5000 ml. To maintain haemostasis, the patient was administered the following intravenous treatment during the six-hour operation: 7000 ml of crystalloids, 3000 ml of colloids, 11 IU of erythrocyte concentrate, 11 IU of fresh frozen plasma (FFPs), 1 IU of platelet concentrate, 5 g fibrinogen, antithrombin III (AT III) total dose of 3000 IU, Antilysin (Aprotinin) 200,000 IU. The patient was subsequently transferred to the anaesthesiology and resuscitation Department of Anaesthesiology, Resuscitation and Intensive Care Medicine (KARIM) of the General University Hospital in Prague on account of disseminated intravascular coagulopathy (DIC) and suspicion of multiorgan dysfunction.

At the Department of Anaesthesiology, Resuscitation of the General University Hospital, the patient received another 6 IU of erythrocyte concentrate, 9 IU of FFPs and 4 g fibrinogen. The abdominal drains emptied 1800 ml of blood. At the intensive care, the patient gradually woke up to full consciousness. This is initially accompanied by psychomotor restlessness, delusions, hallucinations, and delirium. Postpartum psychosis also developed. General condition gradually improved, and the patient was moved to the ICU after nine days at the KARIM. She spent another 12 days in the ICU, followed by two days at the standard gynaecological department. Other treatments are given while admission includes a triple combination of antibiotics, analgesics, sedatives, hepatoprotective and antihypertensives. Renal function was monitored. This comprehensive medical intervention led to a full recovery, and she was discharged home after 21 day after admission to the KARIM.

DISCUSSION

Haemorrhage in pregnancy remains one of the most common causes of maternal morbidity and mortality. The difference in blood flow is measured by radiological findings using dopplerometry. Doppler ultrasonography provides reliable information about the hemodynamic status of the kidneys. There are only a few studies concerning the difference between right and left renal arteries. It was revealed that right kidney doppler ultrasonography indices, except for pulsatility index, may not differ from those of the left kidney (Ansarin, 2010). Peters et al estimated lower RBF in the right than in the left kidney in normal subjects (Peters, 1987). The left renal artery is wider than the right renal artery (Mohiuddin, 2017). We suggest RRA is more common on the left side due to higher blood flow in

the left renal artery. General risk factors contributing to a higher probability of renal artery aneurysm rupture are aneurysm size greater than 2 cm, sudden weight gain, partial calcification of the renal artery, high blood pressure and pregnancy.

CONCLUSION

Rupture of a renal artery aneurysm is rare but can appear acutely during pregnancy with high mortality for women and child, however surgeons prefer conservative treatment. The described case study is remarkably interesting in that it was possible to save both mother and child and preserve renal function without the subsequent need for haemodialysis, antihypertensive therapy or transplantation. Due to the excellent multidisciplinary organization of patient care, such a result has been achieved.

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None declared.

CONFLICT OF INTEREST

None declared.

REFERENCES

1 Ansarin K, Bavil AS, Ghabili K, et al (2010). Are Doppler ultrasonography parameters symmetric between the right and left kidney? Int J Gen Med. **3**: 371–373. Published 2010 Nov 16. doi:10.2147/IJGM.S14119
2 Askari R, Ghomi A, Ramirez S, Mercado R: Renal Aneurysm In Pregnancy: A case of renal aneurysm rupture with fetal demise (https://ispub.com/IJGO/11/2/12608).
3 Balajewicz-Nowak A, Furgala G, Pitynski A, Thor I, Huras U, Rytlewski R (2016). The dynamics of autonomic nervous system activity and hemodynamic changes in pregnant women. Neuro Endocrinol Lett. **37**(1): 70–77.
4 Barron WM (1984). The Pregnant surgical patient: medical evaluation and management. Ann Intern Med. **101**(5): 683–91. doi: 10.7326/0003-4819-101-5-683.
5 Berg CJ, Harper MA, Atkinson SM, Bell EA, Brown HL, Hage ML et al (2005). Preventability of pregnancy-related deaths: results of a state-wide review. Obstet Gynecol. **106**(6): 1228–34. https://doi.org/10.1097/01.AOG.0000187894.71913.e8.
6 Boss N (2006). Roche Lexikon Medizin Sonderausgabe 5th edition. Urban & Fischer. München: Elsevier, 2096 pp. ISBN 9783437593772.
7 Chen SW, Kuo CF, Huang YT, Lin WT, Chien-Chia Wu V, Chou AH, Lin PJ, Chang SH, Chu PH (2020). Association of Family History With Incidence and Outcomes of Aortic Dissection. J Am Coll Cardiol. **76**(10): 1181–1192. doi: 10.1016/j.jacc.2020.07.028.
8 Čech E, Hájek Z (2014). Porodnictví. [(Obstetrics) (In Czech)]. 3rd Edition. Grada Publishing, 580 p. ISBN 978-80-247-4529-9.
9 Donati F, Ferraris F, Rustichelli S, Gagliardi L (1976). A descriptive method for automatically analysing uterine forces during labor. J Perinat Med. **4**(4): 242–54. doi: 10.1515/jpme.1976.4.4.242. PMID: 1011063.
10 Hájek Z (2004). Rizikové a patologické těhotenství. [(Risk and pathological pregnancy) (In Czech)]. 1st Edition. Grada Publishing. 444 p. ISBN: 80-247-0418-8
11 Henke PK, Cardneau JD, Welling TH, Upchurch GR, Wakefield TW, Jacobs LA, et al. (2001). Renal Artery Aneurysms. A 35. Year Clinical Experience with 252 Aneurysms in 168 Patients. Ann Surg. **234**(4): 454–463. doi: 10.1097/00000658-200110000-00005.
12 Jelen K, Herman H, Lopot F, Kubovy P, Otcenasek M, Sedlacek R (2010). Women with incorrect pelvic floor statics: a biomechanical answer to the mechanical loading of the vagina-endopelvic fascia complex. Neuro Endocrinol Lett. **31**(3): 413–7. PMID: 20588227.
13 Klausner JQ, Lawrence PF, Harlander-Locke MP, Coleman DM, Stanley JC, Fujimura N (2014). The contemporary management of renal artery aneurysms. Clinical Research Study from the Society for Vascular Surgery. **61**(4): 978–984. DOI:https://doi.org/10.1016/j.jvs.2014.10.107.
14 Middleton WA, Middleton GW, Dean LK (1980). Spontaneous renal rupture in pregnancy. Urology. **15**(1): 60–3. doi: 10.1016/0090-4295(80)90543-9. DOI: 10.1016/0090-4295(80)90543-9.
15 Mohiuddin M, Manzoor A, Ali M, Hassan N (2017). Analysis of renal artery morphometery in adults: A study conducted by using Multidetector computed Tomography Angiography. Pak J Med Sci. **33**(4): 943–947. doi:10.12669/pjms.334.13063
16 Ostró A, Feyereisl J (2013). Peripartální hemoragie. [(Peripartum hemorrhage) (In Czech)]. 1st Edition. Zlín: Tigris, 282 pp. ISBN 978-80-7490-011.
17 Pařízek A (2012). Kritické stavy v porodnictví. [(Critical conditions in obstetrics) (In Czech)]. 1st Edition. Galén, Mother-Care-Centrum Publishing, 285 pp. ISBN 978-80-7262-949-7.
18 Peters AM, Gunasekera RD, Henderson BL, et al (1987). Non-invasive measurement of blood flow and extraction fraction. Nucl Med Commun. **8**: 823–837
19 Standring S, Gray HA (2015). Gray's anatomy: the anatomical basis of clinical practice. 41th Ed. Edinburgh, Scotland: Elsevier, 1584 p. ISBN: 9780702063060
20 Titze N, Ivanukoff V, Fisher T, Pearl G, Grimsley B, Shutze WP (2015). Surgical repair of renal artery aneurysms. Proc (Bayl Univ Med Cent). **28**(4): 499–501. doi: 10.1080/08998280.2015.11929322
21 Ufberg JW, McNeil B, Swisher L (2003). Rupture renal aneurysm: an uncommon cause of acute abdominal pain. The Journal of Emergency Medicine. **25**(1): 35–38.
22 Velemínsky I, Fuxová L, Sák E (2011). Rare complications of pregnancy: aortic cystic medionecrosis, gallbladder carcinoma, Hodgkin lymphoma. Neuro Endocrinol Lett. **32**(3): 242–245.
23 Wason SEL, Schwaab T (2010). Spontaneous Rupture of a Renal Artery Aneurysm Presenting as Gross Hematuria. Rev Urol. **12**(4): e193–e196.
24 Zeman M et al (2006). Speciální chirurgie [(Special Surgery) (In Czech)] 2nd Edition. Praha: Galén, 575 p. ISBN 80-7262-260-9.