

Appendicitis with concurrent COVID-19 infection in a patient during the third trimester of pregnancy

Laura Jane Sanders-Davis ¹, Joanne Ritchie²

¹Obstetrics and Gynaecology, Shrewsbury and Telford Hospital NHS Trust, Telford, UK
²Obstetrics and Gynaecology, Shrewsbury and Telford Hospital NHS Trust Maternity Services, Telford, UK

Correspondence to

Dr Laura Jane Sanders-Davis; lauradavis@doctors.org.uk

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SUMMARY

This article presents an unusual case of appendicitis in pregnancy complicated by the novel coronavirus (SARS-CoV-2). The novel coronavirus has affected the way medicine is practised across most parts of the world with over 160 000 000 global cases to date. Tackling management of these cases is more complex when other pathological processes are ongoing. Appendicitis is a common occurrence in pregnancy, with most obstetric centres seeing about one or two cases a year. Though maternal morbidity and mortality are relatively unimpacted by this event, fetal loss and preterm labour are common sequelae. This case involves a 35-year-old woman presenting in her third trimester with abdominal pain and who went on to be diagnosed with concurrent appendicitis and SARS-CoV-2 infection. Although spinal anaesthesia would be most appropriate as it avoids aerosol generation, general anaesthetic techniques were indicated due to thrombocytopenia in this case. She underwent a successful appendectomy, although preterm delivery was indicated as a result of maternal and fetal concerns.

BACKGROUND

Appendicitis is known to present challenges during pregnancy. The anatomical changes that occur due to displacement of intra-abdominal organs, the physiological left shift in neutrophils and the symptoms of pregnancy can all result in diagnostic uncertainty.¹ Our case was compounded by the additional diagnosis of coronavirus. The novel coronavirus caused by SARS-CoV-2 has affected patients and healthcare across the world with over 160 000 000 cases of infection to date.^{2,3} Due to the high infectivity and potential for diffuse lung damage, healthcare systems have had to adapt swiftly to manage patients identified to have this infection, often when they have other disease processes affecting them.⁴ Managing this hereto undocumented combination of pathology required the input of a multidisciplinary body of specialists as well as provision for potential deterioration as a result of the SARS-CoV-2 infection.

CASE PRESENTATION

A 35-year-old Caucasian woman attended her obstetric triage service at 33+1 weeks pregnant with abdominal pain. She reported pain localised to the right lumbar region although she had been experiencing generalised abdominal pains prior to this. Although she was currently only experiencing loss of appetite, she had reportedly had four episodes of emesis the previous day. She had no respiratory

symptoms and had no known contact with SARS-CoV-2-positive individuals. Her background included idiopathic thrombocytopenic purpura, which had been diagnosed on routine blood tests in her previous pregnancy, and a previous large loop excision of the transform zone procedure for treatment of cervical intraepithelial neoplasia II. She was gravida 3 para 1 with a previous spontaneous vaginal delivery at 40+4 weeks, 6 years prior to these events, and had experienced a first trimester miscarriage 3 years ago.

On examination, there was tenderness confined to the right side of abdomen with maximal tenderness in the right lumbar region. She had no guarding or percussion tenderness. Rovsing's sign was positive. Her observations were normal on admission but fever developed shortly after admission to the antenatal ward. The examination of her respiratory system was unremarkable.

INVESTIGATIONS

Baseline blood tests were haemoglobin 125 g/L, platelets $73 \times 10^9/L$, white cell count $8.0 \times 10^9/L$, neutrophils $6.8 \times 10^9/L$, lymphocytes $0.7 \times 10^9/L$, normal urea and electrolytes, coagulation screen and liver function tests, lactate 1.0 mmol/L and a C reactive protein of 75 mg/dL.

Urinalysis was negative.

A routine admission PCR swab for the SARS-CoV-2 infection was positive.

MRI was obtained to evaluate the abdomen and this revealed a locally perforated appendicitis which was located in the retrocaecal position ([figure 1](#)). Also noted were changes seen in the lungs in keeping with SARS-CoV-2 infection.

TREATMENT

On identification of fever, the patient was screened for sepsis and started on intravenous antibiotics to cover an intra-abdominal source. These antibiotics were 1 g of amoxicillin and 500 mg of metronidazole at 8 hourly intervals and once daily administration of 360 mg of gentamicin.

A surgical opinion was sought and the decision was made to await the results of imaging for a definitive diagnosis. A liaison between the surgical team, the obstetric team and radiology team decided that MRI was the optimal imaging modality.

After the report of the scan findings was confirmed, a multidisciplinary meeting was set up between the surgical consultant, the obstetric consultants and the anaesthetic consultant to plan the management of this complex case. The surgical team opted for an open procedure with a high



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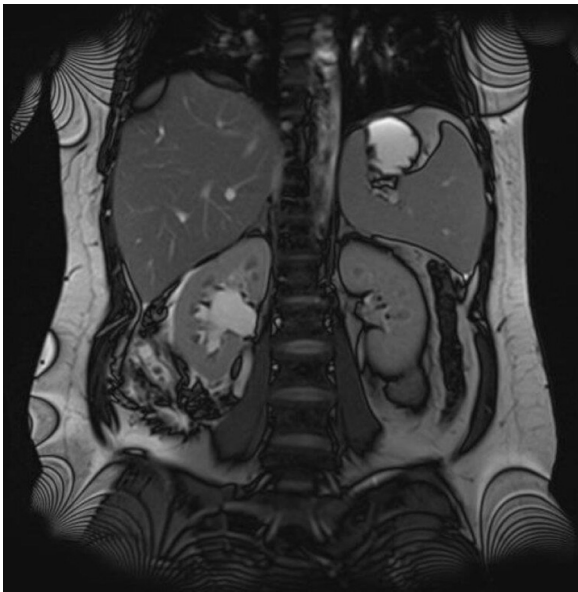


Figure 1 Locally perforated appendicitis with fat stranding. Also note moderate right hydronephrosis in keeping with pregnancy.

right-sided transverse incision guided by the available imaging to allow access to the cranially displaced appendix. Spinal anaesthesia was discussed as the optimal method of anaesthetic cover as concerns were raised regarding recovery from a general anaesthetic. However, the spinal anaesthesia was contraindicated due to thrombocytopenia, attributed to the patient's known diagnosis of idiopathic thrombocytopenic purpura, so a general anaesthetic was performed.

The decision was made to give two 12 mg dexamethasone intramuscular injections as the surgery could precipitate preterm delivery. This was also thought to be protective as a result of the chest findings in dampening down the patient's reaction to the SARS-CoV-2 infection. One was administered before surgery and the other 24 hours after the first.

The intraoperative findings were of perforated appendicitis and local peritonitis without generalised contamination. The operation was uneventful, and the patient returned to the delivery suite for further monitoring.

Following recovery from the anaesthetic, the patient began to experience difficulties with her respiratory function. There were also some concerns about fetal well-being due to a persistently high baseline on cardiocotograph monitoring. On the third day following appendicectomy, the patient was still requiring 2 L of supplemental oxygen and had an increasing respiratory rate of 22. On assessment of her respiratory system, she had widespread crackles bilaterally. A chest X-ray showed evidence of bilateral pneumonia. The medical team were sought for an opinion at this point. They advised to continue treatment of the patient with amoxicillin 1 g intravenously and start 6 mg of dexamethasone orally once per day. The medical and obstetric consultant discussed the case and it was agreed that expedition of the delivery was likely to improve maternal outcome. The decision was made to opt for a category three emergency caesarean section. A live infant was delivered at the gestation of 33+6 via lower segment caesarean section under general anaesthetic. There were no significant intra-abdominal findings during this procedure. The estimated blood loss was just over 1 L.

OUTCOME AND FOLLOW-UP

The patient's respiratory function returned to normal following delivery and she was discharged from both the surgical and obstetric teams within 2 days. The infant was transferred to the neonatal unit after delivery. Although they cried at birth, their respiratory function required further support. They were evaluated to have respiratory distress syndrome of the newborn and due to the continuing high oxygen requirement and moderate respiratory distress they were intubated in theatre, requiring high pressures on mechanical ventilation. After two doses of artificial surfactant, the infant was extubated into air at 24 hours of age and did not require any further respiratory support.

The infant's SARS-CoV-2 swabs were negative at day 3 and day 5 of life.

The patient was discharged with 6 weeks of low molecular weight heparin to cover for increased venous thromboembolism risk.

Histology of the appendix confirmed acute appendicitis.

DISCUSSION

Appendicitis is known to complicate somewhere between 1 in 800 and 1 in 1500 pregnancies.⁴ With the highest incidences seen in the first and second trimesters, it is the most common non-obstetric surgical emergency to occur during pregnancy.^{5,6} Appendicitis in the third trimester is often identified and acted on late. This is suspected to be due to the immunosuppressive effects of pregnancy, the anatomical displacement of the appendix, omentum and abdominal wall as a result of the effects of the gravid uterus and decreased sensation of the peritoneum which all result in atypical presentation.⁷ It has been reported that the typical clinical picture for appendicitis is present in 50%–60% of gravid women.¹

The other factors relating to management are the risks associated with fetal loss and premature labour as a result of intra-abdominal surgery which have been quoted as 15%–45% when there are no intra-abdominal findings.¹ However, inaction may prove just as costly with fetal loss at 1.5% in simple appendicitis but rising to up to 55% in ruptured appendicitis.^{8,9}

In suspected appendicitis, when the diagnosis is unclear, imaging can be crucial. Ultrasound imaging has historically been used as the first-line investigative tool but MRI is becoming increasingly advocated.⁸ In our case, ultrasound sonography was discussed as a potential imaging option with the radiology team, yet due to concerns regarding visualisation of the appendix in a gravid abdomen, an MRI was performed in the first instance. With the sensitivity of the MRI having been identified as 90%–100% at determining acute appendicitis with a specificity of 94%–98%, many centres are moving to advocate this as the gold standard imaging technique in pregnancy.⁹ This is in comparison with ultrasound imaging which has a reported sensitivity of 18% and specificity of 99%. There is evidence that ultrasound allows visualisation of the appendix in only 7% of cases, whereas it is seen on MRI in 80% of cases in pregnancy, although gestational age did not appear to impact either diagnostic tool.¹⁰ Although this is a strong case for first-line use of MRI, provision of this imaging tool may preclude this for patients presenting out of hours or in extremis. Due to the uncertainty in our case, MRI was opted for as the most sensitive modality given the patient's clinical stability.

Surgery is the safest definitive management for appendicitis in all trimesters of pregnancy.⁸

As soon as it became apparent that this patient would require surgical management due to the MRI findings, it was clear that the

concurrent infection would present some difficulties. Although there is limited information present regarding the effects of active SARS-CoV-2 infection in the perioperative period for those who are pregnant, in the general population perioperative infection has been shown to have significant morbidity and mortality. Of those in the patients age range there was an overall 5.8% 30-day mortality rate post-procedure and 29.1% went on to develop pulmonary complications from SARS-CoV-2 infection.¹¹ In terms of the caesarean section, obstetric surgery has a statistically significant lower risk in comparison with other indications.¹² As this patient required a general anaesthetic, it is appreciated that there is a 17-fold higher risk of complications in the pregnant population when compared with regional anaesthetic techniques.⁸ Because of this, the surgical, obstetric and anaesthetic teams responsible for this patient's care discussed spinal anaesthesia with an open approach to obviate these risks. Surgery with this mode of anaesthetic cover in obstetric cases has become far more frequent over time in response to the pandemic. A report from the northwest of England has shown a significant reduction in general anaesthesia performed at caesarean section.¹³ Although patient safety is a key component of this, other surgeries are more frequently being performed under regional methods to limit any unnecessary aerosol-generating procedures such as that of intubation.^{13 14} However, in this case, as this patient had thrombocytopenia, the only safe method of anaesthesia was agreed to be a general anaesthetic, as the risk of spinal haematoma, and therefore spinal cord compression, is deemed too great in those with low platelet counts.¹⁵

A laparoscopic approach was discussed in this case as a potential option. Though historically later gestations of pregnancy have been considered a contraindication to laparoscopy, there is some evidence to suggest the morbidity and mortality outcomes do not differ between open and minimally invasive approaches in the third and second trimester.¹⁶ Although appendicitis is the most common non-obstetric surgical emergency in pregnancy, the incidence is still relatively low with less cases seen in the third trimester.^{5 7} With a laparoscopic intervention, the best outcomes are seen with experienced practitioners and thus these low case rates do not allow for surgical teams, particularly in smaller units, to become well versed in the practice.¹⁶

This patient did end up developing mild respiratory compromise as a result of her concurrent SARS-CoV-2 infection and abdominal surgery under general anaesthetic but this was alleviated with the early delivery of her pregnancy. Physiologically, pregnant women desaturate three times as quickly than those who are not pregnant so it stands to reason that the early delivery of the baby can result in a better tolerance for respiratory dysfunction.⁸ Inducing early delivery to improve maternal health has precedent in SARS-CoV-2 infection as there has been a case report of a patient with deranged liver function whose biochemical abnormalities improved once she had delivered.¹⁷ Currently the data are showing that the risks of SARS-CoV-2 infection in those who are pregnant are increased in comparison with those in the general population, as pregnant individuals with infection have increased rates of admission to intensive care units and are more prone to preterm birth. These preterm deliveries in these cases are cited to be due to iatrogenic intervention.^{18 19} The use of steroids in the antenatal setting may confer benefit to the patient as per the RECOVERY (Randomised Evaluation of COVID-19 Therapy) findings which demonstrated significant reduction in morbidity and mortality in those who received steroids in SARS-CoV-2 infection who required supplemental oxygen or invasive ventilation, but no definitive research has been conducted to confirm benefit in pregnant individuals.^{18 20}

In summary, this case highlighted the difficulties of managing multiple disease processes in a case where there are few precedents set for how to treat and optimise recovery. Although this patient faced a delay in her initial diagnosis due to diagnostic uncertainty, once the appendicitis was confirmed, the patient had immediate intervention.

Learning points

- ▶ Managing surgical emergencies in pregnancy is a contentious issue as any operative treatment has a risk of fetal loss and preterm delivery, yet delay in operative management can increase morbidity and mortality.
- ▶ MRI was instrumental in this case at elucidating pathology.
- ▶ General anaesthetic in those affected with SARS-CoV-2, even asymptomatic individuals, can result in need for respiratory support due to decrease in physiological reserve.
- ▶ Preterm delivery in those symptomatic with SARS-CoV-2 in pregnancy can improve maternal respiratory function.
- ▶ Spinal anaesthesia is preferred to general anaesthesia for caesarean sections in patients infected with SARS-CoV-2 because it avoids the generation of aerosol.

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ORCID iD

Laura Jane Sanders-Davis <http://orcid.org/0000-0002-0132-7887>

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