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CASE REPORT



## *Salmonella enteritidis* during pregnancy, a rare cause of septic abortion: case report and review of the literature

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### Introduction

Enteric fever is due to *Salmonella typhi* and *paratyphi*. The infections associated with nontyphoidal *Salmonella* are generally self-limited gastroenteritis (Sánchez-Vargas et al. 2011). They consist of fever, nausea, vomiting, abdominal pain and an inflammatory diarrhoea. However, the elderly, infants and those with an impaired immune system due to an HIV infection, immunosuppressive agents, malignancy, organ transplant recipients or pregnancy, may have more severe infections such as transient bacteraemia, meningitis and an endovascular infection (Sánchez-Vargas et al. 2011). The most common extra-intestinal organ compromised is the lung. Other extra-intestinal manifestations are meningitis, encephalopathy, endocarditis, pneumonia, empyema, abscess, urinary tract infection, osteomyelitis, cellulitis or arthritis (Sánchez-Vargas et al. 2011).

We describe a recent case of *Salmonella enteritis* during a pregnancy leading to vertical transmission, a septic abortion and acute respiratory distress syndrome (ARDS).

### Case report

A 24-year-old woman, at 14 weeks of gestation, was admitted for general weakness, fever, headaches, phonophobia and photophobia for four days. She had been treated for six years with corticosteroids, plaquenil and azathioprine for a systemic lupus erythematosus. She travelled to Morocco two months prior and had no history of diarrhoea or of having eaten poultry, egg or of drinking tap water during her travels.

On physical examination, her temperature was at 36.6 °C, pulse rate at 125 bpm, blood pressure at 100/50 mmHg and her oxygen saturation at 98% at room air. An abdominal examination revealed a gravid uterus equivalent to 16 weeks of gestation. The remainder of the physical examination was unremarkable.

A blood test showed a CRP level at 216 mg/L (NV <5 mg/L), a white blood cell count at 7480/μL (NV 4000–10000), a platelet count at 112,000/μL (NV 150,000–450,000), and her INR to be at 1.6. Blood cultures were performed. Her chest X-ray was normal. A lumbar puncture could not be performed because of a high INR level, and low platelet count. An empiric intravenous treatment with ampicillin, ceftriaxone and Acyclovir was begun with the hypothesis of meningitis.

She then developed an acute respiratory failure with polypnea; desaturation at 78% at room air and the chest X-ray was compatible with ARDS. She was admitted into the intensive care unit. Her blood cultures came back positive for *Salmonella enteritidis* (sensitive to ampicillin, amoxicillin-clavulanate, cefepime, ceftriaxone and resistant to ciprofloxacin according to the EUCAST criteria 2017) and the antibiotherapy was continued with ceftriaxone once a day. The stool cultures were sterile. Later on, she developed abdominal pain and genital bleeding with the echographic signs of foetal loss. We proceeded to surgical abortion and the placental culture was positive for *Salmonella enteritidis*. The histology examination of the placenta showed diffuse signs of an acute bacterial chorioamnionitis.

An intravenous antibiotherapy with ceftriaxone was continued for 10 days and was later shifted to oral amoxicillin-clavulanate 875 mg t.i.d for four days. The patient completely recovered and didn't relapse at the end of the therapy. The blood cultures repeated after antibiotherapy were negative.

### Discussion

*Salmonella* infection remains a worldwide health problem. The people at risk are the elderly, infants and those with an impaired immune system.

The rate of salmonellosis is the same in pregnant woman as in the general population (i.e. 0.2%) (Sánchez-Vargas et al. 2011). Pregnancy is a condition where the immune system must not reject foreign paternal antigens whilst protecting itself. The immune system overcomes this dilemma by altering the Th1/Th2 cytokine levels to favour Th2 cytokines (Chaouat 2003). This protects the foetus from the Th1 mediated immune rejection at the foetal-maternal interface but at the same time makes pregnant women susceptible to infections such as malaria, leishmaniasis, toxoplasmosis, leptospirosis and salmonellosis (Chaouat 2003), where immunity is Th1-dependent.

During pregnancy, *Salmonella* infections are associated with complications such as septicaemia, chorioamnionitis, foetal infection, preterm labour, foetal growth restriction and abortion. The exact mechanisms by which *Salmonella* infection causes these complications during pregnancy are not clear. Using a self-limiting enterocolitis murine model, Noto et al. showed that an ingestion of a low dose of *S. Enteritidis* at the later stages of pregnancy (day 15 of gestation) is

**Table 1.** Review of cases of vertical transmission of *Salmonella enteritidis*.

Reference	Immuno-suppressive agents	Gestational period	Clinical features	Culture positive samples of <i>Salmonella</i>	Culture negative samples	Treatment	Maternal outcome	Foetal outcome
Mohanty et al. 2009	–	38–40 weeks	Fever, diarrhoea	Blood culture of babies	Stool, blood of mothers	Ampicillin, Gentamicin	Alive	Case 1, 4: uneventful Case 2, 3: baby born with sepsis, managed conservatively Fetal loss
Coughlin et al. 2003	–	16 weeks	Fever, abdominal pain, vaginal bleeding, loose motion	Group C <i>Salmonella</i> in HVS culture	–	–	Alive	
Our case	Corticoid Azathioprine	14 weeks	Fever, meningeal syndrome, ARDS, vaginal bleeding	Blood, placenta	Stool	Ceftriaxone	Alive	Fetal loss

ARDS: acute respiratory distress syndrome; HVS: high vaginal swab.

sufficient to induce massive maternal infection. They found that a *Salmonella* infection led to 40% of the preterm delivery, 33% of abortion and foetal growth restriction. Placental dysfunction during *S. Enteritidis* enterocolitis was confirmed through cellular infiltration and hypoxia markers (MPO activity and COX-1 and COX-2 expression, respectively). When investigated by morphometric procedure apoptosis in placental tissue due to *Salmonella* infection is also evident at day 18 of gestation.

Also, the expression of IFN- $\gamma$ , TNF- $\alpha$ , IL-17 and IL-10 increased in response to *Salmonella* not only in the placenta, but also in the amniotic fluid and maternal serum (Noto Llana et al. 2014).

*Salmonella* is a well-documented cause of abortion in animals (horses, sheep, cattle) (Madić et al. 1997). However, only five cases (Coughlin et al. 2003; Mohanty et al. 2009) of *Salmonella enteritidis* with vertical transmission are found in the literature. The clinical characteristics of these patients are described in Table 1.

In 4% of gastroenteritis cases, the transplacental passage of non-typhoid *Salmonella* might be possible during bacteraemia. In our case, the *Salmonella* species was identified in the maternal blood culture and in the placenta, consistent with *Salmonella* being an aetiological agent crossing the maternal blood through the placenta.

The outcomes in typhoid and non-typhoid infections depend on the stage of pregnancy with the least complications occurring when the infection occurs at the later stages of the pregnancy (Schloesser et al. 2004). If untreated, it has been estimated that typhoid has abortion rates as high as 80% (Seoud et al. 1988). There is no data available for non-typhoid *Salmonella*. According to Scialli and Rarick (1992), an early management of *Salmonellosis* is associated with a good outcome. Clinical manifestations, outcomes and treatment are similar between typhoid fever and an invasive non-typhoidal *salmonella* infection (Sánchez-Vargas et al. 2011).

## Conclusions

*Salmonella* infections are common and usually not severe. However, during pregnancy they can lead to life-threatening

infection and foetal loss. Therefore, a greater vigilance to food-borne infections is recommended in pregnant women. In cases of diarrhoea in pregnant women, stool culture for *Salmonella* and an early medical treatment could avoid serious complications. This case, and other cases reported in literature, argues that bacteraemia due to non-typhoid *Salmonella* species is more severe during pregnancy, but this needs to be confirmed in larger studies.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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