

Case report



## UNPREDICTABLE MANIFESTATION OF *MORGANELLA MORGANII* CHORIOAMNIONITIS AND NEONATAL DEMISE - A CASE REPORT

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### ABSTRACT

*Morganella morganii*, an opportunistic pathogen from the *Enterobacteriaceae* family, part of normal intestinal flora in humans, demonstrates a variety of virulent factors, as well as high antimicrobial resistance and mortality. In adults, *Morganella morganii* is associated with hospital-acquired infections, urinary tract infections in long-term catheter use, wound and hepatobiliary infections. It is not detected in normal vaginal flora and is rarely associated with obstetric infections.

Chorioamnionitis is an inflammatory reaction of chorion and amnion resulting from ascending microbial invasion, although primary intrauterine inflammation has also been reported. This case report presents *Morganella morganii* chorioamnionitis in a 28-year-old woman, delivering by Cesarean section at 26+3 weeks of gestation, without detection of *Morganella morganii* in the genitourinary tract, so non-ascending pathogenesis was hypothesized. Neonatal demise occurred irrespective of appropriate therapy for bacteremia.

*Morganella morganii* chorioamnionitis suggests vertical transmission. In the case presented here, the only risk factor - short-term catheterization, may have been responsible for *Morganella morganii* chorioamnionitis resulting from a possible genitourinary colonization with low bacterial load, leading to early-onset sepsis and neonatal demise. This clinically verifies the significant virulence of *Morganella morganii*, with its obstetric and neonatal complications unpredictable.

**Keywords:** *Morganella morganii*, chorioamnionitis, complications, neonatal demise,

### INTRODUCTION

*Morganella morganii* is an opportunistic pathogen, part of normal intestinal flora in humans, a facultative gram-negative anaerobe from the *Enterobacteriaceae* family [1]. It was reported by Morgan in 1906 as a causative agent of infections in humans and was classified as *Proteus morganii* [2]. *M. morganii* virulent factors include: adhesins, lipopolysaccharide, urease, insecticidal and apoptotic toxins, secretion systems; hemolysins with cytotoxic and hemolytic activity; iron acquisition systems; fimbriae, proteases, biofilms [2, 3]. *M. morganii* is unidentified in normal vaginal flora, rarely associated with obstetric infections [4] and generally does not affect pregnant women [5]. It may remain undetected because of its low bacterial load [3].

In adults, *M. morganii* causes urinary tract infections in long-term catheter use, wound and hepatobiliary infections [2, 6]. Other medical conditions include cellulitis, endocarditis, osteomyelitis, diarrhea, sepsis, skin and soft tissue infections, cerebral and hepatic abscess, chorioamnionitis, peritonitis, pericarditis, septic arthritis, rhabdomyolysis, necrotizing fasciitis, keratitis [3], respiratory distress syndrome [4], meningitis and bacteremia [7].

In the newborn, *M. morganii* rarely causes meningitis, pneumonia, necrotizing fasciitis, ventriculitis, cerebral abscesses, eye infections, sepsis and death [6]. Early neonatal sepsis is generally vertically transmissible, associated with high mortality and morbidity in premature and low birth weight neonates; maternal *M. morganii* sepsis must be treated in order to prevent antenatal fetal demise [8, 9]. In adults, *M. morganii* has been found in 1.47% of sepsis cases and bacteremia - in 10-25% of *M. morganii* infections [9]. The latter occur less frequently in healthy individuals and in non-hospital settings [10]; risk factors include old age, hospitalization, surgery, antibiotic use, concomitant bacteremia [1], and immune deficiency. In immunocompromised and young children, fatal systemic infection may be caused [11].

## CASE PRESENTATION

A 28-year-old second gravida with one previous cesarean section (CS), and no past or current medical history, no abortions, was hospitalized at 12 weeks of gestation because of urine retention requiring catheterization; she had no genital bleeding. One liter of urine was evacuated; renal ultrasound revealed no pathological findings.

Treatment with Ceftriaxon was initiated because of elevated C-reactive protein (CRP), 29.8 mg/L, at reference range 0-5; no leukocytosis was observed. On day 2, a permanent catheter was inserted because of urine retention. Urine culture was sterile, *Candida non-albicans* was isolated in vaginal discharge and treated with a local intravaginal neomycin sulphate/polymyxin B sulphate/nystatin. On day 4, the patient spontaneously urinated following catheter removal. On day 8, she was discharged with proinflammatory markers within normal limits (WNL); they were also WNL at 16 weeks. Vaginal discharge revealed the presence of *Candida non-albicans* at 19 weeks,

for which the patient received local retreatment. She had a respiratory infection at 24-25 weeks.

The patient was hospitalized at 26+3 weeks of gestation with painful uterine contractions every 3 min., 4 cm dilation and intact membranes. Due to the persistent, increasing severe abdominal pain over the uterine scar, suspicious for uterine rupture and the cardiotocographic change of the reactive tracing with normal variability towards loss of variability, as well as the increase in the fetal heart rate from 150 to 170 bpm indicative of fetal distress, CS was performed, characterized by lower uterine segment scar dehiscence, no intraoperative complications and estimated blood loss 500 ml. A female neonate was delivered alive, weighing 1000 g, APGAR score 1/2 at the one/five minutes, the amniotic fluid was green, with an unpleasant odour. Intrauterine culture was obtained for microbiological analysis. Ceftriaxon/Metronidazole treatment was initiated empirically. The clinico-laboratory findings, which were normal 5 days earlier, before the operation, were suspicious but did not verify chorioamnionitis (Table 1).

**Table 1.** Vital signs and laboratory results

Day at hospital	Temperature (T) °C	Blood pressure (BP) mm Hg	Heart rate (HR) bpm	Hemoglobin 120- 180 g/L	White Blood Count 3.5- 10.5x10 <sup>9</sup> L	CRP 0-5 mg/L	Procalcitonin 0-0.5 pg/m
1	36.4	92-110/60-62	100-114	115	21.8x10 <sup>9</sup>	-	-
2	36.4-39.5	90-96/55-60	104-114	93	19.5x10 <sup>9</sup>	198.4	-
3	36-36.6	100-114/60-77	80-78	73	10.4x10 <sup>9</sup>	239.5	33.81
4	36-36.6	111-112/66-77	50-57	99	10x10 <sup>9</sup>	167.1	24.4

On day 2, Ceftriaxon was replaced by Piperacillin/Tazobactam because of clinical signs of endometritis - lochia discharge with unpleasant odour, tachycardia and fever (table 1). On day 3, anemia (hemoglobin drop from 93 to 73 g/L), hypoproteinemia and shortness of breath were observed, albumin 26 g/L, total protein 46 g/L, with no ultrasound evidence of endopelvic free fluid, suggesting hemoperitoneum. Packed red cells and human serum albumin were transfused. On admission, no pathogens were detected in the vaginal discharge. On day 4, using the Analytical Profile Index 20E system for identification and differentiation of members of the *Enterobacteriaceae* family, *M. morganii* was detected in the intrauterine culture, susceptible to Ceftriaxon, Piperacillin/Tazobactam, Meropenem, Levofloxacin and resistant to Ampicillin. The histopathological examination of placenta verified severe *M. morganii* chorioamnionitis-intervillositis and granulocytic infiltration.

The patient remained afebrile until discharge on day 7. Hemoglobin and proteins preserved their values from day 4. Procalcitonin and CRP decreased. The patient was discharged in good condition with CRP 64.3 mg/L and peroral Levofloxacin.

The infant was born in a poor condition with very

low APGAR scores, respiratory distress syndrome requiring intubation, and received exogenous surfactant and Meropenem; blood culture confirmed bacteremia caused by *M. morganii* susceptible to Meropenem. Demise from early-onset neonatal sepsis occurred 8 hours following delivery.

## DISCUSSION

Chorioamnionitis is an inflammatory reaction of chorion and amnion resulting from ascending microbial invasion from the genitourinary tract or primary intrauterine inflammation, polymicrobial infection and abnormal maternal immune response. It is characterized by temperature above 38°C and one of the following criteria: leukocytosis (WBC >15000), maternal/fetal tachycardia, uterine tenderness or foul odour of amniotic fluid. According to the clinical guidelines of the American College of Obstetricians and Gynecologists from 2017, chorioamnionitis alone is rarely an indication for SC, and is not an indication for immediate delivery - cesarean section as the route of delivery should be based on obstetric indications. Chorioamnionitis is associated with increased risk of delivery by CS and development of endometritis, wound infection, pelvic abscess, bacteremia and postpar-

tum hemorrhage. It occurs rarely with intact amniotic membranes. However, *Citrobacter freundii* chorioamnionitis has been reported in vaginally protruded intact membranes [4, 8].

This case report confirmed chorioamnionitis with intact membranes, in the absence of prophylactic use of antibiotics during pregnancy and without identification of *M. morgani* in the genitourinary tract, probably due to low bacterial load [3]. The 4-day catheterization may have been a short-term risk factor [3]. Genitourinary colonization cannot be confirmed or excluded, so chorioamnionitis with primary intrauterine inflammation was also hypothesized [8]. The presumptive findings for chorioamnionitis were observed intraoperatively, and the decision for SC, with a risk for maternal trauma and complications, provided extraction of a living fetus. Fetal survival in the presence of neonatal *M. morgani* sepsis following chorioamnionitis has been observed after both vaginal delivery [12] and CS [6]. Postoperative endometritis and hypoalbuminaemia were managed, although albumin infusions to correct hypoalbuminemia were empirically administered, and probably treating the cause of the ongoing inflammation would have had sufficient clinical benefit; the anemia without excessive intraoperative blood loss and postoperative hemoperitoneum was likely to result from haemodilution or the virulent mechanisms of action of hemolysins and iron acquisition systems [2]. The elevated procalcitonin values did not correlate with sepsis.

Two reports have suggested that *M. morgani* infections are vertically transmissible and vaginal colonization results from prophylactic use of antibiotics during pregnancy, leading to chorioamnionitis with severe early neonatal infections [6, 12]. The neonatal *M. morgani* sepsis can develop following maternal chorioamnionitis, urinary tract infections and sepsis, resulting from *M. morgani* infection [1, 6]. *M. morgani* chorioamnionitis is associated with periventricular leukomalacia and neonatal seizures [13, 14], apart from the reported unfavourable neonatal complications following chorioamnionitis caused by other pathogens - including bronchopulmonary dysplasia, necrotizing enterocolitis, retinopathy of prematurity and intracerebral hemorrhage [8].

Out of 12 reported cases of early-onset neonatal *M. morgani* sepsis, 6 were delivered by CS. One neonate was full-term, 11 premature; 4 had birth weight <1000 g, of which 2 survived without complications. A total of 8 survived, 4 died. *M. morgani* bacteremia showed no predilection for sex; mortality was 33% [12].

Treatment of early *M. morgani* neonatal infection remains uncertain. Regimens include third generation Cephalosporin +/- Gentamicin for 10-14 days [1, 7]. The expression of inducible AmpC  $\beta$ -lactamase makes *M. morgani* resistant to  $\beta$ -lactam antibiotics in extended and/or prenatal exposure [6, 9, 12].

*M. morgani* has been reported as susceptible to or of low resistance to Piperacillin/Tazobactam, Carbapenems and potentially new resistance determinants [10, 15, 16]. The following resistance levels have been found: for Gentamicin 30.3%, Piperacillin/Tazobactam 1.8%, Ciprofloxacin 10.1% [17], Cefuroxim 90.5%, Amoxicillin-Clavulanate 95.9%; Imipenem 19.4% [18].

*M. morgani* bacteremia is rare in children and young adults. It occurs more frequently in adults with comorbidities [7, 15, 17]. Two cases of *M. morgani* chorioamnionitis were reported with fetal demise at 24.1 weeks following SARS-COV2 infection and at 28 weeks of gestation. Urinary tract infection, Amoxicillin/Ampicillin treatment and CS was the course of pregnancy [1, 8]. Two cases reported early neonatal *M. morgani* sepsis following chorioamnionitis, with fetal survival after vaginal delivery at 25+6 weeks [12] and after CS at 28+4 weeks [6]; one case of late neonatal sepsis with peritonitis and survival was reported, occurring following vaginal delivery at 23+4 weeks [9]. All three cases received antenatal Ampicillin treatment [6, 9, 12].

In adults, *M. morgani* sepsis has higher mortality (42%) than *Escherichia coli* sepsis (25%) [10]; *M. morgani* invasive infections at any age, particularly in a hospital setting, have been reported to have 15% mortality, irrespective of treatment [11]. Several sources have reported 27-40% mortality from early-onset neonatal *M. morgani* sepsis [6]. Twenty-eight percent neonatal mortality has been registered in *M. morgani* bacteremia following appropriate antimicrobial treatment [9]; adults receiving inappropriate antibiotic treatment or with urinary or hepatobiliary tract infection have been found to be at increased risk of death [9, 12].

*M. morgani* bacteremia may originate from the urinary tract (13.7-50%) [15, 16], hepatobiliary tract (22-27.5%) [17, 18] skin and soft tissues (18.5-21.1%), or may be primary (10.1%) [15, 17]. Thirty-day mortality has been reported in 13-21.2% [15, 16]; 14-day mortality 14.7-41% [16, 17]; mortality from *M. morgani* bacteremia in a hospital setting 41-42% [7, 16], total mortality 38.3% [18]. *M. morgani* remains a clinically significant pathogen because of its high drug resistance, virulence and mortality [19, 20].

## CONCLUSION

*Morganella morgani* chorioamnionitis suggests vertical transmission. In the case presented here, the only risk factor - short-term catheterization, may have been responsible for *Morganella morgani* chorioamnionitis resulting from a possible genitourinary colonization with low bacterial load, leading to early-onset sepsis and neonatal demise. This clinically verifies the significant virulence of *Morganella morgani*, with its obstetric and neonatal complications unpredictable.

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