

TIPS AND TRICKS TO PROTECT PREGNANCY FROM *LISTERIA*

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Abstract

Listeriosis occurs almost exclusively in pregnant women, newborns, the elderly, and people with weakened immune systems. Pregnant women are 18 times more likely to get listeriosis than other healthy adults. According to the World Health Organization (WHO), the onset of *Listeria* spp. during pregnancy accounted for nearly 43% of total cases, and 14% occurred in late pregnancies. Pregnant women infected with *Listeria* spp. could be asymptomatic, but if they exhibit symptoms, they are mild, almost like influenza, such as fever, headache, diarrhea, myalgia, or other digestive-related symptoms, so can be easily misdiagnosed. It can develop at any time during pregnancy and can cause miscarriage, stillbirth, and premature birth. In the fetus and newborn, the symptoms can be severe, such as respiratory distress, pneumonia, meningitis, and sepsis. Approximately 20% of pregnancies with listeriosis will result in spontaneous abortion or stillbirth. The research aimed to summarize the evidence available regarding listeriosis in pregnancy and educate providers on prevention, clinical symptoms, sequelae, and appropriate treatment guidelines.

A review was conducted using a search for articles about listeriosis and pregnancy from PubMed and Scopus, using the terms "Listeria pregnancy guidelines", "Listeria pregnancy", "Maternal listeriosis," and "Neonatal listeriosis". The search included review articles, original research articles, and guidelines on diagnosis and management of listeriosis in pregnancy as well as the actual national antenatal care guidelines. The results of this research show that listeriosis in

pregnancy can result in severe adverse maternal, fetal, and neonatal outcomes. Early diagnosis and treatment have been shown to improve fetal and neonatal outcomes; therefore, prevention with education and early diagnosis prompting treatment will improve overall outcomes. This research has contributed to the possible need to raise awareness among health providers, obstetricians, and reproductive women for the importance of prevention and early detection of *Listeria monocytogenes* before and during pregnancy.

Listeriosis may cause serious consequences for the fetus and newborn. It requires obstetricians to think about the possibility of pregnancy-related Listeria in pregnant women with influenza-like symptoms and a high-risk diet history. Professional associations and governments may need to strengthen the surveillance for listeriosis to reduce the incidence rate. Additional cost-benefit analyses of routinely monitoring pregnant women are warranted to decrease illness load and ameliorate prognosis through prophylactic management. Prevention, early diagnosis, and treatment before and during early pregnancy to avoid complications are of great importance.

Key words: Listeriosis, *Listeria monocytogenes*, Pregnancy, Women, Neonatal, Guideline.

1. Introduction

Listeriosis is a bacterial infection with a potential 20-30% mortality rate in its invasive form, which can easily be misdiagnosed or missed, and has the potential to

cause detrimental effects to the vulnerable population of pregnant women and neonates; one would think a condition with these staggering characteristics would be mentioned more regularly amongst medical practitioners, especially obstetricians, and the general population. *Listeria* infection is secondary to the bacterial pathogen *Listeria monocytogenes* and is the culprit capable of such profound illness and threat to life especially in vulnerable groups. Spread most commonly *via* food, the World Health Organisation states that 43% of *Listeria* infections occur during pregnancy [1], with 14% occurring late in pregnancy, having increased potential to harm the neonate [2].

Listeria infection is preventable, and its potential negative effects are reducible, *via* good patient education, good food practices, and prompt treatment with readily available antibiotic protocols [1]. Acute infection in the pregnant woman can be easily misdiagnosed as a viral illness due to the vague manifestation of diseases such as pyrexia, gastric upset, diarrhea, myalgia, and headache. *Listeria* infection poses a threat to ongoing pregnancy and increases the risk of miscarriage, premature birth, and stillbirth, with 20% of affected women experiencing one of these aforementioned adverse pregnancy outcomes. Transplacental infection of the fetus from the infected mother has been studied in animal models and *Listeria monocytogenes* has been shown to exhibit fetal tropism in multiple species [3]. The fetus is a preferred target for listeria due to the immature fetal immune system and subsequent inability to combat infection. This paired with the excellent perfusion of the fetus and the placenta provides a nutrient-rich environment for bacteria to prosper [3]. Therefore, the neonate is exposed to a high risk of morbidity and mortality through respiratory and/or cardiac distress, pneumonia, sepsis, and meningitis. Animal models confirm the severity of infection as a common finding because once infection is established the bacteria can rapidly grow to high numbers in the placenta and colonize the fetus with ease [4].

This review aims to synthesize and update the literature and information available about the prevention, clinical symptoms, sequelae, and treatment guidelines of *Listeria* infection in pregnant and neonates.

2. Scientific evidence available regarding listeriosis in pregnancy in prevention, clinical symptoms, sequelae, and treatment guidelines

2.1 Scientific databases search strategy

The computerized databases PubMed and Scopus were systematically searched using PRISMA guidelines. Table 1 outlines the search keywords used, and inclusion and exclusion criteria.

2.2 Studies screening and selection

As there is potentially outdated data on the topic of *Listeria monocytogenes* infection in pregnancy and the neonate, a publication date restriction of 24 years was used in the search. Results were limited to scientific literature published in English that discussed listeria infection in pregnancy and the neonate. If the full article of the study was not available, then the study was not included as the information available would be limited.

Using the initial search criteria and filters mentioned in Table 1, a total of 79 results were found. These records were screened based on the exclusion/inclusion criteria.

2.3 Data extraction

The data extraction Excel sheet was formulated and approved by the authors. Each study selected was examined and pertinent data was extracted for each paper and thereafter compiled into the spreadsheet and cross-checked by co-authors. Content analysis was performed on the following topics: prevention of infection, clinical symptoms in pregnancy, sequelae of infection for the mother, the

Table 1. Search criteria and strategy for the systematic review of literature on *Listeria monocytogenes* infection in pregnancy

Databases searched	PubMed, Scopus
Search keywords	[<i>Listeria monocytogenes</i>] AND [pregnancy OR pregnant] [Listeriosis] AND [pregnancy] [Maternal] AND [Listeriosis] [Neonatal] AND [Listeriosis]
Inclusion criteria	Published in English Between the years 2000 - 2024 Full article available Clinical trial, Randomised control trial
Exclusion criteria	Papers not published in English Papers published before 2000 The full article is not available

pregnancy and the neonate, and treatment guidelines. Information reviewed included the authors, year and country of publication, and summary of findings. All disagreements regarding extrapolated data were resolved by thorough discussion between the authors.

2.4 Selection of studies included in the review

An outline of the selection process can be seen in Figure 1.

Following the initial search, 79 records were screened for inclusion in this review. Of these 79, we excluded 9 based on title, and 49 on the lack of relevance to the topic. Of those, 20 met all the inclusion criteria and were therefore reviewed. 13 studies were included in the final review following full-text assessment based on relevance.

2.5 Selected studies characteristics

Table 2 presents the characteristics of the studies included in this review. Study sample, method, aims and findings are summarized.

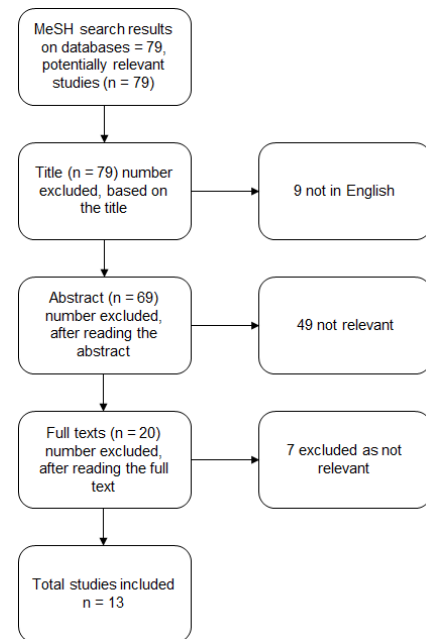


Figure 1. PRISMA information flow diagram for the systematic review of *Listeria monocytogenes* infection in pregnancy and the neonate

Table 2. Data extracted from studies included in the systematic review

Author, date, country	Sample and method	Study aim	Study findings
Mylonakis et al., [15], USA	Review of records to identify all cases of pregnant women with <i>Listeria monocytogenes</i> isolated on cultures (11 cases identified) and a review of 222 cases of perinatal listeriosis reported between Jan. 1980 and Jan. 2000	Examine clinical characteristics of perinatal listeriosis to assess potential risk factors, clinical findings, investigation results, response to treatment, and outcome in mothers and neonates	<ul style="list-style-type: none"> Increased incidence of listeriosis among pregnant women Most had no associated predisposing factors Fever is the most common presenting symptom > 30% of patients presented with flu-like symptoms 1/5 of cases - pregnancy ended with spontaneous abortion or stillbirth 68.3% of neonates infected with <i>Listeria</i>
Mook et al., [10], UK	1,510 laboratory-confirmed cases of listeriosis were reported to the Health Protection Agency (England and Wales) between 2001 and 2008	Assess the role of ethnicity in pregnancy-related cases of listeriosis and examine trends	<ul style="list-style-type: none"> Sustained increased risk of pregnancy-related listeriosis cases from ethnic minorities This increase was not observed in the non-pregnant cases Passive food safety messages may not be reaching pregnant women Targeted methods of communication are needed
Dalton et al., [17], Australia	National case-control study of 136 cases of <i>L. monocytogenes</i> of which 19 were perinatal between Nov. 2001 and Dec. 2004	The identification of dietary, medical, and behavioral risk factors for listeriosis in Australia	<ul style="list-style-type: none"> Requirement of increased targeted prevention of listeriosis in people who do not speak English/the local language Increased use of gastric acid inhibitors within a month of illness increases the risk of bacterial enteric infection. Pregnancy provides an ideal time to counsel patients on preventing infection

Girard et al., [11], France	A review of 606 cases in France recorded in health databases	Describe trends in the incidence of pregnancy-related listeriosis in France and identify the characteristics of recorded cases	<ul style="list-style-type: none"> • Pregnancy-related listeriosis is rare but severe. • Fetal loss occurs in 27% and preterm birth rate is 64% • Promotion of dietary recommendations may contribute to listeriosis prevention in pregnancy as trends are lower in areas that also have lower cases of toxoplasmosis • 80% of women report eating high-risk foods for listeriosis in pregnancy
Elinav et al., [20], Israel	A retrospective cohort study of all <i>L. monocytogenes</i> cases in Israel in 10 years (1998 - 2007); identification of 166 pregnancy-related cases	Identify and analyze cases of pregnancy-related listeriosis in Israel between 1998 and 2007 and perform geospatial analysis to identify infection clusters and risk factors for infection in pregnancy	<ul style="list-style-type: none"> • Antibiotics to cover <i>L. monocytogenes</i> should be used to cover any case of fever of unknown origin in pregnancy. • The most common serotype of <i>L. monocytogenes</i> in pregnancy is serotype 4b • <i>L. monocytogenes</i> has a predilection for pregnancy • Low public awareness of food safety to prevent Listeria infection • Clinical presentation in the second trimester differs from third - higher rates of fetal demise • 10.9% of neonates infected when born to affected mothers • 68% rate of neonatal sepsis in neonates born to infected mothers. • Typically benign infection to the mother, but possibly detrimental to the fetus • Urgent preventative action is needed to educate pregnant women
Pourkaveh et al., [18], Iran	A cross-sectional study in Iran between January and December 2015 surveyed 318 women ages 18 - 35 admitted to medical centers with spontaneous miscarriages in the Tehran province.	Identify the risk factors for contamination with <i>L. monocytogenes</i> in patients with spontaneous miscarriages.	<ul style="list-style-type: none"> • <i>Listeria monocytogenes</i> were detected on 54% of vaginal swabs in women who had experienced a miscarriage • Infection rates were highest in 18 to 23-year-olds and those with lower education levels • Food exposure patterns significantly associated ($p < 0.001$) with Listeria infection were a history of consuming unpasteurized dairy, feta or soft cheese, semi-cooked meat, smoked meat, processed food, smoked seafood, and ready-to-eat vegetables during pregnancy or in the 3 months prior • Contact with domestic animals and soil was also significantly associated with listeriosis ($p < 0.001$) • Women living in the countryside or working in agriculture should be considered particularly high risk
Angelo et al., [24], USA	Review of all outbreak-related invasive <i>L. monocytogenes</i> cases reported to the Centers for Disease Control and Prevention between 1985 and 2015 with exposure date information	Assessment of the incubation periods of cases reported during US <i>Listeria</i> outbreaks using multiple exposure simulation model	<ul style="list-style-type: none"> • Median incubation period for <i>L. monocytogenes</i> is 11 days. • Median incubation period for pregnancy-related listeriosis was 16 days longer. • The window for highest concern for high-risk food consumption in pregnancy may be 5-6 weeks before illness onset

<p>Charlier et al., [15], France</p>	<p>A national prospective observational cohort study enrolling microbiologically proven cases of listeriosis. A total of 818 cases, of which 107 maternal neonatal cases between November 2009 and July 2013</p>	<p>An analysis of clinical features, characterization of isolates of <i>Listeria</i>, and analysis of the 3-month morbidity and mortality predictors</p>	<ul style="list-style-type: none"> • 80% of affected mothers experienced major fetal or neonatal complications. • Fetal losses occur at < 29 weeks gestational age and within 2 days of hospitalization • A high proportion of affected mothers are of ethnic minority and low socioeconomic status. • Maternal symptoms of listeriosis varied widely and were nonspecific • Maternal blood cultures were negative in 45% of cases - we should use antimicrobials that cover listeria even in cases of negative cultures • Term at the onset of disease significantly impacts outcomes, fetal death risk is reduced after 29 weeks of gestation
<p>Moran et al., [23], Australia/Netherlands</p>	<p>A systematic review of nutrition and listeriosis in pregnancy until 2017</p>	<p>To assess the relationship between listeriosis and food choices and food preparation practices in pregnancy</p>	<ul style="list-style-type: none"> • Mothers were more likely to consume unpasteurized/pasteurized dairy products, cooked/semi-cooked/smoked/processed meat, or ready-to-eat fruit and vegetables during pregnancy compared to controls. • Adequate education will reduce the risk of maternal and fetal morbidity and mortality from listeriosis
<p>Herrador et al., [21], Spain</p>	<p>Retrospective study of cases of listeriosis hospitalized (total 5,696 cases) in Spain between 1997 and 2015, including rates of pregnancy and neonatal cases</p>	<p>Describe the epidemiology of listeriosis in Spain between 1997 and 2015</p>	<ul style="list-style-type: none"> • Constantly increasing trend in hospitalized <i>Listeria</i> infections between 1997 and 2015 • Pregnant women account for 7% of hospitalisations • Neonates account for 4% of hospitalizations • Use of gastric acid inhibitors increases the risk of infection
<p>Cappelletti et al., [19], USA</p>	<p>A systematic review of knowledge from different animal models of acute chorioamnionitis</p>	<p>The role of different immune cells in different maternal fetal compartments</p>	<ul style="list-style-type: none"> • Evidence demonstrates that different microorganisms cause intrauterine infections through different routes of invasion • Antibiotic therapy for intrauterine infection (IUI) is disappointing, likely due to residual intrauterine inflammation • <i>Listeria</i> invades the placenta via the hematogenous route • Intrauterine infection is the cause of 40% of preterm labor causes • A multidisciplinary approach to managing IUI is required - reproductive biology, infectious diseases, pharmacology, immunology, obstetrics, and neonatal teams
<p>Xu et al., [16], China</p>	<p>Review of 93 cases of <i>Listeria monocytogenes</i> infection in pregnancy - from hospital clinical data and a literature search of Chinese cases over 15 years</p>	<p>Study of the clinical characteristics of <i>Listeria</i> in pregnant women, including treatment and prevention</p>	<ul style="list-style-type: none"> • Initial presentation was pyrexia in 90 patients, abdominal pain in 50, and abnormal fetal movements or heart rate in 27 cases (out of 93) • Positive cultures were found in amniotic fluid, maternal blood cultures, placental cultures, uterine secretion cultures, and neonatal blood cultures. • Only 24 cases were treated initially with broad-spectrum penicillin to cover potential <i>Listeria</i> • Maternal outcomes included: 20 cases of sepsis, 3 cases of pneumonia, 6 of acute pyelonephritis, 28 of intrauterine infection, 2 of multiple organ failure, and 1 of septic shock - effects on the mother can be detrimental also • Fetal/neonatal outcomes: 16 cases of abortion, 16 cases of intrauterine fetal death, 22 cases of neonatal death and 39 cases of cure

Eallonardo et al., [3], USA	Review of the literature on the pathogenesis of <i>Treponema pallidum</i> and <i>Listeria monocytogenes</i>	Describe the pathogenesis of these 2 bacteria and how they manage to overcome the placental barrier and the role of placental immunity in infection resistance	<ul style="list-style-type: none"> • The fetus is an ideal target for bacteria due to its immature immune system which cannot combat infection. • The maternal immune system has an altered defense during pregnancy to prevent a response to fetal alloantigens. • The highly perfused placental environment is nutrient-rich for bacterial survival
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2.6 Prevention

Listeria infection is most commonly foodborne. However, it can also be transmitted through infected soil and contact with livestock. Practitioner and patient education is as crucial in *Listeria* prevention because of food hygiene practices on both household and industrial levels [1].

The prevention process commences during the handling of fresh raw products including the sanitary processing of food, and the cutting, packaging, and storage of ready-made food at which point contamination and re-contamination of food with listeria bacteria may occur. To reduce this risk, the reliability of packaging, and prevention of contamination should be ensured at all stages. Individuals must be informed of the importance of heat treatment and proper cooling, handling, and storage of food in the home [5].

Adequate counseling of women both pre-conception and in early pregnancy on the avoidance of high-risk foods empowers them to make safer decisions around the foods they consume and helps limit their exposure to listeria. The European Union permits the presence of up to 10^2 colony-forming units (CFU) of *Listeria monocytogenes* per gram in food at the expiration date [6]. One study showed that a maternal dose of 10^7 CFU

of listeria was lethal to 50% of third-trimester fetuses and that pregnancy losses have been observed at doses as low as 10^3 CFU [7]. Another study found that 10^7 CFU of listeria led to a fatal demise in the first trimester, and therefore posed a fatal risk to pregnancy throughout [8]. There is evidence suggesting that prior maternal infection may be protective against complications in pregnancy [9]. These findings highlight the importance of infection prevention in tackling this infection with potentially serious consequences in pregnancy.

Mook *et al.*, [10], looked at the relationship between ethnic minorities and listeriosis in pregnancy in England and Wales and saw a positive association between ethnic minorities and listeriosis, which was not as prevalent in non-pregnancy cases. The proposed relationship between generalized food safety messages not reaching these high-risk populations was emphasized through this study. In 2014, Girard *et al.*, [11], found that 80% of pregnant women in a review of 606 cases had consumed a high-risk food either during pregnancy or in the 3 months prior.

Table 3 shows guidance on unsafe and safe foods in pregnancy which should be clearly outlined to pregnant patients at antenatal consultations [12, 13, and 14].

Table 3. Guidelines on unsafe foods and safe alternatives in pregnancy to avoid contamination with *Listeria monocytogenes* bacteria and subsequent infection [13]

Unsafe foods to eat	Safe choices for unsafe foods
Unpasteurized soft cheese Pre-sliced unheated cheeses	Hard cheese Soft cheeses heated to at least 74 degrees Celsius
Unheated deli meat, cold cuts, hot dogs and sausages	Deli meat, cold cuts, hot dogs, and sausages heated to at least 74 degrees Celsius
Premade deli salads	Deli salads made at home
Refrigerated pate or meat spreads	Pate and meat spreads which are sold in airtight containers and do not require refrigeration
Refrigerated smoked fish	Smoked fish are sold in airtight containers and do not require refrigeration.
Uncooked sprouts	Sprouts cooked until steaming
Pre-cut melon left exposed for over 2 hours (reduce to 1 hour in warmer temperatures) Cut melon refrigerated for 1 week or more	Freshly cut melon
Raw, unpasteurized dairy products	Pasteurized dairy products

2.7 Maternal clinical symptoms

Pregnancy-related listeriosis has been found to account for 20.7% of total listeriosis cases worldwide, with associated overall fatality rates of 14.9% including neonatal mortality [2].

The most common symptoms of listeria infection in pregnancy are non-specific, with literature confirming that the most common symptoms are pyrexia (often ranging between 38.2 and 41.2 degrees Celsius) with a general flu-like syndrome of myalgia and chills [14, 15]. Pyrexia as the presenting symptom was found in a range between 32 and 96% of cases [14, 15, and 16]. Muscle pains and chills were present in 33% of pregnant women with *Listeria monocytogenes* infection [15]. 1/5 of pregnancies affected by listeria resulted in spontaneous abortion. Dalton *et al.*, [17], found that fever, chills, and headache were reported more frequently in pregnant women than in non-perinatal cases.

2.8 Diagnosis

A positive microbiological result is required to confirm a diagnosis of *Listeria monocytogenes* in pregnancy. This culture can be isolated antenatally from the cervix or maternal blood cultures, as well as uterine, placental, or neonatal secretions postnatally [14]. *Listeria monocytogenes* can be isolated on vaginal swabs, with one study finding that out of 317 vaginal swab samples from women who had experienced a spontaneous abortion < 20 weeks gestation 17% were positive for listeria [18]. The work of Charlier *et al.*, [15], showed that the most sensitive samples for diagnosis of positive *Listeria* infection were placental cultures and new-born gastric fluid cultures. Cappelletti *et al.*, [19], looked at the immunobiology of acute chorioamnionitis and found that uterine infection and inflammation are the cause of 40% of cases of preterm labor, as the infection enters the villi and fetal circulation, a positive feedback loop of inflammation takes over and stimulates preterm birth and labor. Although maternal cultures were found to be positive in 45% of cases in the study of Capellati *et al.*, [19], there were 55% of infected women had negative cultures, therefore cultures directly in contact with the fetus or from the newborn are most reliable [15, 20]. In the study conducted in 2010 by Dalton *et al.*, [17], *Listeria monocytogenes* was isolated from a materno-fetal pair in 10 cases, the remaining cases had positive cultures from the mother only in 2 cases and the fetus in 7 cases out of 19 - confirming that maternal cultures are not always as reliable as neonatal cultures in confirmed cases of listeria.

2.9 Sequelae in the mother and the fetus/neonate

Maternal outcomes in *Listeria monocytogenes* infection are overall good. Elinev *et al.*, [20], identified a single

case of mortality in a study of 166 perinatal cases. In 2019, Herrador *et al.*, [21], identified no cases of maternal mortality in 396 cases in a retrospective study over 10 years with a p-value of <0.001. Xu *et al.*, [16], in China, found that there were 20 cases of maternal sepsis, 3 of pneumonia, 6 of acute pyelonephritis, 2 of multiple organ failure, and 1 of septic shock in a review of 15 hospital cases, and 77 literature cases, i.e. a total of 93 women. Effects on the fetuses of affected mothers were not as optimistic.

The majority of studies reviewed confirmed that *Listeria* infection is associated with high rates of fetal demise in pregnancy. Fetal viability increased with each additional week of pregnancy at the time of diagnosis, as one study showed a 33% increased survival chance per additional week (OR 1.331, 95% CI, p < 0.001) [20]. According to Pourkaveh *et al.*, [18], fetal survival in the second trimester was 22.2% compared to 95.3% in the third trimester. Mylonakis *et al.*, [14], in 2002 also showed outcomes with 20% rates of spontaneous abortion or stillbirth (36 of 178 cases). In 2022, Xu *et al.*, [16], also confirmed that out of 93 cases positive for *Listeria*, 16 resulted in spontaneous abortion (5.8%), 16 resulted in intrauterine fetal death (5.8%), and 22 resulted in neonatal death (23%). The work of Charlier *et al.*, [15], reflected similar values with 24% of cases resulting in fetal loss, and impressive rates of preterm delivery at 44.8%. In 2014, Girard *et al.*, [11], showed that these rates of preterm birth might be 64%. Dalton *et al.*, [17], showed rates of fetal death between 18 and 32 weeks of 21% fatality rate. Another study conducted in 2010 by Mook *et al.*, [10], showed that rates of miscarriage were roughly 10% of positive cases, and 3.5% resulted in stillbirth. Girard *et al.*, [11], identified 166 fetal losses in 603 mothers who were positive for *Listeria*, of which 57% were classified as miscarriages and 43% as stillbirths. This study also confirmed that fetal loss significantly decreased with gestational age at diagnosis (p < 0.001). Charlier *et al.*, [15], supported this finding and confirmed that the term of the pregnancy at diagnosis is crucial to fetal outcome.

If the fetus survives to be born in listeria-positive cases, it still faces many potential risks as a neonate. Rates of neonatal infection from listeria-positive mothers varied greatly and were reported between 4%, and 68% (in the studies conducted by Herrador *et al.*, [21], and Mylonakis *et al.*, [14], respectively). The most common symptoms in the neonate were respiratory distress, fever, and/or neurological abnormalities. 24.5% of infected neonates developed meningitis, 20.2% pneumonia, and 25.5% had bacteremia/sepsis in the review conducted by Mylonakis *et al.*, [14]. Rates of neonatal death were also high in listeria cases with Xu *et al.*, [16], reporting 23% neonatal death rates,

which contrasted the findings of the MONALISA study [15], which found rates of neonatal death to be 4.9%. There is a possibility that these different rates of neonatal mortality are the result of differing diagnoses and treatment or local factors with one study being conducted in China and the other in France. Elinav *et al.*, [20], showed rates of neonatal death to be at 10.9% even when listeria had occurred in the third trimester.

In the study conducted by Charlier *et al.*, [15], it was found that listeria also complicates delivery methods, causing abnormal delivery at term in 20.5% of cases. In the same study, cesarean section rates were 39%, preterm birth rates were 44.8%, and fetal distress at delivery was present in 21%.

2.10 Management/Guidelines on treatment

The mainstay of treatment of listeriosis is appropriate antimicrobial therapy. The most common antimicrobials used in pregnancy for *Listeria monocytogenes* infection treatment are penicillin, ampicillin, and amoxicillin in adequate doses to penetrate the placenta [22]. The MONALISA study published in 2017 [15], found that the mean duration of antibiotics was 15 days, and that amoxicillin was the most commonly used agent for treatment (85% of cases). A combination of gentamicin and amoxicillin may improve survival according to multivariate analysis, however, randomized control trials are not available to support this finding. Adjunctive dexamethasone use at the time of infection was found to reduce survival, especially in patients with neuroinfection, hence its avoidance is advised [15].

Local sensitivities must be considered when determining antimicrobial agents used in infection. National guidelines must be reviewed and microbiologists should be consulted when making this decision.

3. Conclusions

- *Listeria monocytogenes* infection in pregnancy is a rare, yet dangerous infection that can have detrimental effects on the mother, the pregnancy, and the neonate.
- Prevention through patient and practitioner education and empowerment is crucial for the infection rate reduction, and the minimization of potential adverse effects of this infection, particularly in minority and ethnic groups where generalized communications or messages regarding food safety may not be reaching the target audience.
- Pregnant women present with vague symptoms of infection with *Listeria monocytogenes*. Therefore, practitioner suspicion of listeriosis must be high in all women presenting with pyrexia and being generally unwell. Miscarriage, fetal demise, fetal distress, and

neonatal infection and death are all real potential risks of *Listeria* infection in pregnancy.

- The impact outcomes depend on early diagnosis and treatment with adequate antibiotics. Collaboration with local medical teams including microbiologists and neonatologists is key to the safety of mother and baby affected by listeriosis management.
- Awareness regarding food safety must consider marginalized populations. Local healthcare networks must work on ensuring the relay of this information to high-risk groups.
- Ongoing research is required in the field of listeriosis in pregnancy to aid in better management and prevention of this condition and its harmful effects on both mother and fetus.

Conflict of interest

There are no conflicts of interest to report.

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