A Brief Review of Some Animal Pathogens Causing Miscarriages in Women

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Brucella melitensis, Brucella suis, Brucella canis and Brucella abortus, which normally infect various species of domestic animals, can infect humans through unpasteurized milk from infected animals or from contact with reproductive tract fluids. They cause flu like symptoms with the fever rising and falling over months or years. Boiling milk before consumption can prevent brucellosis. It can be treated with antibiotics. Listeria monocytogenes usually affects sheep, goats and cattle but may infect humans through consumption of unpasteurized milk and dairy products from infected animals. Prevention of listeriosis is by avoiding unpasteurized milk and dairy products and it is treatable with antibiotics. Toxoplasma gondii is a protozoan parasite of cats, which are the definitive hosts in which the parasite completes its life cycle and produces eggs that are exteriorized in the faeces. Secondary hosts include pigs, sheep and humans. Humans catch the disease from eating poorly cooked meat from infected pigs and sheep, or from accidentally swallowing eggs with food or water contaminated with cat faeces. Toxoplasmosis can be avoided by avoiding close proximity with cats and is treatable with antibiotics. Pregnant women who get infected by these pathogens may miscarry.

Key words: Brucella spp; Listeria monocytogenes; Toxoplasma gondii; miscarriage in women

Causes of miscarriages

There is a very wide variety of aetiological factors that can lead to miscarriage in women. By far the most common cause of miscarriages is chromosome abnormalities. The non-chromosomal factors leading to miscarriage are endocrine and anatomical abnormalities. Infectious conditions also feature as causes of miscarriage\(^1\),\(^2\). Some of these are due to

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pathogens that typically infect human beings, such as *Mycoplasma hominis*, *Chlamydia trachomatis* and *Ureaplasma urealyticum*. Other infectious conditions resulting in miscarriages in women, however, are due to pathogens that primarily infect domestic animals, such as *Brucella abortus*, *Listeria monocytogenes* and *Toxoplasma gondii*. This review article will explore the circumstances in which human beings acquire these primarily animal infections, the effects of these infections on people, particularly on pregnant women, how to avoid contracting these infections and how to treat and control them in the event that they are contracted.

**Circumstances leading to infection**

*Brucella abortus*

The genus *Brucella* has a number of species that cause disease in various species of domestic animals, such as *Brucella melitensis* in goats and sheep, *Brucella suis* in pigs, *Brucella canis* in dogs and *Brucella abortus* in cattle. Any of these can cause brucellosis in humans\[3\]. In pregnant ruminants, *Brucella* organisms accumulate in the placenta and foetus, which produce the sugar erythritol, a growth stimulant for *Brucella* organisms. The *Brucella* infection subsequently establishes itself in the foetus, often leading to abortion of the foetus\[4\]. Brucellosis in cattle and humans has been brought under control in many developed countries of the world, mainly through vaccination of cattle and the widespread pasteurization of milk\[5\]. The disease nevertheless still occurs in many parts of the world, although there are schemes aimed at eradicating the disease in many countries due to its public health significance. People catch the disease from animals through the eating and drinking of unpasteurized milk and milk products from infected animals. For people in the veterinary profession, brucellosis is an occupational hazard. It is often contracted by people assisting aborting cows. The placenta tends to be retained following cases of *Brucella* abortion, and often has to be pulled out by hand. This is a hazardous activity as the fluids from the reproductive tract contain large amounts of *Brucella* organisms. These gain access into the bodies of people assisting aborting cows through abrasions in the skin of the hands and arms. Droplets with the organisms, falling on the conjunctiva, can also find a ready avenue there to go systemic\[6\].

*Listeria monocytogenes*

Listeriosis is a disease caused by *Listeria monocytogenes*. It is seen in domestic animals, particularly in sheep and cattle. Animals are infected by ingestion, particularly when they feed on poor quality silage with a pH exceeding 5.0\[7\]. Following the septicaemic phase, *Listeria monocytogenes* may then localize in the placentomes, amniotic fluid and in the foetus itself, where the infection culminates in an abortion. It can also spread haematogenously to the brain, causing a meningoencephalitis. *Listeria monocytogenes* may be shed from the bovine udder and consumption of unpasteurized milk and milk products from infected animals may cause listeriosis in humans. There may be a meningoencephalitis and pregnant women
may suffer miscarriage\textsuperscript{7}. Dairy products that are likely to lead to infection by \textit{Listeria monocytogenes} in humans when consumed include soft cheeses, particularly where such cheeses are made from unpasteurized milk\textsuperscript{8}. Other foods typically associated with listeriosis include refrigerated, ready-to-eat perishable products with a long shelf life eaten without further cooking\textsuperscript{9}. Earlier in 2013, soft cheeses made by Crave Brothers Farmstead Cheese Company of Wisconsin in the United States of America were recalled following an outbreak of listeriosis that was traced to these cheeses. In the outbreak, one person died and four others were hospitalized, while a pregnant woman miscarried\textsuperscript{10-12}.

Issues of food security during pregnancy are therefore critical because \textit{Brucella abortus}, \textit{Listeria monocytogenes} and \textit{Toxoplasma gondii} are all transmittable through food and drink. Pregnant women are particularly susceptible to some of these food borne pathogens. With listeriosis, for example, pregnant women are at least 14 times more likely to catch the disease compared to other non-pregnant, healthy adults\textsuperscript{9,13}. Whereas this has often been explained by arguing that the hormonal changes in pregnancy lead to a suppression of the immune response\textsuperscript{9}, others have argued that this higher incidence among pregnant women may have nothing to do with a suppression of the immune response. Instead, once \textit{Listeria monocytogenes} organisms enter the placenta, they are protected from the body’s immune response\textsuperscript{14,15}. They therefore enjoy unrestricted growth in the protected compartment of the placenta, from which they spread to other organs\textsuperscript{14}. In this context, expulsion of the infected placenta and its contents through spontaneous abortion is seen as a survival mechanism for the mother, whereby it gets rid of the source of infection to other parts of the body\textsuperscript{14}.

\textbf{Toxoplasma gondii}

\textit{Toxoplasma gondii} is a protozoan parasite whose definitive host is the cat. The parasite can only complete its life cycle and produce eggs in cats. The eggs are excreted in large numbers in the cat’s faeces. These eggs are then ingested by the secondary hosts, which include other species of domestic animals, such as sheep and pigs, and also humans. Tissue cysts form in the intermediate hosts. If pregnant women contract the disease, the organism may be transmitted to the foetus, where it invades the central nervous system. Toxoplasmosis in pregnant women can lead to miscarriages or stillbirths\textsuperscript{16-18}. In a serological survey for \textit{Toxoplasma gondii} carried out in 35 940 pregnant women in Norway, 47 tested positive for the parasite. Among these, congenital infection was detected in the infants of 11 of them\textsuperscript{18}. Humans get infected either by ingestion of eggs from the cat, or through the consumption of poorly cooked meat from other intermediate hosts such as sheep and pigs.

\textbf{Effects of the infections in humans}

\textbf{Brucella abortus}

Symptoms of brucellosis in humans include fever, headache, muscle pain, backache and joint pain. The fever occurs in the evening along with severe sweating, but returns to
normal in the morning, only to begin again at night. The disease may go chronic with the fever rising and falling over months or even years\[^{19}\]. Brucellosis in pregnant women may also lead to miscarriage\[^{3,6}\]. Of the four species of *Brucella* mentioned above, *Brucella meltensis* may cause sudden and severe symptoms, while symptoms caused by *Brucella bovis* and *Brucella canis* tend to be milder but may last longer. *Brucella suis* may cause abscesses in various organs\[^{3}\]. Chronic brucellosis may also result in valvular endocarditis.

**Listeria monocytogenes**

Symptoms are usually mild and flu like in healthy adults\[^{20}\]. There may be diarrhoea, fever, muscle aches, headaches, and stiff neck. More severe cases of listeriosis in humans can cause meningitis. This is in contrast to the case in animals, where brain involvement is usually in the form of encephalitis\[^{7}\]. The patient may suffer some degree of mental confusion and may experience difficulties maintaining balance while standing or walking. Pregnant women may suffer miscarriage or stillbirth\[^{8,9}\].

**Toxoplasma gondii**

Toxoplasmosis is often an asymptomatic or mild clinical disease\[^{18}\]. Symptoms may include fever, headache, and muscle aches\[^{17}\]. There may be lymphadenopathy, particularly of the occipital and cervical lymph nodes\[^{21}\]. Pregnant women may miscarry\[^{10}\]. Infants may be infected in utero. Such infants may be quite normal at birth but may subsequently develop disorders of the central nervous system and ocular disease later in life\[^{17}\].

**Prevention, treatment and control**

**Brucella abortus**

Some of the ways in which brucellosis can be prevented include boiling milk before drinking, or using pasteurized milk. The use of protective clothing when attending to cows that have aborted is also important. Brucellosis in humans can be treated using a long course of antibiotics such as tetracyclines, doxycycline and rifampin, usually in combination\[^{3,5}\].

**Listeria monocytogenes**

Unpasteurized milk should be avoided. Soft cheeses made with unpasteurized milk, such as feta, brie, camembert, blue veined, queso fresco, queso blanco and panela\[^{9}\] should be avoided, particularly by pregnant women. Listeriosis may be treated with antibiotics such as amoxicillin and ampicillin\[^{21}\].

**Toxplasma gondii**

Pregnant women in particular should wash all surfaces of cutting boards and utensils with hot, soapy water, especially those that come in contact with raw meat. Undercooked mutton and pork should be avoided. If a pregnant woman has a cat as a pet, she should ensure that the cat’s litter box is changed daily, preferably by someone other than herself. Hands should be washed after handling animals or working in the garden\[^{9}\].

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Toxoplasmosis is treated with antibiotics[9], such as pyrimethamine and sulfadiazine, or trimethoprim and sulfathoxazole[21].

References

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Conference Information

2014 Annual Women’s Health Conference
February 21st to 22nd New Mexico / Albuquerque Family Medicine, General Medicine, Internal Medicine, Obstetrics / Gynecology
Contact: Office of Continuing Medical Education, University of New Mexico School of Medicine
Phone: 505-272-3942
Fax: 505-272-8604
E-mail: CMEWeb@salud.unm.edu
Website: http://som.unm.edu/cme/2014/WHC.html

Healthy Mothers and Healthy Babies: New Research and Best Practice
February 21st to 22nd British Columbia / Vancouver Family Medicine, Obstetrics / Gynecology, Pediatrics
Contact: Interprofessional Continuing Professional Education, University of British Columbia
Phone: 604-827-3112
Fax: 604-822-4835
E-mail: katia.ipce@ubc.ca
Website: http://www.interprofessional.ubc.ca/Perinatal2014/default.asp

23rd Annual Comprehensive Workshop on Minimally Invasive Gynecology for Residents, Fellows & New MIG Specialists
March 1st to 2nd Illinois / Rosemont Obstetrics / Gynecology
Contact: Gerardo Galindo, American Association of Gynecologic Laparoscopists
Phone: 714-503-6200
Website: http://www.aagl.org/event/39/

Primary Care Refresher Tahiti CME cruise
March 1st to 12th Tahiti / Papeete Cardiology, Emergency Medicine, Endocrinology, Family Medicine, General Medicine, Internal Medicine, Legal/Ethics, Obstetrics / Gynecology, Other Specialties, Plastic Surgery, Respirology, Rural Medicine
Contact: Dr. Martin Gerretsen, Director of CME, Sea Courses Cruises
Phone: 888-647-7327
Fax: 888-547-7337
E-mail: cruises@seacourses.com
Website: http://www.seacourses.com/primary-care-refresher-tahitian-pearls.html

Family Medicine: An Evidence-Based Approach to Patient Care
March 3rd to 7th Florida / Sarasota Emergency Medicine, Family Medicine, General Medicine, Internal Medicine, Obstetrics / Gynecology
Contact: Tara Esteves, Live CME Administrator, American Medical Seminars, Inc.
Phone: 866-267-4263 (TOLL FREE) or 941-388-1766
Fax: 941-365-7073
E-mail: testeves@ams4cme.com
Website: http://www.ams4cme.com/www/LiveSeminars/SEMLA-2820140303.aspx