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Major diseases of pregnancy and abortion in cows

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The data from the literature of domestic and foreign authors indicates that reproductive pathology and infertility are often complex and multifactorial phenomena, in which veterinary specialists aim to determine the cause of its violation, as well as to prescribe effective treatment and propose preventive measures. Infertility is defined as a decrease in reproductive capacity in cows. Fertility losses in animals include all causes of pregnancy termination: embryo death, resorption, abortion at any stage of pregnancy, and still-birth. According to various authors, the etiology is diverse and includes ineffective treatment, as well as abnormal anatomical development or function of the reproductive system. In addition, infection, invasion, and neoplasia may be involved. Miscarriage is considered a component of infertility but it is more specific in its etiology and pathogenesis. There are many potential causes of pregnancy termination, some of which are still not understood. The causes of abortion are divided into two main categories, namely, infectious and non-infectious; and the main diseases of pregnancy are divided into four groups: diseases that occur and develop in the maternal body and are related to pregnancy; diseases of the fetus and its membranes; diseases that are concomitant with pregnancy but not directly related to it; and extragenital pathology.

Key words: cows, pathology of pregnancy, swelling of pregnant, nephropathy of pregnant, hepatopathy of pregnant, osteodystrophy of pregnant, eclampsia, prenatal addiction, abortions.

Introduction

Reduction of natal and postnatal diseases of the breeding stock, diseases and death of newborn animals remains the main problem of veterinary science and practice in matters of animal reproduction (Christianson, 1992; Roberts, 2004; Braun, 2007; Drost, 2007; Barrier et al., 2013; Uematsu et al., 2013; Romano & Fahning, 2013; Koreyba et al., 2021).

Diseases of the reproductive organs of females reduce reproduction rates and significantly affect the economic indicators of the livestock industry. At the same time, approaches to the prevention and treatment of diseases in females of various animal species are changing, where economic feasibility and technological feasibility are the main criteria. However, when solving these questions, it is necessary to take into account the fact that we are dealing with pregnant animals, in which the normal development of pregnancy and the fetus, the health of the offspring, the course of labor and the postpartum period are largely determined by the adaptation and metabolic processes in the maternal organism and the functional state of

the system: “mother-placenta-fetus” (Roberts, 1962, 1986; Caldow et al., 1995; Lefebvre, 2015; Gábor et al., 2016; Vikram et al., 2020; Koreyba et al., 2021).

In these conditions, along with issues of herd reproduction and animal health, veterinary specialists need to study the entire technological complex of milk production, including issues of fodder production, maintenance, feeding and exploitation of animals.

The aim of the study

Our research aimed to analyze the prevalence of major pregnancy diseases and to study the causes of abortion among cows in farms of different forms of ownership.

Results and discussion

Diseases of pregnant animals are classified into four groups: diseases that arise and develop in the mother's body and are related to pregnancy; diseases of the fetus and its membranes; diseases associated with pregnancy, but not directly related to it; extragenital pathology.

The first group includes toxicosis of pregnant women or pre-eclampsia. The disease occurs only during pregnancy, which determines its name.

Toxicosis of pregnant – a syndrome of multiple organ functional insufficiency as a result of rearrangement of blood proteins, which develops as a pathological response of the body to pregnancy and is accompanied by a disorder of metabolism, neurohumoral connections and general intoxication.

Pre-eclampsia is a complication of pregnancy characterized by generalized vascular spasm with impaired perfusion of vital organs. At the same time, the symptom complex leads to dysfunction of vital organs and systems and multiple organ failure.

Early toxicosis, characteristic of the first half of pregnancy, and late toxicosis (second half of pregnancy) are distinguished. The difference between them is that disorders of digestive system functions are typical for early toxicosis, and vascular disorders are characteristic for late toxicosis.

In veterinary practice, it is customary to differentiate them into the following diseases: swelling of pregnant, nephropathy of pregnant, hepatopathy of pregnant, osteodystrophy of pregnant, eclampsia, prenatal addiction.

Late toxicosis of pregnancy can be accompanied by such obstetric complications of labor and the postpartum period, such as weakness of labor activity, litter retention, postpartum eclampsia, postpartum subinvolution of the uterus.

Clinical manifestations of pre-eclampsia are diverse, but these diseases have common features: they are associated with pregnancy; fetoplacental insufficiency develops earlier than clinical signs; the less adapted system is affected (more often this pathology is registered during the first pregnancy); changes in metabolism are expressed in a tendency to acidosis.

Currently, foreign works have also appeared, where pre-eclampsia are considered as a single symptom complex without dividing them into clinical forms (Roberts, 1986; Caldwell et al., 1995; Braun, 2007; Gábor et al., 2016; Chekan, 2023).

The second group of diseases – pathology of the fetus and fetal membranes – remained poorly studied until recently and was considered as the cause of idiopathic non-contagious abortions. These diseases were diagnosed with regard to fetal membranes and placentas of aborted fetuses, that is, already with the development of severe morphological changes. Functional disorders in the “mother-placenta-fetus” system were not considered at all.

Destructions of the function of the fetoplacental system and toxicosis of pregnant animals are closely related. The fetoplacental insufficiency often develops earlier than the clinical signs of toxicosis and, to one degree or another, is present in all forms of obstetric or extragenital pathology in pregnant animals; generalized vascular spasm, characteristic of pre-eclampsia, leads to impaired microcirculation in the placenta and contributes to the development of fetoplacental insufficiency.

If we talk about developmental anomalies, ugliness, fetal diseases, and other pathologies included in this group, then this issue requires separate consideration.

The nosological spectrum here is large. At the same time, there are anomalies with a precisely established genetic nature, and the death of fetuses with such a pathology reduces the genetic burden of the population. There are anomalies and deformities that occur during embryogenesis that cannot be corrected, as well as anomalies and diseases of the fetus that can be corrected (Roberts, 2004; Braun, 2007; Drost, 2007; Romano & Fahning, 2013; Chekan, 2023).

The next group of fetuse-bearing pathologies includes prenatal diseases: vaginal eversion, uterine hernias, uterine bleeding, uterine torsion, and others. Etiologically, they are not related to toxicosis of pregnancy and most often have a traumatic origin. In addition, it is important to note that the course of extragenital diseases in the mother changes during pregnancy. Moreover, diseases of the mother's organs and systems affect the development and functioning of these systems in the fetus. There is an experimentally confirmed theory of parallel damage to the same systems of the mother and fetus, which must be taken into account during the analysis of perinatal pathology. On the other hand, studies by many authors show that among all the risk factors for pre-eclampsia, the prominent place belongs to extragenital pathology. In particular, obesity, fatty hepatoses, and ketosis are the causes of many complications of the perinatal period (Roberts, 1986; Ametaj, 2017; Mudaliar et al., 2017; Dervishi & Ametaj, 2017; Egyedy & Ametaj, 2022).

In this regard, pre-eclampsia, fetoplacental insufficiency and extragenital diseases in pregnant animals should be considered together, as they have common etiological and pathogenetic mechanisms.

Swelling of pregnant animals – the disease is characterized by the accumulation of transudate in the subcutaneous tissue of the abdominal wall, under breast, pelvic limbs, and udder. The basis of the development of this pathology is a destruction of water-salt and protein exchanges in the body, as a result of which the permeability of blood vessels increases, which causes the liquid part of blood to leave them and its accumulation in tissues.

Favorable factors for the development of this pathology are abundant feeding of pregnant animals with juicy food, lack of mineral substances in the diet, hypo- and adynamia.

Nephropathy of pregnant animals – the disease is a destruction of kidney function, which is accompanied by dystrophic changes in renal tubules, an increase in their permeability to blood proteins, and the development of proteinuria. Nephropathy should be considered as the next stage of edema in pregnant animals. The pathogenesis of the disease lies in damage to the tubular epithelium of the kidneys by toxins of endogenous and exogenous origin (Linde-Forsberg, 2010).

Clinically, this pathology is manifested by depression of the general condition of the animal, the presence of edema, and protein, epithelial and granular cylinders in the urine. Along with this, oliguria is noted. In severe cases, uremia develops, accompanied by general depression or, on the contrary, increased excitement of the animal, partial or complete loss of vision. The birth of dead fetuses is noted.

Excessive lying down of pregnant females It develops a few days or weeks before labor. It is characterized by damage to the neuromuscular and ligamentous apparatus of the croup and pelvic limbs, which causes impaired motor function. Symptoms of the disease develop gradually or appear suddenly.

With the gradual development of the disease in animals, there is a swaying of the rear part of the body, it lies for a long time, and it is difficult for them to get up.

In the case of a sudden onset of illness, the animal does not get up after lying down and can only crawl from one place to another.

Changes in the organs of the cardiovascular, respiratory, digestive systems, skin sensitivity at the beginning of the disease are not detected.

During the development of the disease long before the labor, disorders of the gastrointestinal tract, bedsores, which often lead to septicopyemia, are observed.

This pathology should be considered as one of the clinical symptoms of pre-eclampsia in pregnant animals, and favorable factors of the disease are mineral and vitamin deficiency, protein metabolism disorders, double pregnancy, hydrops.

Secondary osteodystrophy of pregnant animals – this is a chronic endocrine disease of high-yielding cows, which develops as a result of disorders of the function of the pituitary-adrenal system, thyroid and parathyroid glands, and the fetoplacental complex, characterized by systemic bone dystrophy and a violation of carbohydrate-fat, protein, and mineral metabolism (Caldow et al., 1995; Linde-Forsberg, 2010).

Typical clinical signs of this pathology are thinning and osteolysis of the tail vertebrae, ribs, deformation of the chest and horn shoe of the hooves, stiffness and pain when moving and lifting, as well as symptoms of myocardiosis and fatty hepatosis.

In the blood of sick animals, an increased content of protein and inorganic phosphorus is noted; decrease in alkaline reserve and reduced content of hemoglobin, glucose, urea. Calcium levels may increase or decrease.

Most often, the disease is registered in herds of highly productive cows with high-energy rations of non-milking cows. In this regard, the easiest way to control the condition of non-milking animals is the point assessment of fatness, which is recommended to be mastered by veterinary specialists. For the non-milking season, the most desirable score is 3.5.

As is well known, non-milking cows are very poor at regulating nutrient intake to meet their needs, so even with moderate energy rations freely available, they can easily consume large amounts of energy. And this is a risk factor in the development of ketosis, fatty hepatosis, secondary osteodystrophy, complications of the birth and postpartum period.

Unlike alimentary osteodystrophy, the occurrence of secondary osteodystrophy is not associated with a lack of calcium, phosphorus, and other mineral elements, as well as protein and total energy in the diet.

Eclampsia is acute nervous disease, which is the highest stage of manifestation of toxicosis in pregnant women, and develops, as a rule, with nephropathy and is characterized by sudden with tonic and clonic seizures and co-

ma. In cows in the prenatal period, the disease is rarely registered, and the development of the disease is associated with ketosis (Linde-Forsberg, 2010; Avdeenko, 2019).

Eclampsia of pregnant cows associated with toxicosis must be differentiated from hypomagnesemic pasture tetany, which occurs as a result of a decrease in magnesium in the spring period during a sharp transition from a stall type of feeding to pasture and in the fall when feeding a large amount of the leaves of root crops.

Fetal mummification is a polyetiological and most serious pregnancy disorder in females of various animal species, which is most common in multiparous (pigs up to 4 %). In cows, fetal mummification is registered at 4–8 months of pregnancy and is characterized by the cessation of development and death of the fetus without abortion, the production of progesterone by the corpus luteum, which contributes to the formation of the mummified fetus. Common causes include genetic or chromosomal abnormalities, placental defects, infectious agents, abnormal hormone concentrations, and inappropriate drug use (Roberts, 1962; Card, 2011; Lefebvre, 2015; Koreiba et al., 2021).

Fetal mummification occurs in the event of intrauterine death when the cervix does not open and the fetus undergoes aseptic transformation (resorption of amniotic fluid and tissue juices). As a result, the intrauterine pressure and volume of the fetus decrease, the density of its tissues increases, myometrial contractions intensify, and the fetus acquires a bizarre shape. The fetal tissues are saturated with calcium salts and become stony (Perumal & Srivastava, 2011).

There are cases of fetal maceration, which is an enzymatic process of softening and liquefaction of the fetal tissues. Fetal maceration can be caused by catarrhal or catarrhal-purulent inflammation in the endometrium in the absence of putrefactive microflora (Sameer Ali et al., 2020).

In cows, fetal maceration occurs due to trichomoniasis and is characterized by the cessation of pregnancy signs and discharge of a white or brown mushy mass of unpleasant odour with an admixture of crushed fetal bones from the genital slit (Ate et al., 2011; Card, 2011).

Nutritional and traumatic abortions in cows are common, resulting from deficiencies in feeding and housing and caused by stress factors, blows, bruises to the abdominal walls, jumping and falling, rough fixation, rectal palpation, and enucleation of the corpus luteum (Koreiba et al., 2021).

Less commonly, cattle have the pathology of the reproductive system of contagious origin due to bacteria, viruses, fungi, protozoa and helminths.

Among the infectious diseases of bacterial origin that manifest themselves as signs of damage to the reproductive system of cows in Ukraine, leptospirosis, chlamydia, salmonellosis, listeriosis, campylobacteriosis, pseudomonas, mycoplasmosis are more commonly recorded, anthrax and tuberculosis are very rare, and brucellosis is not recorded (Romano & Fahning, 2013; Chekan, 2023).

In Ukraine, herpesviruses (*BHV-1*, *BHV-4*), pestivirus (*BVDV*), and retrovirus (*BLV*) are the most common pathogens of viral origin in cattle. Foot-and-mouth disease, bluetongue, infectious nodular dermatitis, Akabane dis-

ease, and Rift Valley fever are not registered in Ukraine (Koreiba et al., 2021).

Alphaherpesvirus (*Bovine alphaherpesvirus 1*, *BHV-1*) is a causative agent of infectious rhinotracheitis in cattle, a disease characterized by damage not only to the respiratory tract but also to the genital organs, so this disease is also called pustular vulvovaginitis, coitus exanthema, vesicular vaginitis, and vesicular rash. In infected animals, the genital form of the disease develops, in which inflammation of the vaginal mucosa is observed with the appearance of nodules that turn into pustules and then ulcers. In pregnant cows (especially heifers), abortions occur at 6–8 months of pregnancy.

Bovine gammaherpesvirus 4 (*BHV-4*, *Movar virus*) infection in cattle can be subclinical with no visible clinical signs and manifested only by abortion and retention of membranes or with pronounced clinical signs of endometritis, vulvovaginitis, and mastitis.

The virus of the family *Flaviviridae*, genus *Pestivirus* (*BVDV*) is a causative agent of pestivirus infection, *bovine viral diarrhoea* (*BVD*) or “mucosal disease”, due to its erosive and ulcerative damage.

The virus, when it enters the body, including through sexual contact, multiplies and spreads throughout the body via the lymphatic and circulatory systems; it affects the walls of blood vessels, which leads to impaired blood circulation, hyperaemia, mucosal edema, necrotic changes, and erosion. In addition, the virus can cross the placental barrier, which can lead to abortion.

Abortions of leptospirosis origin are observed in the last months of pregnancy and are caused by *Leptospira serovars L. hardjo* (type *hardjo-prajinto*), *L. pomona*, *L. canicola*, *L. icterohemorrhagiae*, *L. grippotyphosa*; however, only *Leptospira hardjo* (type *hardjo-bovis*) is a host-adapted to the cattle.

As a result of *L. hardjo-bovis* colonisation of the reproductive system and kidneys (where the pathogen can persist for a long time and be excreted in the urine), cattle become a dangerous source of infection in the herd and infect other animals and humans. In addition to traditional abortions in the last months of pregnancy, cattle infected with *L. hardjo-bovis* show a general decrease in reproductive capacity: lower fertilisation rates, increased embryo deaths in the early stages of pregnancy, stillbirths, and the birth of weak, non-viable offspring. If the fetus is retained in the uterus, it decomposes or mummifies, and the afterbirth is swollen and compacted.

The infection caused by *Chlamydomphila abortus* does not manifest itself until the animal aborts in the last months of pregnancy or gives birth to a weak, non-viable foetus. In pregnant animals, chlamydia penetrate the uterus and multiply in the amniotic membranes, causing placental abruption, necrosis, and fetal infection. Abortions in cows at 7–9 months of pregnancy are considered the main clinical sign of chlamydial infection, although abortions may occur in the first half of pregnancy.

Salmonellosis in cows is usually latent, but is activated at calving and manifests itself as a sexual infection (abortion, stillbirth) and intestinal infection.

Campylobacteriosis is associated with abortions in the first or early second half of pregnancy with post-abortion complications (retention of afterbirth, vaginitis, metritis;

in heifers there are granulation vaginitis, cervicitis, salpingitis) (Roberts, 1986; Barrier et al., 2013; Dervishi & Ametaj, 2017; Egyedy & Ametaj, 2022).

In cows with mycoplasmosis, serous-purulent vaginal discharge and swelling of the uterine mucosa are observed. Abortions occur without noticeable symptoms at 7–9 months of pregnancy. The mucous membrane of the vagina and uterus is reddened and hyperemic; there is a serous-purulent exudate in the uterine lumen (Chekan, 2023).

In pseudomoniasis, the development of gynaecological pathology, vaginitis, and endometritis are noted, which in turn leads to a decrease in fertility.

With listeriosis, abortions in cows are observed at 4–7 months of pregnancy, which are complicated by afterbirth retention, endometritis and mastitis.

In cows with trichomoniasis, the mucous membrane of the vagina and vulva is swollen, a small amount of mucus is discharged from the vagina, and small bubbles appear on its mucous membrane. After abortion, cows develop purulent catarrhal endometritis. At 2–4 months of pregnancy, 40–50 % of cows are aborted (Koreiba et al., 2021).

Conclusions

The consequences of pregnancy and abortion in cows include delayed afterbirth, exacerbation of vaginitis, development of purulent catarrhal and purulent fibrinous inflammation in the uterus, salpingitis, mastitis, prolongation of the service period, numerous unproductive inseminations and prolonged infertility and barrenness.

The analysis of literature data of domestic and foreign authors showed that pregnancy diseases and abortions are widespread in cows, have non-contagious and contagious etiology, are often complicated by diseases of the reproductive organs, leading to persistent infertility and milk yield and cause significant economic losses, consisting of a shortage of offspring, milk, as well as the cost of treating animals with complications after abortion.

Currently, there are very few specialists who are well-versed in the causes of pregnancy diseases and effective preventive measures. Therefore, the problem of the spread of pregnancy diseases, as well as abortions, their outcome, and complications in cows is very complex, of great practical importance, and requires further study.

Prospects for further research are to study the causes of the spread of pregnancy pathology and to develop effective preventive measures for premature abortion in heifers and cows.

Conflict of interest

The author declare that there is no conflict of interest.

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