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Case Report

Suspected neonatal isoerythrolysis with concurrent *Actinomyces hyovaginalis* in a foal

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ABSTRACT

Objectives: This case report aimed at diagnosing and instituting timely intervention to avert Neonatal Isoerythrolysis with concurrent infections in foals.
Material and Methods: Baby Dokki is a one day old, filly, foal, pony cross, weighing about 20kg. She is managed in a stable with its dam. Baby Dokki was found dead a day after her birth. Post mortem examination revealed a generalized jaundice in the mucous membrane, muscles and aorta. Besides that, the synovial fluids were also thicken and yellowish. As well, the large intestine contains very hard greenish fecal material obstructing the rectum. Softer yellowish fecal material was found to be impacted dorsal to the hard fecal material.
Results: Furthermore, the bacteriology result divulged the presence of *Actinomyces hyovaginalis*. In addition, blood was also collected from the mare and the stallion to check for blood compatibility.
Conclusion: Thus, the case was diagnosed as suspected neonatal isoerythrolysis with concurrent *Actinomyces hyovaginalis* infection.

KEYWORDS

Blood compatibility; Foal; Neonatal Isoerythrolysis; Pony Cross

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INTRODUCTION

Neonatal Isoerythrolysis (NI) is an illness of newborn horses within the age of 1-7 days. The clinical characteristics, and laboratory anomalies of foals with NI are being reported on a current retrospective study (Boyle et al., 2005; Polkes et al., 2008). This disease is described by failure to nurse, dejection, clinical icterus, weakness, fever, low RBC count, an increased respiratory rate, and effort (dyspnea and tachypnea), tachycardia (elevated heart rate) and occasionally rapid death (Stoll and Kliegman, 2000; Loynachan et al., 2007). In foals three foremost classes of NI are notable, comprising of per-acute, acute, and sub-acute. Per-acute manifestations exhibit a momentous prognosis as they frequently do not live for protracted period to manifest emblematic signs clinically and they usually die suddenly (Boyle et al., 2005; Loynachan et al., 2007; Zaruby et al., 2010; Kwon et al., 2011). The two category of NI remain likely to respond to therapy and often show good indications for improvement, contingent on the nature of the disaese. The mucous membranes might be white or pale prior to the manifestation of clinical icterus (Boyle et al., 2005; Loynachan et al., 2007; Zaruby et al., 2010; Kwon et al., 2011). The sclera is the supreme site to recognize icterus at earliest stage (**Figure 2**). White portion of the eye is the sclera. After the sclera, the gums' mucous membranes gives an icteric impression. The progression of the condition is indicated by the appearance of pigmented or dark red colored coffee urine. Several newborn disorders can manifest these signs clinically, comprising of sepsis a blood born toxemia and contagion, which is the prime malefactor of newborn horse bereavement.

Precise diagnosis and assessment could assist in the determination of the possible reason for icterus in addition to its associated symptoms clinically. Newly born horse exhibiting NI is typically delivered in good condition, nevertheless developed lethargy in addition to weakness in 2 days of lifespan (Boyle et al., 2005; Loynachan et al., 2007; Zaruby et al., 2010; Kwon et al., 2011). Furthermore, before a new born horse exhibit the symptoms of NI, it must consume and digest a sufficient quantity of colostrum subsequent to foaling. Neonate that are at risk, the ingestion of supreme quality colostrum could be injurious (Boyle et al., 2005; Loynachan et al., 2007; Zaruby et al., 2010; Kwon et al., 2011). There are isolated reports of liver disease as an outcome of NI in foals (Ramaiah et al., 2003; Boyle et al., 2005; Loynachan et al., 2007; Polkes et al., 2008). NI is the cause of the destruction of red blood cells in the foal circulatory system by the antibody complexes present in the colostrum from the dam (Honig, 2000; Polkes et al., 2008; Zaruby et al., 2010).

Population studies of red cell factors most recurrently complicated in NI divulge that roughly 14% of foals have erythrocyte mismatches with the dam (Polkes et al., 2008). Conversely, as alloimmunization does not ensue throughout every mismatched pregnancy (Polkes et al., 2008). NI is an infrequent illness with an occurrence rate of one to two percent, nevertheless it was documented at an escalated regularity in numerous breeds. NI foals can occur in any breed, but Thoroughbreds, along with Standardbreds, Paints, Quarter Horses, and donkeys, seem to be more affected than other breeds. "Mule foals have higher incidence due to what we call 'donkey factor'; a difference in blood types between horses and donkeys (Boyle et al., 2005; Kwon et al., 2011). The illness indicates inhereted expression of hemolytic anemia that is immune mediated, subsequent to mismatch of blood type of the new born horse and the dam (Finding and McSloy, 2011). This does not affect the new born horse throughout gravidness since no immunoglobulins or blood is capable of crossing the mares' afterbirth; hence new born horses are delivered in good condition. Nevertheless, the hemolytic condition will happen the moment the new born horse consumes huge number of immunoglobulins in the colostrum at birth and this will cause clomping and obliteration of the new born horses' RBCs.

There are over 30 blood group of horses, of which only 8 are major systems (Uner et al., 2012). Of these 8, 7 are internationally recognized (A, C, D, K, P, Q and U), whilst the T system is primarily of research interest (Franks, 2006). There are abundant cell surface antigens that additionally differentiate the RBCs in each of these wide-ranging clusters (Reed et al., 2004). Of these, the Aa and Qa are most important for hemolytic reactions, especially NI (Blackmer, 2010; Weiss and Wardrop, 2010; Uner et al., 2012). Other blood groups can occasionally give NI reactions, including Dc, Ua, Ab and Pa (Kim, 2003). Captivatingly, even though roughly 14% of stallion and mare matings is expected to manifest in mismatch, the occurrence of clinical NI is suggestively in smaller amount and it fluctuate depending on the breed (Boyle et al., 2005). The Arabians, Standardbreds and Thoroughbreds showed the highest rate of roughly 1-2% of foaling. Foals that appeared NI are typically delivered to dams which had earlier given birth to many foals which is rare in the initial gravidness of a mare. If this even ensues in first time dams, it indicates that the dam have record preceding administeration of blood products

or come up with a leakage of placenta primarily in her pregnancy that permitted blending of the new born horse blood with her own (Smitherman et al., 2006). The current case report presents per acute form of NI with concurrent *Actinomyces hyovaginalis* infection.

MATERIALS AND METHODS

Patient signalment, Baby Dokki is a one-day-old, filly, foal, pony cross, weighing about 20kg. She is managed in a stable with its dam. Baby Dokki was born on the 31st of March 2017. The stable worker observed the foal was nursing but weak. Unfortunately, Baby Dokki was found dead in the stable the next day at 1am in the morning. The worker was unsure about the urination but did remove some meconium hanging at the anus.

Thus, a post mortem was performed on the carcass of the foal. The general appearance of the carcass reveals a body score of 2/5 (**Figure 1**). The navel was clean and dry, but the mucous membrane of the sclera and gum were jaundice (**Figure 2A & B**). There were generalized enlargements of the submandibular, prescapular and popliteal lymph nodes. Organ insitu reveals gas filled and congested intestine (**Figure 3**). The thoracic cavity still contains negative pressure where air flow outs when the diaphragm was punctured. When the thoracic cavity was exposed, there was blood tinged fluid present in the thoracic cavity. The intercostal muscle was also jaundice and haemorrhagic. The lung was congested with frothy material and blood found along the trachea. There was no fluid oozing out from the lung along the cut section. Besides, the aorta also appeared to be jaundice. The pericardium was firmly attached to the sternum. The heart was slightly enlarged at the left ventricle. Upon cutting the surface, the myocardium appeared to have an iron out effect which indicates a hypertrophy (**Figure 4**). In the abdominal cavity, the liver, spleen and kidney were also congested and enlarged (**Figure 5**). The liver was also observed adhering to the peritoneum. The stomach was filled with thick yellowish colostrums (**Figure 6**). In addition, the large intestine contains very hard greenish fecal material obstructing the rectum. Softer yellowish fecal material was found to be impacted dorsal to the hard fecal material. Finally, the knee joint of the left forelimb was cut open and the synovial fluid appeared to be thicken and yellowish (**Figure 7**).

Thus, the tentative diagnosis were neonatal isoerythrolysis and septicaemia. For the diagnostic work-up, joint fluid was collected for bacteriological culture and the result indicated the presence of *Actinomyces hyovaginalis*. As well, blood was also collected from the mare and the stallion to check for blood compatibility.

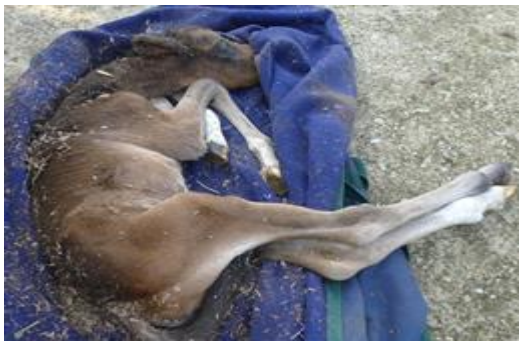

Figure 1. General appearance of he carcass having a body score of 2/5. The navel was clean and dry. There were generalized enlargements of the submandibular, prescapular and popliteal lymph nodes.

RESUTS AND DISCUSSION

There are few requirements for NI to occur. Firstly, according to Sellon (2010), the new born horse have to receive and manifest antigens of blood for male horse which aren't obtainable in dam. The type of blood mismatch amongst the new born horse and mare is not predominantly infrequent, conversely, most of these circumstances are due to trivial mismatches and there is no outcome for the disease clinically. In the present case, the foal presented an initial ability of nursing and progressive weakness, this type of presentation in foals is usually suggestive and associated with NI especially at an early age of a day due to blood type incompatibility. According to Uner et al. (2012), NI is the reason for isoimmunisation of a young dam for most common blood type which are Qa and Aa antigens of RBC of newly born horse. Aa and Qa antibodies from the mare is the reason for haemolysis and haemagglutination in newly born horse, with a resultant degeneration of RBCs, hematocrit and Hb subsequent to numerous symptoms clinically. This phenomenon is a probable occurrence in current case, and this is exhibited by the unusual or sudden death of the foal and the associated clinical symptoms observed in the first early hours of her life.

Secondly, Kim (2003), stated that exposure of mare is paramount, and primed, to generate humoral immunity for mismatched antigen of the blood and precise contrivances accountable regarding the prevailing state of affairs aren't wholly implicit, nonetheless seepage of and contagion of the new born blood throughout previous pregnancies are the likely triggers, and Kim (2003), similarly documented that it is the perception of the

Figure 2 (A&B). The mucous membrane of the sclera (A) and the mucous membrane of the gum (B) were jaundiced.

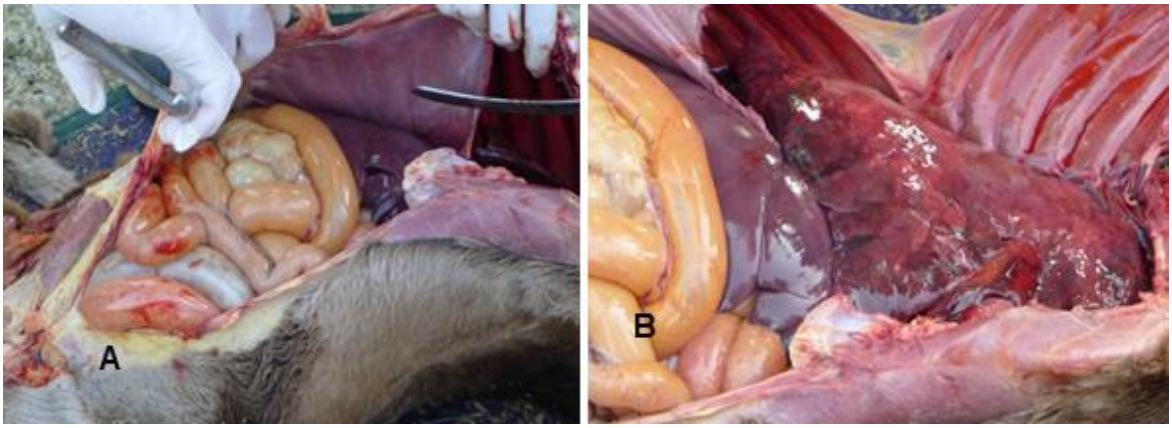

Figure 3 (A&B). Organ in situ reveals gas filled and congensted intestine. The thoracic cavity still contains negative pressure where air flow outs when the diaphragm was punctured (A) and when the thoracic cavity was exposed, there was blood fluid present in the thoracic cavity (B). The intercostal muscle was also jaundiced and hemorrhagic (B). There was also generalized congesion of the lung lobes (B).

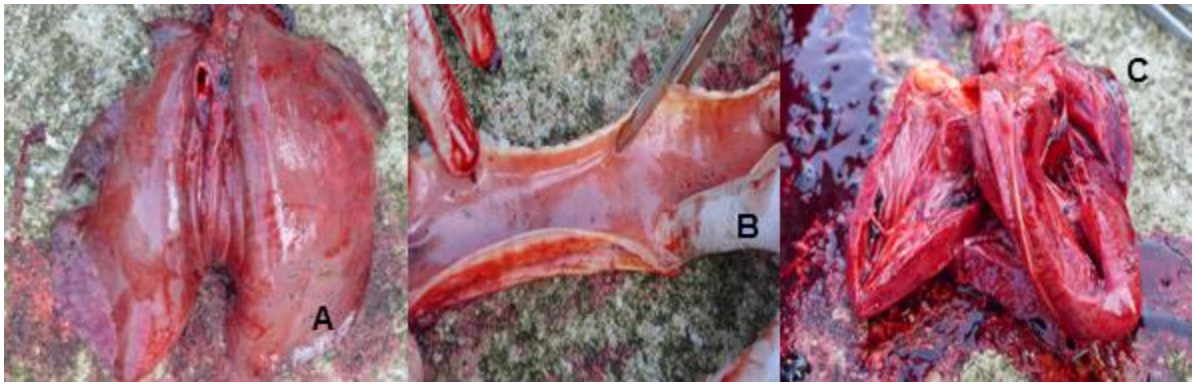

Figure 4 (A&B). The lung was congested (A) with frothy material and blood found along the trachea (B) and the aorta also appeared to be jaundiced (C). The pericardium was firmly attached to the sternum (C). The heart was slightly enlarged at the left ventricle (C). Upon cut surface, the myocardium appeared to have an iron out effect which indicate an hypertrophy (C).

colossal occurrence of NI new born horses from multiparous mares. The mare that had the foal in the current case happened to be a multiparous mare and this might not be far from the NI occurrence in the day old foal and the clinical outcomes is reminiscent of definitive NI. Transplacental contagion by the new born horse RBCs primarily in the gravidity could come up with immunoglobulins generation in the mare; conversely, this contrivance is less momentous for the existing gravidness (Zaruby et al., 2010). Due to the documentation above,

Figure 5 (A&B). The liver appeared to be enlarged and congested. It was also adhered firmly to the peritoneum (A) and the spleen appeared to be enlarged and congested (B).

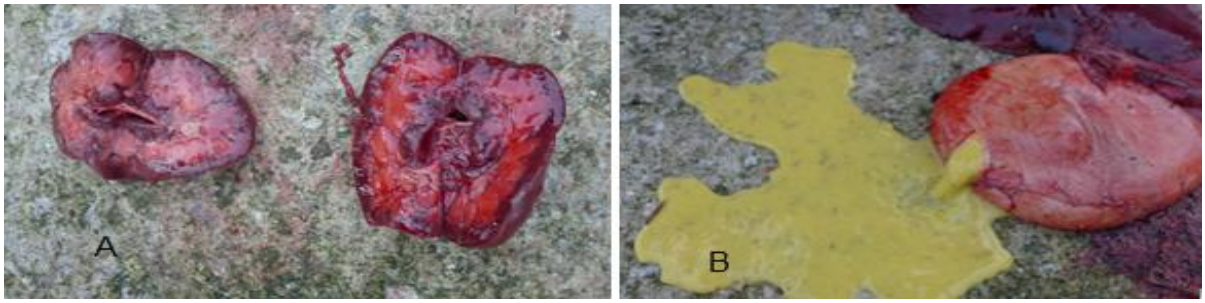

Figure 6 (A&B). Both kidneys appeared to be enlarged and congested (A) and the stomach was filled with think yellowish colostrum (B).

Figure 7 (A, B & C). The large intestine contains very hard greenish fecal material obstructing the rectum (A), softer yellowish fecal material was found to tbe impacted dorsal to the hard fecal material (B) and the knee joint of the left forelimb was cut open and the synovial fluid appeared to be thicken and yellowish (C). The surrounding soft tissues were also appeared to be jaundiced (C).

earlier experience of blood products by the mare throughout lifespan might similarly upsurge the risk of generating an NI new born horse. The mare in the present case had received several blood product during her life and this exposure might likely upsurge her proclivity of having NI foals as indicated in the current case.

Thirdly, according to VMTH (2015), the new born horse should consume and digest high levels of the insulting immunoglobulins to the mare's colostrum. The foal in the current case had a capricious appetite and had consumed enormous quantity of the colostrum from the mare even though she was weak, and the enormous consumption of the colostrum could be responsible for the augmented insulting antibody responses. The speed of the progression and sternness of the signs clinically is evaluated by the volume of immunoglobulins digested and its capability to abolish the new born horses' RBCs. New born horse that failed to consume colostrum in a well-timed means, was unable to efficiently digest it, or mares that failed to sufficiently generate supreme colostrum, diminish the risk for NI, even when all requirements are accomplished. Inappropriately, these new born horses are at higher risk for sepsis. This could similarly be the case as *Actinomyces hyovaginalis* was isolated

from the tissues of the foal in the current case. *Actinomyces hyovaginalis* is particularly found in the vaginal secretions of animals but, were similarly isolated from necropsy samples of pigs (Storms et al., 2002) and was likewise incriminated in goats (Vanessa et al., 2009) as causative agent of caseous lymphadenitis (CLA). Interestingly, in the current NI case *Actinomyces hyovaginalis* was isolated from the tissues of the foal on bacterial culture suggestive of sepsis observed in the foals and probably concurrent episode of NI.

When NI is suspected in a depressed, failure to nurse, clinical icterus, weakness, fever, anemia, an increased respiratory rate, and effort, tachycardia and occasionally speedy death of new born horse, several diagnostic tests should be deliberated on to ratify the diagnosis (Stoll and Kliegman, 2000; Loynachan et al., 2007). These include the Jaundice Foal Agglutination Test, Saline agglutination cross-match, Direct Coomb's Test, RBC flow cytometry and hemolytic cross-match. All of these tests have dissimilar expediency, prerequisites, specificities, sensitivities and the capability to generate false positive and false negative outcomes. Therapy of NI is influenced by the speedy recognition of unwell new born horses and isolation of the new born horse from its dam to avert suckling for 2-3 days, pending on the time the mare stops generating colostrum and the new born horses' gastrointestinal tract becomes shut (Perkins and Divers, 2007). New born horses require substitute bases for nutrition, for instance replacer of milk, or another mare milk. Meanwhile the new born horses are compromised, broad-spectrum antibiotic is paramount for their wellbeing and is of value if supplementary helpful care are administered, such as oxygen, corticosteroids and IV fluids. A new born horse with very low number of RBCs may need transfusion from an apposite donor.

CONCLUSION

NI in neonates needs to be detected quickly to save the life of the foals. History of previous foaling, clinical sign and laboratory diagnostic work-up can be done to confirm the disease. Even though the illness has an overwhelming effects, it is equally avertible by classifying those mares that are inclined to producing RBCs obliteration in new born horses. Another means of accomplishing compatibility of blood is to confirm whether the blood type of the mares matches with the foals' earlier during primary reproduction. Stallions that are negative for antigens of blood can then be matched to negative Mares. In rare cases, blood typing will not successfully identify mares that have hemolytic antibodies. Alternatively, mare with an unknown blood type can be tested for the presence of antibodies shortly before the expected due date. Before delivery, young dams could be tested for immunoglobulins to Qa and Aa typed and for blood groups to classify dams at risk for neonatal isoerythrolysis reasons in newly born horse. Even at foaling, a diagnosis can be carried out utilizing the mare colostrum and new born horses' RBCs. The procedure is known as jaundice agglutination assessment of the foal. Preferably, this is carried out prior to the time the new born horse will suckle and consume the colostrum. If the dams' first milk droplet causes the obliteration belonging to the new born horses' RBCs, the new born horse should remain isolated from the dam or gagged to avert feeding and plasma or colostrum could be provided using dissimilar mare to safeguard sufficient inert transmission of immunity. Three days afterwards, the new born horse will resume suckling typically.

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CONFLICT OF INTEREST

The authors declare that there is no conflicting interest with regards to the publication of this manuscript.

AUTHORS' CONTRIBUTION

All the authors have equal contribution.

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