A Case Study: Environmental stressor leading to reproduction problem in a cow

Eric Lim Teik Chung[1,2*], Faez Firdaus Abdullah Jesse[2,3], Mamat Hamidi Kamalludin[1,2], Mohd Farhan Hanif Reduan[4], Anjas Asmara Samsudin[1], Teck Chwen Loh[1,2]
[1]Department of Animal Science, Faculty of Agriculture,
[2]Institute of Tropical Agriculture and Food Security,
[3]Department of Veterinary Clinical Studies, Faculty of Veterinary Medicine, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia,
[4]Department of Paraclinical Studies, Faculty of Veterinary Medicine, Universiti Malaysia Kelantan, Pengakalan Chepa 16100, Kota Bharu, Kelantan, Malaysia.
*Corresponding author: ericlim@upm.edu.my
Received: 20 March 2019. Accepted: 25 May 2019.

Abstract

Heat stress may have long-lasting effects on the reproductive physiology where the fertility will be reduced. During gestation, heat stress affects also the reproductive success of the cow through its direct effect on the early foetus development. The present case reports the incidence of heat stress causing abortion of a full-term foetus and a retained placenta in a cow. A 4-year-old Kedah-Kelantan cross cow weighing 250 kg was presented with a primary complaint of abortion and a retained placenta. The cow was managed intensively on a dirt ground without shade. Physical examination revealed that the cow was pyrexic (40ºC) with congested mucous membrane. However, the body temperature reduced after the cow was showered and transferred into a shade facility. The most noticeable abnormality was the fouled smelling placenta hanging from the vulva. The case was diagnosed as abortion due to environmental stress. Treatment of flunixin meglumine 1.1 mg/kg and oxytetracycline 20 mg/kg were administered accordingly where the cow responded well to the medication. The farm manager was advised to shift all pregnant animals into a facility with shade and practise good waste management in the farm to prevent the occurrence of abortion and other problems related to heat stress. The prognosis of the case was good with prompt diagnosis and effective treatment.

Keyword: Heat stress, gestation, abortion, retained placenta, cow.

Introduction

Heat stress may be defined as the number of exterior forces that change the body temperature above of its resting state. The comfort zone for cattle has been estimated between 5ºC to 25ºC (Ravagnolo et al., 2000). This comfort zone may vary between sex, breed and geographical location of the cattle. Although some local breed of animals may show a genetic predisposition to heat tolerance, high temperatures have been significantly linked to low fertility in cattle (De Rensis and Scaramuzzi, 2003). Heat stress has consequences on both the physiology and reproductive performance of cows, but the most affected is the decrease in fertility. The effects of heat stress on fertility include an increased number of days open, reduced conception rate, and a larger number of cows suffering different types of anestrus. During gestation, heat stress affects also the reproductive success of the cow through its direct effects on the ovary, uterus, gametes,

embryo, and early foetus development leading to abortion (Rensis et al., 2015).

The gestation period of a cow ranges from 274 to 283 d. This gestation length is dependent of the calf genetics, size, sex and occurrence of twin pregnancy rather than the genetics of the dam (Villarroel and Lane, 2010). Towards the end of the gestation period, calving which is a physiological process, will take place and usually occurs without intervention. The calving process is divided into 3 stages where stage 1 is the cervical dilation that occurs within 4 to 24 h; stage 2 is the foetal expulsion that happens within 30 min to 2 h; and stage 3 is the placental expulsion that follows within 4 to 12 h (Safdar and Kor, 2014). The length of calving period in different stages differs in a multiparous cow to first-calf heifers. Foetus and placenta that have not been passed by 24 and 12 h, respectively are considered as complications (Jesse et al., 2016).

Abortion is one of the most significant health issues in the cattle industry. Infectious agents, toxic agents, environmental stressors, and genetic abnormalities are the few causes of abortion (Derdour et al., 2017). Heat stress in specific has been associated with shorter gestations causing stillbirth (Damaso et al., 2018). There is some evidence suggesting that a very sudden increase in environmental temperature may result in abortions and eventually a retained placenta (Al-Samarai et al., 2012). The incidence of retained placenta is increased by abortion, dystocia, hypocalcaemia, twin birth, advancing age of the cow, induction of parturition, placentitis, nutritional disturbances and high environmental temperature (Kahn and Line, 2005). The aim of this case report was to describe the incidence of abortion and retained placenta in a cow due to heat stress.

Materials and Methods

History

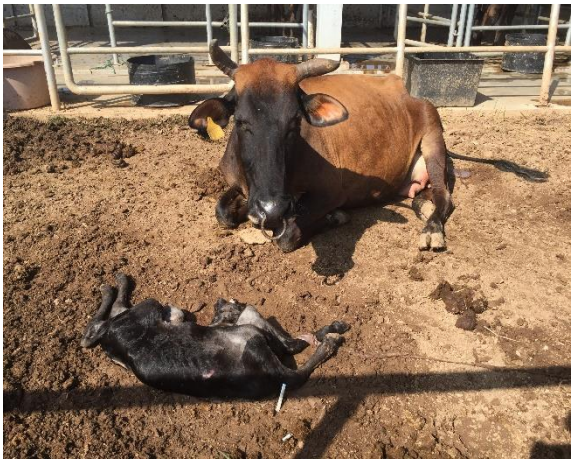
A 4-year-old Kedah-Kelantan cross cow weighing 250 kg with a body condition score of 3 out of 5 was presented with an aborted full termed foetus and a retained placenta. The abortion occurred 48 h prior to presentation. This is the third parity for the cow. The cow was managed intensively where the vaccination and deworming status were up-to-date. The cow was fed with cut Napier grass as the basal diet using cut and carry system and was supplemented with palm kernel cake based diet. The foetal loss in the farm was less than 3% per year.

Environmental observation

The current case was presented in the month of August 2018 during the southwest monsoon which occured from early June and ended in September. It was relatively a dry season with the mean temperature of 29ºC and humidity of 79%. Nonetheless, the environment temperature at that point in time was 35ºC. All cattle in the farm were reared intensively on a dirt ground without shade. Faeces were not collected and left to dry which acted as bedding for the cattle.

Physical examination

The cow appeared to be dull and depressed but responsive. The dead foetus was left beside the cow untouched (Photograph 1). Clinical evaluation revealed that the cow was pyrexic (40ºC) with congested mucous membrane. However, the body temperature dropped to 38.6ºC after the cow was showered and transferred into a shade facility. The most obvious sign was the fouled smelling placenta seen hanging from the vulva opening (Photograph 2). Post mortem on the foetus showed no significant findings.



Photograph 1: Dead foetus was left untouched after 48 hours of abortion.

Photograph 2: Foul smelling placenta hanging from the vulva opening.

Results

Treatment and Prevention

The case was diagnosed as abortion due to heat stress. The cow was treated therapeutically for pyrexia and retained placenta. Flunixin meglumine 1.1 mg/kg was administered intramuscularly once a day for 3 d as anti-inflammatory and analgesic. Broad spectrum long-acting oxytetracycline 20 mg/kg antibiotic was also given once intramuscularly to treat current infections and to prevent secondary bacterial infections. The farm manager was advised to shift all cattle especially pregnant animals into a facility with shade during the hot afternoon. On the other hand, faecal removal and cleaning was advised to be done every day especially in holding pens to help decrease the ground surface temperature and to prevent ascending secondary bacterial infection.

Progression

The case was followed up on Day 4 post-treatment where the cow responded well to the treatments. The cow was bright, alert and responsive with a good appetite. There was no discharge observed from the vulva and the retained placenta appeared dry with no foul smelling (Photograph 3). The tissue was completely detached on Day 6.

Photograph 3: Dry retained placenta with no foul smelling on Day 4 post treatment.

Discussion

Abortion is a major concern in the cattle farming industry because of the economic losses and public health implications. The causes can be divided into infectious and non-infectious ones. Nonetheless, attempting to make an aetiology diagnosis in every abortion should be avoided. According to Kahn and Line (2005), cases of abortion should only become concerned if the foetal loss is more than 3 to 5% per year which did not occur in the present case. Establishing a definitive cause of foetal loss can be difficult due to the absence of pathognomonic lesions, lack of available confirmatory tests for certain conditions, the high cost of laboratory work, and the low profit-margin in the beef and dairy industries. Even if infectious causes seem to be the most prevalent, the identification of the pathogen involved is difficult due to the facts that different pathogens can be involved in the same case and that diagnosis methods are not always optimised. Often these infections are associated with unclean or poorly managed calving areas where pregnant cows were placed on dirty flooring leading to abortion and uterine infection (Abdullah et al., 2015). This condition was observed in the current case report. It is often difficult to determine if infectious agents are the cause of abortion since some can also be found in the reproductive tract of healthy cows (Anderson, 2007).

Heat stress is defined as a point on a temperature-humidity index (THI) above that is considered the thermo-neutral zone (Bova et al., 2014). THI exceeds the comfort threshold (>72) was reported to have deleterious effects on a cow reproductive system. According to Rojas-Downing et al. (2017), the ambient temperature exceeding 37ºC can cause significant stress on cattle such as reduced feed intake, increased water intake, altered physiological functions such as reproductive or productive efficiency, change in respiration rate and even death. This heat stress is often worsened in the tropical region due to the excessive humidity which causes livestock to feel hotter compared to actual temperature. In the present case study, the temperature and relative humidity were 35ºC and 80%, respectively, making the THI to be in the red or emergency zone (>90). Heat stress during pregnancy slows down the growth of the foetus and can increase foetal loss (Nardone et al., 2010). Therefore, the number of abortions commonly increases

during excessive periods of heat. Aborted foetuses presented for examination during these periods often exhibited insignificant finding. This finding would suggest that increased abortions may be due to heat associated stress (Al-Samarai et al., 2012) supporting the post mortem result of this case report.

Heat stress may have long-lasting effects on the reproductive physiology of the cow, thus different strategies can be practiced at the farm level. Heat stress in cattle can be mitigated using different cooling options based on the principles of convection, conduction, radiation, and evaporation. The most practical system to reduce heat stress is to group cattle into shade while providing ventilation and cooling (Polsky and Keyserlingk, 2017). In this case report, all pregnant cows were moved into a shade facility but without a direct cooling system. The installation of fans and sprinkler systems is often promoted as the solution to a heat stress problem (West, 2003). However, the benefits are reduced unless the sprinkling is combined with fans to increase airflow for evaporative losses. Thus, other methods to curb with heat stress can be adopted by the farm. Adjusting animal diets and providing sufficient cool, clean fresh water in holding pens can be used as a mitigation measure (Rojas-Downing et al. 2017). Animals' feeding time is moved to the late afternoon or evening to avoid some potential additional heat from digestion. This will allow rumen fermentation to occur during the cooler night temperatures, and it will increase lung capacity for the cattle during the hotter daytime temperatures. Altering the farm management by not working the cattle during extreme temperature can be another mitigation strategy during hot temperature. If working cattle is absolutely necessary, use calm animal handling techniques and keep working time as short as possible to help reduce the effect of heat stress. In summary, management methods do not need to eliminate heat stress completely, but rather lessen the severity of the environmental challenge and assist the animals in acclimatizing to it (Mader, 2003).

Conclusion

In this clinical case, the prognosis for the cow was good where the prompt diagnosis of the environmental stressor and effective treatment for retained placenta was conducted. A delay will eventually lead to other breeding and fertility problems causing significant economic impact on the farm.

Acknowledgement

The authors wish to acknowledge staff from Farm 15, Department of Animal Science, Universiti Putra Malaysia, in particular, Mr. Mohd Faizal bin Yeob Baharuddin and Mr. Hidayad Ali bin Arman Ali for their technical assistance.

References

Abdullah, F.F.J., Chung, E.L.T., Abba, Y., Tijjani, A., Sadiq, M.A., Mohammed, K., Osman, A.Y., Adamu, L., Lila, M.A.M. and Haron, A.W. 2015. Management of clinical case of endometritis in a cow: a case report. J. Vet. Advances. 5(4): 887-890.

Al-Samarai, F.R., Abdulrahman, Y.K., Ibrahim, W.I. and Al-Nedawi, A.M. 2012. Effect of some environmental factors on abortion and offspring sex ratio in Holstein cows in Iraq. Int. J. Sci. Nat. 3(2): 361-365.

Anderson, M.L. 2007. Infectious causes of bovine abortion during mid to late-gestation. Theriogenology, 68: 474–486.

Bova, T.L., Chiavaccini, L., Cline, G.F., Hart, C.G., Matheny, K., Muth, A.M., Voelz, B.E., Kesler, D. and Memili, E. 2014. Environmental stressors influencing hormones and systems physiology in cattle. Reprod. Biol. Endocrinol. 12: 58.

Damaso, A.F., Velasova, M., Winden, S.V., Chang, Y. and Guitian, J. 2018. Occurrence of preterm calving in Great Britain and associations with milk production and reproductive performance in dairy cattle. Vet. Rec Open. 5: e000221.

De Rensis, F. and Scaramuzzi, J.R. 2003. Heat stress and seasonal effects on reproduction in the dairy cow: a review. Theriogenology, 60: 1139-1151.

De Rensis, F., Garcia-Ispierto, I. and Lopez-Gatius, F. 2015. Seasonal heat stress: clinical implications and hormone treatments for the fertility of dairy cows. Theriogenology, 84: 659-666.

Derdour, S., Hafsi, F., Azzag, N., Tennah, S., Laamari, A., China, B. and Ghalmi, F. 2017. Prevalence of the main infectious causes of abortion in dairy cattle in Algeria. J. Vet. Res. 61: 337-343.

Jesse, F.F.A., Chung, E.L.T., Abba, Y., Sadiq, M.A., Bitrus, A.A., Hambali, I.U., Lila, M.A.M., Haron, A.W. and Saharee, A.A. 2016. A case of retained placenta in a dairy cow. Livest. Res. Int. 4(4): 125-127.

Kahn, C.M. and Line, S. 2005. The Merck Veterinary Manual. 9th Edition. Merial, USA.

Mader, T.L. 2003. Environmental stress in confined beef cattle. J. Animal Sci. 811(14): 110-119.

Nardone, A., Ronchi, B., Lacetera, N., Ranieri, M.S. and Bernabucci, U. 2010. Effects of climate change on animal production and sustainability of livestock systems. Livest. Sci. 130: 57–69.

Polsky, L. and Keyserlingk, M.A.G.V. 2017. Effects of heat stress on dairy cattle welfare. J. Dairy Sci. 100(11): 8645-8657.

Ravagnolo, O., Misztal, I. and Hoogenboom, G. 2000. Genetic component of heat stress in dairy cattle, development of heat index function. J. Dairy Sci. 83: 2120-2125.

Rojas-Downing, M.M., Nejadhashemi, A.P., Harrigan, T. and Woanicki, S.A. 2017. Climate change and livestock: impacts, adaptation, and mitigation. Clim. Risk Manag. 16: 145-163.

Safdar, A.H.A. and Kor, N.M. 2014. Parturition mechanism in ruminants: a complete overview. Euro. J. Exp. Bio. 4(3): 211-218.

Villarroel, A. and Lane, V.M. 2010. Effect of systematic parturition induction of long gestation Holstein dairy cows on calf survival, cow health, production, and reproduction on commercial farm. Can. J. Vet. Res. 74(2): 136-144.

West, J.W. 2003. Effects of heat-stress on production in dairy cattle. J. Dairy Sci. 86(6): 2131-2144.