

Case Report

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# Hypothermia as a Threat to Young Calves in Cold Ambient Temperatures: Development of a Workable Therapeutic Protocol

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## Case Report

This case report aimed to underline cold stress impacts on young calf thermoregulation. As a result, an innovative and empirical therapeutic method was developed to successfully overcome calf hypothermia. In cold seasons, the core body temperature is controlled by a very subtle system because maintaining body temperature within the normal range (38.5-39.3 °C) is required for optimal functions of vital organs as well as cellular chemical reactions. Rectal temperatures below 38.5°C are considered as hypothermia that must be treated as soon as possible. Otherwise, they can lead to death. There are many conditions in which calves might develop different degrees of hypothermia. Calving difficulty, preterm birth, poor nutrition and heavy infection are among the main factors that predispose young calves to hypothermia [1].

In cold seasons, symptoms of hypothermia such as lethargy and anorexia may be seen in calves before morning milk-meal because calves have suffered from cold stress nocturnally when ambient temperature is minimal. However, after the ambient temperature rises, the body temperature rises simultaneously. Such a process is utilized artificially to warm human and animal newborns routinely [2]. Therefore, mild cases of hypothermia (rectal temperature of 36.5 to 37.5 °C) can be treated by prompt rewarming of the calf.

According to world health organization (WHO), the 1997 report; evaporation, radiation, conduction and convection are the four fundamental mechanisms that can account for losing heat

from the infant body. On the other hand, brown adipose tissue metabolism, peripheral vasoconstriction and shivering are three main physiological mechanisms involved in body heat production [2]. As such, hypothermia can be prevented by modifying some management practices such as providing dried bed and draft control in calf rearing barns. Most cases of hypothermia occur during the first hours of life, but it seems that older and even weaned calves might experience hypothermia, as well.

As we noted, heavily infected calves may develop hypothermia which is called hypothermic sepsis [3]. Gastrointestinal and respiratory tract infections are the most common causes of sepsis in young ruminants. In both humans and animals, the body responds to sepsis by either increasing (fever) or reducing (hypothermia) body temperature [3]. It has been reported that hypothermia is more detrimental than fever and has higher mortality rate (~ 47%) [4]. Thus, emergency help is needed to protect calf from destructive effects of sepsis and resulting hypothermia.

Hypothermia in diarrhetic calves or those with pneumonia is sever in cold seasons because of additional energy requirements for maintenance and defend mechanisms against infection. Such calves generally are unable to eat adequately, and thus, reduced energy intake may lead to sever hypothermia. In addition, cardiovascular issues have been proposed as the main factors causing hypothermia [3]. We contemplated that mild or even sever hypothermia could be

treated by application of a feasible dense serum therapy method to immediately supply essential nutrients for promoting metabolic heat production, with using antibiotics for eliminating infectious agents. As such, a therapeutic protocol was developed as following:

In our experience, the immediate dense serum therapy is the last chance to recover hypothermic calf. A total of 400 cc dextrose (50%) is added into 1 lit of isotonic dextrose-sodium chloride serum (0.3% of salt and 3.33% of dextrose) to make a dense hypertonic solution. Then, vitamin B-complex and phosphorus are also infused into the prepared solution before intravenous injection. The isotonic serum is accompanied by suitable antibiotics and injected immediately. Afterwards, 10 cc of calcium-magnesium-phosphorus (CMP) supplementation is injected subcutaneously. After finishing serum therapy, the calf is transported to a warm environment, helping her to rewarm properly. Applying this treatment method leads body temperature to rise significantly within 5 to 6 hours. When the body temperature rises to 37-37.5 °C, suckling and chewing behaviors are resumed and the calf is able to eat again.

Providing significant amounts of dextrose would result in high blood glucose levels, promoting metabolic rate, and hence, increased heat production. As we noted, reduced energy intake and depletion of bode reserves occur during acute phases of inflammation [4]. Thus, glucose infusion supplies an easily available energy source to body tissues making them to function normally and timely. Moreover, serum therapy increases plasma volume by glucose and sodium therein and may correct hypotension caused by sepsis [4]. Calcium and phosphorus are involved in muscle contractions and energy metabolism. We suggest that calcium injection contributes to calcium ions circulation in the body which is involved in different mechanisms of heat production [5]. The B-group vitamins possess key roles in energy production and the related biochemical pathways, thereby contributing to energy interchanges and further metabolic heat production. Altogether, these events result in increased body temperature and corrected hypothermic conditions.

It is important to note that this therapeutic protocol has been found workable, and thus, gainful in most cases of calf hypothermia. However, individual differences among calves in responding to sepsis and different environmental conditions among barns and farm facilities might lead to different outcomes.

## Conclusion

As mortality rate is high in hypothermic young calves, it is maybe more dangerous than fever. Rewarming is a routine method to correct hypothermia, but in some cases such as sepsis, it may not be helpful. Elevating the body temperature to normal levels is the main goal in the treatment of hypothermia. A workable dense serum therapy protocol was successfully developed in this study with beneficial and healthy outcomes.

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## Conflict of Interest

No conflict of interest.

## References

1. Süleyman Kozat (2018) Hypothermia in newborn calves. *Journal of Istanbul Veterinary Sciences* 2(1): 30-37.
2. Vilinsky A, Sheridan A (2014) Hypothermia in newborn: An exploration of its cause, effect and prevention. *British Journal of Midwifery* 22(8): 557-562.
3. Wiewel AM, Harmon BM, Van Vught AL, Scicluna PB, Hoogendijk JA, et al. (2016) Risk factors, host response and outcome of hypothermic sepsis. *Critical Care* 20(1): 328.
4. Rumbus Z, Matrics R, Hegyi P, Zsiboras C, Szabo I, et al. (2019) Fever, hypothermia, and mortality in sepsis. *Temperature (Austin)* 6(2): 101-103.
5. Bal CN, M Periasamy (2020) Uncoupling of sarcoendoplasmic reticulum calcium ATPase pump activity by sarcolipin as the basis for muscle non-shivering thermogenesis. *Philos Trans R Soc Lond B Biol Sci* 375: 20190135.