

Regenerative Medicine Therapy: Mesenchymal Stem Cells – A Breakthrough for Healing Wounds in Livestock

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Introduction:

Hoof and accidental wounds are major issues in livestock, leading to reduced milk production and lower reproductive efficiency. Umbilical cord blood-derived mesenchymal stem cells (UCB-MSCs) hold immense promise as a regenerative therapy for wound healing in livestock. When MSCs are injected into animals, they release various cytokines, including anti-inflammatory, immunomodulatory, and antimicrobial factors, which help eliminate bacteria and regenerate injured tissues. These cytokines gradually heal wounds and improve overall body condition, leading to weight gain and increased milk production.

Methods:

The present research project aims to treat hoof wounds in cattle using UCB-MSCs. The UCB-MSCs were aseptically isolated during a cow's delivery, cultured in vitro in a CO₂ incubator, and cryopreserved in liquid nitrogen (LN₂). The MSCs were characterized according to the International Society for Cellular Therapy guidelines. Additionally, these MSCs were differentiated in vitro into adipogenic, chondrogenic, neurogenic, and osteogenic lineages. The differentiation was confirmed through various staining methods. A dose of 5×10^6 allogeneic UCB-MSCs was administered locally near the wound and intravenously to 10 hoof-wounded cows.

Results:

The complete blood count (CBC) parameters were observed in the 10 (first group among the 40 cows) treated cows before treatment, with average values WBC 6.88, RBC 5.24, PLT 333, and HGB 5.45. After treatment, the average values increased to WBC 7.9, RBC 6.73, PLT 586, and HGB 8.03. All blood parameters showed an increase one month after MSC treatment. Similarly, the average weekly body weight of these 10 treated cows was recorded as 323.8 kg, 326.95 kg, 328.43 kg, and 330.47 kg over four weeks. In contrast, the control group of 10 cows received antibiotics instead of MSCs. Before treatment, their CBC parameters averaged WBC 11.41, RBC 4.93, PLT 388.25, and HGB 8.01. After the treatment of antibiotics, the average values changed to WBC 9.89, RBC 5.61, PLT 320.62, and HGB 8.91, indicating a decline in all blood parameters after one month. Additionally, the body weight of these 10 control cows decreased from 361.07 kg to 354.50 kg, reflecting an average weight loss of 6.5 kg per cow over a month. All UCB-MSC-treated cows recovered fully within a month. Surprisingly, most of the control cows did not recover after antibiotic treatment. These findings demonstrate that MSC therapy is significantly more effective than antibiotics for treating hoof wounds in cows.

Conclusion:

In conclusion, MSCs were successfully isolated from umbilical cord blood, characterized, and differentiated into various lineages. The MSC treatment healed hoof wounds in all treated cows within a month, whereas the control cows treated with antibiotics showed limited recovery. This stem cell technology has the potential to significantly improve the economic condition of farmers in our country.