

Quantifying the forces applied during assisted calvings and the impacts on newborn beef calves

Ann Kulser,⁴ BS; Jennifer M. Pearson,¹ DVM; Edmond Pajor,¹ BS, MS, PhD; Akshay Gurdita,² BS, MS; Mark Ungrin,³ PhD; M. Claire Windeyer,¹ BS, DVM, DVSc

¹ Department of Production Animal Health, University of Calgary Faculty of Veterinary Medicine, Calgary, AB, Canada, T2N 4Z6

² Laboratory Medicine and Pathobiology, University of Toronto, Krembil Research Institute, Toronto, ON, Canada, M5S 1A1

³ Department of Comparative Biology and Experimental Medicine, University of Calgary Faculty of Veterinary Medicine, Calgary, AB, Canada, T2N 4Z6

⁴ Kusler Ranch Ltd., Maple Creek, SK, Canada, S0N 1N0

Introduction

Dystocia is recognized as the leading cause of mortality in the beef industry, with almost 26% of neonatal calf losses being attributed to birth-related issues (USDA, 2010). The term dystocia is defined as a prolonged or difficult birth that may or may not require human intervention (Mee, 2008), while calving ease is a subjective measure of the effort required for an assisted delivery. A Canadian study reported that 8.9% of calvings in beef herds required assistance, with severe dystocia occurring in 3.7% of births (Waldner, 2014). Similarly, in the United States, 7.7% and 3.4% of heifers and 3.2% and 1% of cows, respectively, required easy and hard pulls to deliver their calf (USDA, 2009). Despite the incidence and impacts of assisted calvings, there is little available data that quantifies the forces applied during an assisted delivery and the associated compromise in the newborn calf. The objectives of this study were to: 1) quantify the force applied during manual and mechanical delivery of beef calves, and 2) examine the association of force with calf birthweight, vigour, acidemia, and tissue trauma.

Materials and Methods

Twenty-six heifers requiring assistance at parturition were enrolled. Assisted deliveries were either manual (i.e. 1 or 2 people pulling) or mechanical (i.e. using a fetal extractor or “calf jack”). Modified obstetric chains containing force measuring devices were applied to the calf for delivery. The readings from the modified obstetric chains were verified using known masses ranging from 55 to 91 lb (25 kg to 200 kg) in increasing increments of 55 lb (25 kg).

Peak Force (kg) was determined based on the highest force measured during the delivery. Duration (min) will be defined as the time from when the force reached 2 standard deviations above baseline until it dropped below that threshold for the last time. Total Force (kg sec) will be calculated as the sum of the force readings measured for the duration of the delivery. Average jerk (kg/sec) will be calculated by dividing the difference in force between readings by the

amount of time elapsed and taking a rolling average over 5 sequential readings. For each delivery, the Maximum Average Jerk (kg/sec) will be determined. For ease of interpretation, Peak Force, Total Force, and Maximum Average Jerk will be reported in kg, kg sec, and kg/sec, respectively.

Force parameters will be compared by delivery method (manual versus mechanical) and assessed for their associations with calf birthweight and clinical indicators of vigour (suckle reflex), acidemia (blood L-lactate concentration; LAC), and tissue trauma (blood creatine kinase concentration; CK). Wilcoxon Rank Sum tests will be used for non-parametric data and Student's T Tests for parametric data. Simple linear regression models will analyze the relationships between birthweight and forces. Birth LAC and CK will be categorized by quartiles and assessed using Kruskal Wallis tests or one-way ANOVA.

Results

The following results are preliminary findings. Mean Peak Force for mechanical deliveries (122.9 kg; 95% CI: 100.2 to 145.7 kg) was greater ($P=0.002$) than manual deliveries (56.0 kg; 95% CI: 34.8 to 77.1). Calf birthweight was associated with Peak Force ($P=0.001$), with every 1 kg increase in weight being associated with a 4.5 kg (95% CI: 2.1 to 7.0 kg) increase in Peak Force. Calves with blood CK concentrations in the top quartile (≥ 897 IU/L) had significantly higher mean Peak Force ($P=0.001$) than calves with lower CK. There were no significant associations of suckle reflex or LAC with Peak Force. The analysis of the remaining force parameters (Duration, Total Force, Maximum Average Jerk) is pending.

Significance

Overall, mechanical delivery and heavier calves required greater Peak Force for extraction. Higher Peak Forces at delivery was associated with evidence of tissue trauma, but not with clinical indicators of calf vigour or acidemia.