Obstetrics and perinatal calf care simulators - The future of training and re-training bovine veterinarians

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SUMMARY

Veterinary undergraduate students often have few opportunities to practice bovine dystocia assessment and correction during their university training. Their exposure to calving cases in the university clinic, ambulatory practice or during extra-mural practice can be highly dependent upon the case load and type. However, being able to successfully deal with an emergency dystocia is a Day-One Competency of veterinary graduates. In addition, as veterinarians move between employment positions and sometimes, animal species, e.g. from small to large animal practice, they may need to re-train in the basic principles of bovine obstetrics. Relying on field exposure to upskill may not prepare the veterinarian for the range of problems that can be encountered at calvings. Often such on-the-job learning occurs in the absence of an experienced colleague to share practical knowledge and skills needed to navigate difficult obstetrical cases. Modern simulators can provide this exposure to multiple calving scenarios and with experienced teachers can assist undergraduates and veterinarians in animal-free training of these skills with increasing bio-fidelity. Calving simulators consist of a life-size, complete, free-standing or partial, bench-top cow and a calf. They vary in quality from home-made, cheap, inauthentic models to purpose-built, expensive commercial high-fidelity models. These can be used to teach recognition of eutocia, management of dystocia, e.g. diagnosis and correction of foetal maldisposition, use of calving aids and calf resuscitation and after-care. Limitations of obstetrical models include inability to put the full-size cow model on its side to simulate normal calving posture, more pelvic space than would be in a tight heifer dystocia, absence of maternal abdominal and uterine contractions, inability to simulate uterine torsion and some calf resuscitation procedures. Despite these limitations, a blended learning approach involving simulator experiential learning and group discussion of periparturient issues has been shown to enhance the learning experience and competence of both students and practicing veterinarians thus providing real world clinical utility.

KEY WORDS

Dystocia; Simulator; Obstetrics; Experiential learning.

INTRODUCTION

Being able to deliver a calf successfully at an emergency dystocia is a Day-One Competency of veterinary graduates (1). However, the opportunities to practice dystocia assessment and correction can be quite limited during the undergraduate's college term. Such experience is often gained during extramural practice with practicing veterinary surgeons but even the opportunities here can be highly variable as dystocia rates can vary widely between seasons and herds, (2). One way of bridging this knowledge gap is to use simulation to explore dystocia scenarios. This can be done with computer models/3D animation/virtual reality (computer assisted learning; CAL) (3) or with mannequin/phantom cow/calf simulation models.

OBSTETRICAL SIMULATORS

In veterinary universities across the world various home-produced, one-off, dystocia simulators have been used for years to demonstrate dystocia correction to students (4, 5). These often consist of a real cow's pelvis enclosed in a mock-up of a cow's hind quarters or an obstetric box. These dystocia simulators are used in conjunction with a real stillborn calf cadaver (suitable for foetotomy training) or a dummy calf toy mannequin. Such models are relatively cheap to build but of variable quality and verisimilitude; this is important as students prefer high- to low-fidelity models (6). In order to increase verisimilitude, it is now possible to 3-D print an excellent simulation of a cow's pelvis which can be used in a calving simulation model (Gnemmi, G, personal communication).

To facilitate exchange of knowledge on these and other veterinary models a discussion forum has been established for veterinary educators involved in veterinary clinical skills teaching and model building (Veterinary Clinical Skills + Simulation; https://www.clinicalskillsandsimulation.com/). Commercial companies have designed much more expensive but much more realistic dystocia models for teaching and demonstration purposes also. Examples include the Dystocia Simulator from Veterinary Simulator Industries (www.vetsimulators.com) and the Bovine Birthing and Ultrasound Simulator from Realityworks (www.realityworks.com). The former has fullsize both Holstein and Hereford models available (Figure 1). In addition to the

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life-size fiberglass phantom cow there is a life-size (25 kg) silicone phantom newborn calf. The latter (Realityworks) has a table-top cow phantom and a neoprene-material calf model. In addition, indigenous commercial models have been developed within countries and used in their national universities but are not on sale internationally.

Limitations of some of these larger models are the inability to put the full-size cow model on its side to simulate normal calving posture, superficial damage to the painted surface of the fibre-glass cow body by the calving jack, cracking of the calf silicone body after repeated use/misuse and more pelvic space than would be in a real tight heifer dystocia [though space can be altered by inflating air bags in the abdomen ('rumen') and bags surrounding the pelvic 'bones']. Other limitations include absence of maternal abdominal and uterine contractions, absence of birth fluids [though obstetrical lubricant can be added to the 'uterus' (a velcro-closed plastic bag) and to smear the calf] and inability to simulate uterine torsion or some calf resuscitation procedures as well as the obvious absence of the real live animal. Additionally, the use of such simulators in a skills lab obviously does not replicate the diverse and often stressful indoor and outdoor environments in which veterinarians have to assist calvings.

EXPERIENTAL LEARNING

There are a number of basic and advanced obstetrical skills which can be taught through experiential learning (learning by doing) using simulator cow and calf models (7). These include: intravaginal/intrauterine palpation assessment of birth canal patency/foetal size, foetal disposition and diagnosis of type of abnormal foetal disposition, correction of abnormal foetal disposition, protection of the uterus during foetal manipulation, twin calvings (if two calf models), correct placement of the calving chains/ropes, double knotting calving chains/ropes, use of a head snare, (use of eye hooks is not possible on calf model), simulated use of a foetotome (ropes), point of the umbilical cord compression (anterior/posterior presentations), trial traction, tractive force, use of a gyn-stick, calving aid/belt/jack (Figure 2), calf resuscitation (Figure 3), acupuncture, stomach tubing and Madigan thoracic squeeze technique (Figure 4).

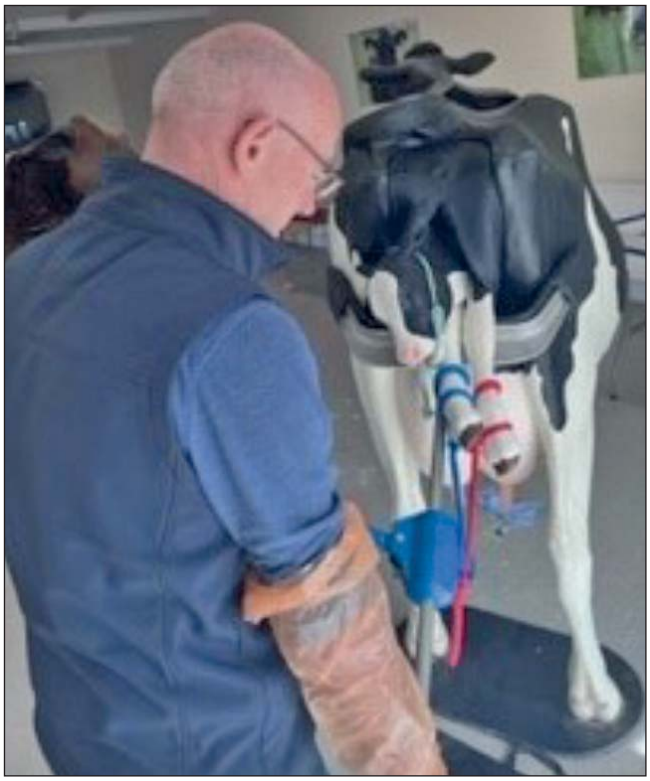

Figure 2 - Demonstrating assisted calving using a calving jack with the dystocia simulator cow-calf models.

Figure 1 - Dystocia Simulator cow and calf models from Veterinary Simulator Industries.

BLENDED LEARNING

In addition to practicing these skills, use of the simulator facilitates a blended learning approach to decision making at dystocia cases. Group discussion can evolve about peripartum care of the dam and the calf which cannot be demonstrated on the simulator, e.g. use of pharmaceuticals at calving for

Figure 3 - Demonstrating correct use of a resuscitator pump with a calf simulation model.

Figure 4 - Demonstrating the thoracic Madigan squeeze technique with a calf simulation model.

maternal/perinate pain relief, epidural, milk letdown, episiotomy, caesarean section, foetotomy, retained placenta/metritis/milk fever management, perinate apnoea and perinate acidosis/weakness. In addition, periparturient management of the dam can be highlighted, e.g. pre-calving vaccinations, close-up feeding and BCS, movement of the cow to the maternity unit, calving facilities, calving supervision, calving prediction, cow restraint, history collection, health and safety at calving and checking the cow after calving for birth canal tears and another calf! Similarly, perinatal care of the newborn calf can be discussed including tissue biopsy-tagging, navel haemorrhage/herniation/omphalocele/antisepsis, congenital defects, stomach-tubing calves, colostrum feeding and cow-calf contact time.

The value of blended learning using a simulator to teach bovine obstetrics has been shown in a recent UK study of veterinary undergraduates (8). While these simulators are of greatest value to veterinary (and agricultural) undergraduate students in the clinical years, this experiential learning is also of value to provide continuing professional development (CPD) to veterinarians who are less experienced, e.g. new graduates, those who attend few dystocia or those changing career path back to cattle practice. Given welfare concerns about over-use of animals for teaching purposes, obstetric simulators fulfill a vital role in veterinary and agricultural undergraduate and postgraduate training and re-training.

Conflicts of interest

The authors declare that they have no conflict of interest.

Authors Contributions

All Authors who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the conception and design of this work or the analysis and interpretation of the data, as well as the writing of the manuscript, to take public responsibility for it. Authors believe the manuscript represents valid work. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication.

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