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Use of on-farm emergency slaughter for dairy cows in British Columbia

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ABSTRACT

On-farm emergency slaughter (OFES), whereby inspection, stunning, and bleeding occur on the farm before the carcass is transported to a slaughterhouse, is permitted in some jurisdictions as a means to avoid inhumane transportation while salvaging meat from injured animals. However, OFES is controversial and its use for dairy cows has been little studied. Inspection documents for 812 dairy cows were examined to identify how OFES was used for dairy cows in British Columbia, Canada, over 16.5 mo. Producers used OFES for dairy cows aged 1 to 13 yr (median of 4 yr). Leg, hip, nerve, spinal, foot, and hind-end injuries or conditions (in that order) were the most common reasons for OFES, and some cases may have been a consequence of calving. Foot conditions were disproportionately common among cows 5 yr and older, and hind-end conditions were disproportionately common among cows 6 yr and older. Producers used OFES promptly after traumatic injury (within 1 d) for some cows, but OFES was delayed for others, sometimes until cows had been nonambulatory for 2 to 6 d. In some cases, OFES was used for nontraumatic chronic conditions, such as lameness and hind-end weakness, rather than traumatic injuries such as fractures and dislocated hips. Use of OFES appears to conform to the purpose of the program when used promptly after traumatic injuries, but clear guidelines are needed to avoid inappropriate use and delays that may prolong animal suffering.

Key words: dairy cow, emergency slaughter, culling decisions, humane transportation

INTRODUCTION

When farm animals become injured, managers must decide whether to treat, transport, euthanize, or, where permitted, use on-farm emergency slaughter (OFES). The OFES procedures—whereby inspection, stunning, and bleeding occur on the farm before the carcass is

transported to a slaughterhouse—are permitted in many jurisdictions, including the European Union and the Canadian provinces of Alberta, British Columbia, Manitoba, Ontario, and Saskatchewan; however, this is not the case in the United States. Regulations for OFES vary among jurisdictions; for example, regarding the training of participating veterinarians. However, most regulations and guidelines indicate that OFES is intended to avoid undue or additional suffering of an injured animal and to salvage meat.

Planned culling and transport of dairy cows has been studied (González et al., 2012; Compton et al., 2017), but little research has been done on the injuries, conditions, and underlying causes that lead to OFES. A few studies have monitored cattle (presumably beef and dairy) that underwent emergency slaughter at slaughterhouses and found that locomotor injuries are especially common (Večerek et al., 2003; Pistěková et al., 2004; Cullinane et al., 2010). More recently, Fusi et al. (2017) found that OFES on Italian dairy farms was used because of accidents, metabolic or digestive disorders, and calving problems.

In British Columbia, OFES is an option for dairy cows and other species. By regulation, an animal may undergo OFES if (1) it “is in a physical condition that precludes it from being transported to a slaughter establishment without undue suffering” or (2) if the animal “poses a high risk of significant injury to humans if it is transported to a slaughter establishment” (Government of British Columbia, 2014). According to OFES guidelines (BCMA, 2014a), producers who use OFES must confirm that the slaughterhouse can accept the carcass and then a veterinarian must confirm that the animal is fit for human consumption (i.e., no clinical sign of disease). The veterinarian completes an inspection document titled “Document for an Approved Emergency Slaughter on Farm” (BCMA, 2014b) with details about injury type, condition of the animal, and timing of the OFES procedure. A transporter with a Specified Risk Material permit then stuns the animal (using a firearm), bleeds it on the farm, and transports the carcass and inspection document to the slaughterhouse within 2 h. Slaughterhouse operators and meat inspectors then record final details on the document;

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these include time of arrival and whether the carcass is condemned based on postmortem inspection. Veterinarian and transporter fees are paid by the producer and the producer receives payment from the slaughterhouse for the carcass.

We analyzed OFES inspection documents (1) to establish the type of injuries or conditions that lead to OFES, (2) to assess whether OFES is being used for its intended purposes according to the regulation, and (3) to provide recommendations for improving OFES.

MATERIALS AND METHODS

Inspection documents were examined for cows that underwent OFES in British Columbia from January 1, 2014, to December 31, 2015. Data from the documents included (1) age, (2) reason for OFES, (3) history of the animal's condition, (4) results of clinical examination on the farm, (5) time of stunning, (6) time of bleeding, (7) time shipped, (8) time arrived at the establishment, (9) disposition, and (10) the reason for condemnation in cases where the carcass was condemned. All identifying details including farm, personal, and location names were redacted by government staff before the documents were released for research. Of the 1,041 documents received, a total of 229 documents were missing data and therefore were not included in data analysis. Specifically, 177 involved an earlier version of the inspection document that did not include information on carcass disposition and reason for condemnation, 31 contained illegible information, and 21 were either missing information, were duplicates of documents already analyzed, or pertained to male animals; this left 812 documents for dairy cows spanning the 16.5 mo from August 14, 2014, to December 31, 2015.

Descriptive statistics were generated for the age of the cows, the times elapsed from stunning to bleeding and to arrival at the slaughterhouse, and the reasons for carcass condemnation, where applicable. Documents generally recorded age as an integer (e.g., 4 yr) or fraction (e.g., 4.5 yr). Because fractions were not recorded for all animals, we used whatever integer was recorded to create age categories. For example, animals recorded as 1, 1.3, and 1.8 were put into age category 1.

Details written under results of the clinical examination were analyzed to classify each case as a leg, hip, nerve, spine, foot, or hind-end injury or condition. For example, fractured femurs and ruptured gastrocnemius muscles were classified as leg injuries. Pedal arthritis and foot abscesses were classified as foot conditions. Two additional groups were created, including cases with minimal description and rarely occurring injuries or conditions. Chi-squared tests were used to test for relationships between cow age group and injury type.

Additional written comments on the documents were analyzed thematically using document analysis (Bowen, 2009). To do this, comments were first characterized with a short definition or code (Charmaz, 2006). For example, the terms "recumbent," "down due to injury," and "down" were coded as nonambulatory cows. Codes were then analyzed to reveal features of how OFES was used.

RESULTS

Data from CanWest DHI (Guelph, Ontario, Canada) showed that 20,981 dairy cows were culled from dairy herds in British Columbia in 2015 (D. McKeen, CanWest DHI, personal communication). Therefore, the 631 animals that underwent OFES in 2015 represented about 3% of all dairy cows culled in the province.

Cow age ranged between 1 and 13 yr, with a median of 4 yr. Only 27 cases were recorded at age 1; the number rose steadily to age 5 (281 cases) and then dropped precipitously at ages 6 and older (91 cases). With the cows grouped for Chi-squared analysis (Table 1), 15% were aged 1 or 2 yr, 39% were 3 or 4 yr, 35% were 5 yr, and 11% were 6 yr or older. Data from CanWest DHI (D. McKeen, CanWest DHI, personal communication) were also used to calculate the age-specific OFES incidence for cows present and cows culled in 2015. For cows culled, approximately 6.8% of cows aged 5 yr underwent OFES, whereas the incidence for cows aged 1 to 4 yr and 6 yr and older ranged from 1.6 to 2.7%. For cows present (animals culled and remaining in 2015), the proportion that underwent OFES was 2.3% for cows aged 5 yr but less than 1% for other age groups.

Excluding OFES cases with minimal description or rarely occurring conditions, the reason for OFES varied somewhat with age (Table 1). Leg injuries were the most commonly recorded type of injury at all ages (Table 1), accounting for 33 to 48% of cases in each of the 4 age groups. Hip injury was the second most common in cows up to and including 5 yr. The percentage of foot conditions increased steadily with age, and hind-end conditions were most common in the oldest group. Chi-squared tests (excluding cases classified as minimal description and rarely occurring) showed an overall difference among age groups in injury type ($\chi^2 = 47.18$, $df = 15$, $P < 0.001$), with foot conditions (primarily lameness) disproportionately common among cows aged 5 yr and older ($\chi^2 = 21.7$, $df = 3$, $P < 0.001$) and hind-end conditions disproportionately common for cows aged 6 yr and older ($\chi^2 = 9.2$, $df = 3$, $P < 0.05$).

Documents reporting leg injuries (35% of total cases) included varying levels of detail about the specific injury. Some gave specifics, such as stifle injuries (44 of

280 animals with leg injuries), fractured femurs (32) and ruptured gastrocnemius muscles (26), whereas others simply reported front leg injuries and dislocations (31) and rear leg injuries and dislocations (97).

Hip injuries (20% of total cases) most commonly included partial and full hip dislocations (98), adductor muscle injuries (15), and splayed legs or the “splits” (21). The most common nerve injury (11.5% of total cases) was obturator nerve damage (57), which likely occurs during calving when pressure is exerted on the obturator nerve (Greenough, 2018).

Spine injuries (8% of total cases) were mostly classified as spinal column or cord injuries. Of foot conditions (7% of total cases), most (40) were classified as pedal arthritis and lameness. For hind-end conditions (7% of total cases), most (39) reported some form of hind-end weakness, but the cause of weakness was not specified. Of the 59 cows in the minimal description group (7% of total cases), 55 were merely noted as down. Finally, cows in the rarely occurring group (4.2% of total cases) had digestive disorders (6), injuries, or metabolic conditions related to calving (11), lacerations (3), broken tails (2), emaciation (2), and muscle injuries (2).

Time elapsed from stunning to bleeding was recorded as 0 to 60 s for 50% of cases, up to 120 s in an additional 38%, up to 180 s in an additional 9%, and 240 s and longer in the remaining 4%. The mean time from stun to arrival at the slaughterhouse was 74 min \pm 57 s (\pm SEM), with a range of 4 to 178 min. The 38 carcasses reported to have a transportation time over 2 h were not rejected at the slaughterhouse.

Of the 812 cows, 11 were condemned at the slaughterhouse after final inspection. Reasons for condemnation were lymphosarcoma (7 cases), neoplasm (1), nephritis (1), waiting for residue result (1), and unspecified (1).

Analysis of comments written under history of the animal's condition showed that 511 documents (63%) included terms such as sternally recumbent, laterally recumbent, down due to injury, and down, all of which were coded as nonambulatory cow. This indicated that,

regardless of the specific injury or condition, OFES was used most often for nonambulatory cows.

Details written on 303 documents indicated conditions that often occur as a consequence of calving. These included hind-end weakness or injury (45 cases), adductor muscle injuries (15), pelvic injuries (8), splits (21), fractured femur (32), ruptured gastrocnemius (26), nerve injuries including hind-end paralysis, leg, obturator, and peroneal and sciatic nerve damage (90), down (55), and specific fresh-cow problems including ketosis, low phosphorus, nonresponsiveness to milk fever treatment, retained placenta, and uterine tear (11). Thus, approximately 37% of the documents involved injuries or conditions that could be a consequence of calving.

The inspection document requires veterinarians to report the reason for emergency slaughter by selecting either (1) inhumane to transport or (2) behavior/size of animal. Inhumane to transport was selected on all 812 documents. Additionally, the phrase inhumane to transport was written on 102 documents (13%) and lameness was written on 74 documents (9%).

On 35 documents, veterinarians recorded duration of recumbency or the number of days elapsed since the injury or onset of the condition that resulted in OFES. Of these, 12 cows underwent OFES within 1 d of the onset of conditions, as indicated by comments such as “sternally recumbent – down this morning,” “non-ambulatory, laterally recumbent – found down in alley this morning,” or “injured left hind-limb this morning.” Eight cows underwent OFES on the second day after the onset of conditions, as noted by comments such as “down 2 days ago – did splits,” “unable to walk now 2 days,” and “down with the splits 2 days ago.” Four cows underwent OFES 4 d after the onset of conditions, as noted by “unable to rise for 4 days” and “5 days in milk – downer after 1 day.” Finally, 7 cows underwent OFES 5 d or more after the onset of conditions, as noted by “down for 6 days, unable to get up” and “injured 2 weeks ago, difficulty getting up after injury.” Thus,

Table 1. Injury or condition that led to on-farm emergency slaughter for each age group of cows from August 14, 2014, to December 31, 2015 (percentage of cases within each age group, with actual number of cases in parentheses)

Injury or condition ¹	Age group			
	1–2 yr	3–4 yr	5 yr	6+ yr
Leg	48 (57)	40 (112)	33 (80)	40 (31)
Hip	21 (25)	26 (73)	24 (58)	13 (10)
Nerve	13 (15)	12 (35)	16 (39)	5 (4)
Spinal	9 (11)	10 (28)	7 (18)	10 (8)
Foot	1 (1)	5 (15)	13 (31)	14 (11)
Hind-end	8 (9)	7 (20)	6 (15)	17 (13)
Total	100 (118)	100 (283)	100 (241)	100 (77)

¹Cases involving minimal description (59 cases) and rarely occurring conditions (34 cases) are not included.

we found a large range in the number of days between injury (or onset of the condition) and use of OFES.

DISCUSSION

The types of injuries and conditions that led to OFES were similar to those reported for general dairy cow mortality on farms; these commonly include accidents (Thomsen and Houe, 2006; McConnel et al., 2009) and calving-related injuries (McConnel et al., 2009; Alvåsen et al., 2014; Fusi et al., 2017). Relationships between age and injury type or condition also conformed to patterns seen in the literature. The fact that foot injuries were most common in cows aged 5 yr and older fits with the observation that foot problems tend to increase with age (Espejo et al., 2006; Solano et al., 2015). The increase of hind-end injuries with age may result in part from the higher incidence of milk fever at older ages (Horst et al., 1997), as some cases were likely due to secondary recumbency if a cow was unable to rise because of milk fever (Stull et al., 2007; Green et al., 2008). Recently, Poulton et al. (2016a) found that secondary damage was more important than primary injuries and conditions in determining whether a nonambulatory cow would recover or be euthanized. This knowledge should inform the development of proactive culling protocols on farms, as encouraged by the National Farmed Animal Health and Welfare Council (NFAHWC, 2017), which may help to prevent unplanned situations and thus avoid OFES.

In our study, most transportation was well within the 2-h guideline required by regulation in British Columbia as well as other provinces and the European Union, with only 4.7% of the inspection documents recording a transportation time that exceeded 2 h. Additionally, most (88%) of OFES animals were bled within 2 min of stunning. The Humane Slaughter Association recommends that cattle stunned by a penetrative tool, such as a firearm (as is the case with OFES), are bled within 60 s to ensure death (HSA, 2016). However, if the firearm caliber is sufficient for the size of the cow, a correctly placed shot can kill the animal by destroying the brain stem (Appelt and Sperry, 2007; Shearer and Ramirez, 2013; Schiffer et al., 2017). Hence, the slightly longer delay before bleeding when done under farm conditions should not result in animal suffering if the firearm is correctly used.

Of the small number of carcasses condemned at the slaughterhouse (11 cases, or 1.4%), most were because of lymphosarcoma or bovine leucosis. This can be diagnosed by a blood test or confirmed from lesions during postmortem inspection and is a common reason for the condemnation of dairy cow carcasses (Nagy, 2018).

Broadly, cows selected for OFES fell into 2 groups: those with traumatic injuries that clearly meet the goals of OFES and those with nontraumatic conditions that may not meet those goals. Most leg, hip, and spine injuries (511 cases), plus some of the rarely occurring injuries, can be classified as traumatic and represent clear emergency situations. For example, a fractured femur could occur if a cow develops splayed legs due to weakness after calving (Huxley, 2006). On the other hand, many nerve, foot, and hind-end conditions (208 cases), plus some cases involving minimal description, appear to be nontraumatic conditions and thus not emergencies. For example, lameness (written on 9% of the documents) can develop over time because of calving, diet, and infectious agents (Cook and Nordlund, 2009). However, a guidance document titled "Guidelines for Veterinary Practitioners Emergency Slaughter Under the B.C. Meat Inspection Regulation" states that emergency slaughter is not allowed for chronic conditions (which lameness could be considered; BCMA, 2014). Evidently the OFES program requires clearer criteria or clearer communication of the criteria to producers and veterinarians.

The wide range in the number of days elapsed from the injury (or onset of the condition) to OFES provides insight into the highly variable decisions that are made for compromised dairy cows. Where the decision to use OFES was made on the day of the injury, the duration of animal suffering was likely brief, in contrast to other cases when several days elapsed before slaughter. The situation clearly calls for better guidance to achieve prompt decisions to either treat or euthanize compromised animals (Poulton et al., 2016b). The likelihood of recovery decreases when cows remain nonambulatory for more than 24 h (Green et al., 2008), likely in part because secondary damage from recumbency is a major reason for poor recovery (Poulton et al., 2016a). However, many farms fail to make prompt end-of-life decisions. In the United States, for example, where OFES is not available, only 41% of large farms (500+ cows) reported that they euthanize nonambulatory cows within 24 h, and the percentage is even lower for smaller farms (USDA, 2016). Hence, information on the likelihood of recovery for nonambulatory cows, the critical role of high-quality nursing care (Poulton et al., 2016b), and clear euthanasia protocols (Turner and Doonan, 2010) could facilitate fast and consistent end-of-life decision-making.

CONCLUSIONS

In many cases, OFES was used in true emergency situations where a cow sustained a traumatic injury. In

other cases, OFES was used for chronic conditions, such as lameness, contrary to the stated intention of OFES. Details of recumbency duration showed that OFES was sometimes used promptly (same day) after an accidental injury, but in other cases a delay of 2 or more days elapsed before OFES. Precise timing parameters and criteria for OFES should be added to program regulations. The use of proactive culling protocols on farms could help prevent unplanned situations that require emergency actions. Finally, a clear need exists for farms to develop end-of-life decision-making protocols to prevent delays in action for compromised animals.

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