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PEER-REVIEWED CORRESPONDENCE

A case of bovine dystocia secondary to congenital mesothelioma in a calf

Hydrops fetalis, or fetal ascites, is the accumulation of fluid within the peritoneum of the fetus prior to birth and when present in full-term calves can result in dystocia (Pandit and Singh 1990; Katiyar *et al*. 2016). The incidence of dystocia due to fetal ascites is likely to be low. In three retrospective reviews of dystocia in cattle, only 1/156, 2/236, and 1/560 dystocia cases were attributed to fetal ascites (Purohit and Mehta 2006; Sarkar *et al*. 2014; Stanciu *et al*. 2015, respectively).

The ascites observed in hydrops fetalis can be due to either an overproduction of peritoneal fluid, or a lack of sufficient drainage of this fluid, and may occur as a result of a range of congenital abnormalities (Ravikumar *et al*. 2013). One such abnormality is the formation of congenital mesotheliomas in the fetal abdomen (Katiyar *et al*. 2016). Worldwide, reports of congenital mesotheliomas as a cause of bovine dystocia are very rare. A literature search conducted using the search terms "cattle AND mesothelioma AND dystocia" in Web of Science on 6 May 2021, retrieved only three peer-reviewed papers (Drieux *et al*. 1949; Charan *et al*. 1974; Tammen *et al*. 1994). A further two cases were described in Baskerville (1967).

Mesotheliomas are tumours of the mesothelium and associated connective tissue of mesodermal origin, which form the lining of the thorax (pleura), abdomen (peritoneum) and viscera (Peli *et al*. 2018). In cattle, mesotheliomas most often occur in the peritoneal cavity, though can be seen elsewhere, including in the pericardium (Morita *et al*. 2019). Mesotheliomas may occur in animals of any age but in cattle, they are most commonly seen as congenital neoplasms in fetal or young calves (Parkinson *et al*. 2019). The ascites caused by these lesions, which is typically marked in young animals, is a common clinical sign in cattle with this disease and tends to be caused by a serosanguinous fluid produced by the neoplastic mesothelial cells (Milne *et al*. 2001; Morita *et al*. 2019). In humans, mesotheliomas are most commonly associated with the inhalation of asbestos particles (Selikoff *et al*. 1965), while in animals, the pathogenesis and aetiology of these tumours are not well understood, with inconsistencies in the current literature (Peli *et al*. 2018).

This description of a case of bovine dystocia secondary to congenital mesothelioma in a calf is, to the authors' knowledge, the first reported example in New Zealand.

In August of 2020, a mature age, mixed breed dairy cow in the Eltham district of New Zealand, was examined because of calving difficulty. On arrival, it was reported that attempts had been made by farm personnel to assist the calving, with no progress noted for the last 20–30 minutes. The cow was bright and alert, with no signs of significant distress. The calf was partially exteriorised, with the forelimbs and head protruding from the vulva in a normal anterior presentation. On vaginal examination, it was found that the calf was alive and appeared to be breathing, and on palpation was noted to have a distended abdomen, suggestive of fetal ascites.

The calf was euthanised via injection of an unspecified quantity of 500 g/L pentobarbitone sodium (Pentobarb 500; Provet, Auckland, NZ) directly into the tongue. Following euthanasia, the head of the calf was removed, and its abdomen was incised within the uterus with a finger knife. A piece of polythene pipe was then inserted through the vagina into the uterus to assist in removing the fluid and to allow sufficient space for the calf to be removed. The pipe was then passed into the abdomen of the calf via the oesophagus to further aid in the removal of the fluid. Once sufficient fluid had been removed from the abdomen of the calf and uterus of the cow, calving chains were placed on the forelimbs of the calf, and it was removed using controlled traction via a calving pulley, assisted by the uterine contractions of the cow.

After removal from the dam's uterus, an incision was made into the abdomen of the calf, causing exteriorisation of the remaining fluid along with multiple free-floating masses within the abdomen. Masses were variably soft to very firm, pink to white in colour, irregular ovoid to multinodular in shape and ranged in size from approximately 5–70-mm diameter (Figure 1). Upon further inspection of the calf's abdominal cavity, numerous (>100) similar masses were present both free within the abdomen as well as adhered to and diffusely scattered across the abdominal viscera and peritoneum. A full necropsy was not performed, but the calf's intestinal contents were noted to be more firm and more green than would be expected in a fetus. No further gross abnormalities were seen on the remainder of the limited post-mortem examination.

For histopathologic examination, various tissues including samples of the free and peritoneal masses

Figure 1. Photograph showing 5–70-mm diameter, soft to very firm, pink to white, irregular ovoid to multinodular masses free in the abdomen of a calf.

were fixed in 10% neutral buffered formalin and routinely processed (embedded in paraffin, sectioned at 5 µm and stained with H&E). Immunohistochemical staining of histological sections was also performed for cytokeratin (clone AE1/AE3) and vimentin (clone V9). Both cytokeratin and vimentin are valuable immunohistochemical markers for the differentiation of mesotheliomas from other adenocarcinomas (Vural *et al*. 2007).

Histologically, all examined masses consisted of poorly demarcated, unencapsulated and highly cellular populations of neoplastic cells, forming papillary and micropapillary projections which often extended from the visceral serosa (Figure 2(a)). Neoplastic cells were large and pleomorphic, polygonal to spindle-shaped, had variably distinct cell borders, a moderate amount of eosinophilic, often vacuolated cytoplasm, round to ovoid central nuclei, vesicular to stippled chromatin and 1–3 often large and prominent nucleoli. There was moderate to marked anisocytosis and anisokaryosis, with low numbers of binucleated or multinucleated cells. Average mitotic rate was two mitoses per 40× objective high-power field. Cells were supported by a moderate to extensive fibrovascular stroma, with several multifocal areas of chondroid and

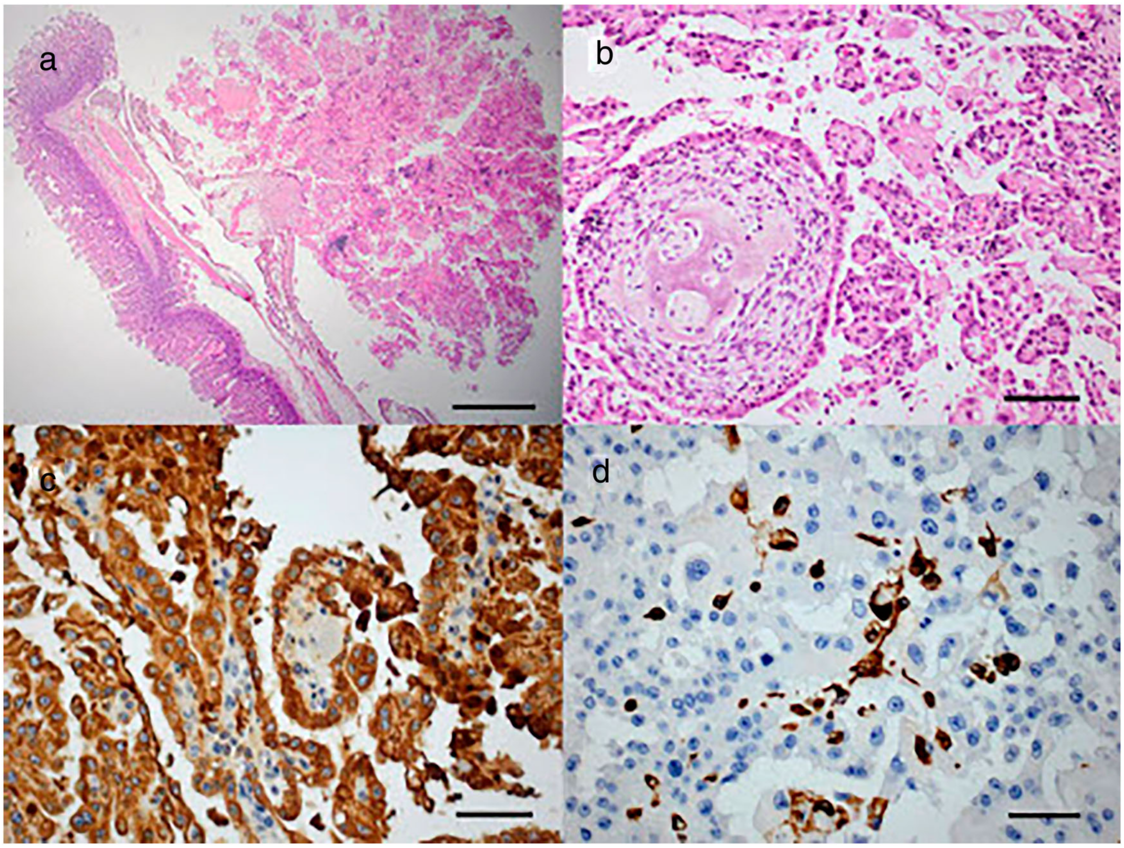

Figure 2. Photomicrographs of sections of a peritoneal mass from the calf in Figure 1 showing (a) neoplastic cells at the surface of the jejunal peritoneum that are epithelioid and form short papillary projections within a variable fibrovascular stroma (H&E; bar 500 µm) and (b) neoplastic cells supported by a moderate to extensive fibrovascular stroma, with areas of osteoid formation present multifocally (H&E; bar 30 µm). (c) Most neoplastic cells reacted strongly with an anti–pancytokeratin antibody (immunohistochemical stain for pancytokeratin with 3,3′-diaminobenzidine chromogen and haematoxylin counterstain; bar 15 µm) while (d) low numbers of neoplastic cells reacted strongly with an anti-vimentin antibody (immunohistochemical stain for vimentin with 3,3′-diaminobenzidine chromogen with haematoxylin counterstain; bar 15 µm).

osteoid formation (Figure 2(b)). Scattered neoplastic cells were hypereosinophilic or shrunken with pyknotic nuclei (cell necrosis) and rare focally extensive necrosis was also present throughout some sections. Immunohistochemistry revealed strong positive cytoplasmic immunoreactivity for pancytokeratin antibody clone AE1/AE3 (Figure 2(c)), while low numbers of individual or clustered neoplastic cells showed positivity for vimentin (Figure 2(d)). Together with the gross findings in the calf, these microscopic findings were considered confirmatory of a diagnosis of epithelioid mesothelioma (Munday *et al*. 2017; Brakel *et al*. 2018).

Mesotheliomas are reported to be the second most common neoplasm in calves after juvenile lymphoma (Brakel *et al*. 2018), but, as stated earlier, are not a commonly reported cause of bovine dystocia. However, it is possible that the role of mesotheliomas in causing fetal ascites and dystocia has been overlooked since although these calves are invariably delivered by partial fetotomy, this does not always involve full incision of the calf's abdomen. No strong link to a causative agent for mesothelioma in cattle has been found, and while a putative association between acquired mesotheliomas in adult cattle and exposure to asbestos, as in humans (Robinson *et al*. 2005), is suggested, this is unlikely to be true for congenital mesotheliomas in calves (Peli *et al*. 2018).

In conclusion, congenital mesotheliomas are rare bovine neoplasms, but when present in pre-term calves can cause fetal ascites leading to dystocia. The authors would be interested to hear from other practitioners who have also encountered this unusual condition.

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