Myositis, lameness, and paraparesis associated with use of an oil-adjuvant bacterin in beef cows

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- Local inflammation caused by injection of oil-adjuvant bacterin can damage perineural vessels, and spread to adjacent structures.
- Intramuscular vaccination adjacent to the vertebral column is risky, because inflammation may spread into the vertebral canal.
- Veterinarians and livestock producers must weigh the costs and benefits of ice vaccination in livestock, because such vaccination may result in substantial scarring of muscle.

Lameness and paraparesis were observed in a herd of 600 beef cows after intramuscular vaccination for evaluation of pregnancy and injections of killed infectious bovine rhinotracheitis/vaccine viral diarrhea virus vaccines, rotavirus/mucosal immune vaccine, and Corynebacterium bovis bacterin. Leptospira bacteri, and verrucavirus into the neck, left hind limb, and right shoulder. Cows also received the recommended dose (2 mL) of Escherichia coli/Canarypseudobacter bacterin in an oil adjuvant injection into the longissimus lumborum (longissimus) muscle by use of a 38-mm (1.5-inch), 16-gauge hypodermic needle. Needles were not changed between vaccination of each cow.

In most cows, an area of skin, approximately 15 cm in diameter, at the injection site of the E.coli/Canarypseudobacter bacterin became edematous 2 to 3 days. The center of this area felt warm for several days. Lameness was first noticed 6 days after vaccination in 3 cows and was discovered in a total of 36 cows (incidence, 6%) over the course of the next 4 weeks. Lameness always began in the right hind limb and was characterized by toe dragging and a shortened stride. Gait abnormalities persisted in severity and spread to involve both hind limbs in most affected cows. Clinical signs in these cows consisted of toe dragging, leg crossing, limb elevation, stumbling, and walking on the dorsal surface of the pasterns. A few cows had scoliosis, and several became paraplegic.

Treatments attempted in various cows consisted of administration of antibiotics, nonsteroidal anti-inflammatory drugs, calcium/dextrose solution, vitamin E and selenium, and caudal epidural injection of corticosteroids. Rapid improvement in clinical signs was not observed in any cow.

Serum samples were obtained 37 to 42 days after vaccination from 2 clinically normal, 3 lame, and 3 paraplegic cows. ELISA biochemical variables measured in each sample, high activities of muscle-associated enzymes were the only consistent abnormalities (Table 1).

Five cows were euthanized and necropsied at the state veterinary laboratory between 43 and 63 days after vaccination. Tissues were recovered in each cow in the

| Table 1—Muscle-associated enzymes activity in serum from clinically unaffected (n = 2), lame (n = 3), and paraplegic (n = 3) cows 37 to 42 days after vaccination
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right longissimus lumborum muscle at the site of vaccination and within the epidural tissue of the adjacent vertebral canal. Clinical signs in 1 cow that was paraplegic but ambulatory and had not been treated with corticosteroids included a poorly demarcated, white-to-tan, firm, nodular, 10 × 10 × 0.5-cm mass with sparsely scattered, 1- to 3-mm abscesses in the right longissimus lumborum muscle (Fig 1). This mass was located dorsal to the transverse processes of L4 and L5. The lesion extended ventrally between the transverse processes to involve a focal portion of the underlying psoas major muscle and extended through the right L4-L5 intervertebral foramen into the vertebral canal. Epidural fat on the right side was effaced by the mass, which adhered to the dura mater and extended cranially within the vertebral canal for 9 cm (Fig 2). The associated spinal cord was compressed, and the right L1 and L4-L5 nerve roots were entrapped.

Histologically, the lesions in muscle and epidural fat consisted of programed immunolysis, with extensive fibrous and small abscesses and foxtail of necrosis. Inflamed tissue contained multifocal oval spaces (Fig 3). Examination of osmium-fixed tissue specimens revealed that these spaces contained stained material coaggregate with lipid. Compressed segments of spinal cord were atrophic and degenerate. Programed immunolysis was found in an arctic limb lumborum and more dense, histophotologic description and ultrastructural study of these lesions have been reported.

Bacteria were not found on aerobic and anaerobic culture of specimens from the vaccination site. Gomori’s methenamine silver, Steiner’s silver, and Kinyoun’s carbolchular staining of tissue sections from the vaccination site, the epidural lesion, and lumbar lymph node did not reveal bacteria or fungi. Viral culture of specimens from the vaccination site and multiple organs did not reveal bovine viral diarrhea virus. Arthritic and anarcortic bacte- rial cultures also were performed with specimens from an unopened bottle of the bacterin from the same lot that was used in the herd, but bacterial were not cultured.

Severity and extent of lesions in other cows varied slightly. Vaccination-site lesions in muscle were up to 15 mm long. Recurrent cows had mild-to-severe degeneration and necrosis of skeletal muscles of all limbs, which was interpreted as compressive myopathy of recumbent (downer) cattle. Because of neurovascular deficits,
10 cows died or were euthanized; 37 cows recovered sufficiently to be returned to the range. Most of the recovered cows calved normally, although 6 months after vaccination, many cows had mild persistent weakness, ataxia, and areoophagy of the hind limb muscles.

In addition to lesions observed on postmortem examination, high activity of muscle-associated enzymes in serum of clinically normal and lame cows was further evidence of muscle damage in the hind limb (Table 1). Intramuscular injections can cause high creatine kinase activity, but the serum half-life of this enzyme is only 4 hours. Therefore, high creatine kinase activity 5 to 6 weeks after vaccination was indicative of continuing damage to muscle, consistent with persistent inflammation at injection sites. The greatest activities were observed in paraplegic cows, attributable to superimposed generalized myopathy secondary to prolonged recumbency.

The E coli/Campylobacter bacteria apparently induced severe inflammation in these cows. Lameness and paraparesis were caused by entrapment of spinal nerve roots and compression of the spinal cord as a consequence of administration of the bacteria near the vertebral column. The bacterium could have been contaminated by live microbial agents (before use or during administration), but we were unable to find evidence of this. Bacteria were not found on microbial culture of samples from the bacterium and from lesions, and special histologic stains did not reveal any organisms. Antibiotic treatment of some of the affected cows did not have obvious clinical effect.

In a previous report,1 vaccination into paravertebral muscles of guinea pigs induced granulomatous myositis, compressive pachymeningitis, and paraparesis. The authors...
speculated that vaccine components had migrated into the vertebral canal. Granulomatous inflammation extending into the vertebral canal also has been found in chicken hatchlings following vaccination into cervical muscles. The episode in the cattle of this report appeared to be similar to the problems in guinea pigs and chicks. In the cattle, inflammatory nodules surrounded clear spaces that most likely represented remnant emulsion from the oil adjuvant.

Veterinarians, livestock producers, and the meat industry must weigh the costs and benefits of routine administration of vaccines known to cause marked swelling in cattle, because the amount of local inflammation incited by vaccines in livestock is not closely regulated. Although vaccine adjuvants that cause marked or prolonged inflammation are intended to promote an enhanced immune response of long duration, reduction of carcass yield and lameness are possible negative consequences of titration of initiating products. The intended fate of livestock, therefore, should be carefully considered when selecting vaccine products. Vaccine-induced inflammation severe enough to cause scarring in meat is undesirable, especially when it develops in animals intended for market. Similar histologic lesions in animals used primarily for breeding, although not desirable, may be less objectionable. Vaccination into paravertebral muscles in risky in any type of animal because of possible extension of inflammation through intervertebral foramina.

References

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