

Diagnostic Ultrasound in the Investigation of Septic Tenosynovitis of the Digital Flexor Tendon Sheath In 33 Cattle

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Abstract

Clinical, radiographic, sonographic, centesis and intraoperative findings in 33 cattle with septic tenosynovitis of the digital flexor tendon sheath were evaluated retrospectively. A unilateral septic tenosynovitis was diagnosed in 13 cattle. In 20 cattle the contralateral digital flexor tendon sheath or one or more of digital joints were affected additionally. Using diagnostic ultrasound (7.5 MHz linear scan), the distended compartments of the digital flexor tendon sheath and, if affected, the distended digital joint recesses could be determined accurately. Depending on the type of inflammation (serous, fibrinous, purulent) the compartments and recesses were filled with anechoic, heterogeneous hypoechoic or echogenic inflammatory exudate. Involvement of the 3 compartments of the tendon sheath varied. Flow-phenomena within the synovial cavity were observed in all cases with liquid effusion. Ultrasonography provided accurate preoperative details of pathological alterations of tendon sheaths, tendons and adjoining digital joints.

Introduction

Septic tenosynovitis of the digital flexor tendon sheath is a frequent cause of bovine lameness. Common origins of septic tenosynovitis in cattle are puncture wounds or purulent claw disorders penetrating into the tendon sheath. Haematogenous infections were rarely reported (Van Pelt 1970, Dirksen 1978, Greenough *et al.* 1981, Stanek 1987/88). Differential diagnostic problems occur, especially in patients with swelling of the whole digit, if both tendon sheaths or one of the digital joints are affected. Radiography often reveals no addi-

tional findings, and centesis can fail, if the synovial cavity is not filled with liquid inflammatory effusion (Dirksen 1978, Greenough *et al.* 1981, Stanek 1987/88, Kofler 1994). Early diagnosis and treatment, however, is important for successful recovery of the patient.

In musculoskeletal disorders of man and the horse, diagnostic ultrasound has proven to be of paramount importance for soft tissue differentiation, adding information to the clinical and radiographic examination (Sattler and Harland 1988, Denoix *et al.* 1991, Marr 1992, Bonnaire *et al.* 1994, Chem *et al.* 1994, Redding 1994). In our clinic, ultrasonography has been used as an additional approach in the diagnosis of septic tenosynovitis of the digital flexor tendon sheath in cattle since 1992 (Kofler and Edinger 1992, 1995, Kofler 1994).

The objective of this study is to present the sonographic findings of septic tenosynovitis of the digital flexor tendon sheath in thirty three cattle, pointing out the diagnostic advantages when using diagnostic ultrasound.

Materials and Methods

Thirty three cattle, showing unilateral or bilateral septic tenosynovitis of the digital flexor tendon sheath were selected for this retrospective study (1992-1994). Clinical, radiographic, ultrasonographic, centesis and intraoperative findings were evaluated. After the clinical orthopaedic and radiographic examination, the evident swelling was investigated sonographically. The animal was fixed in lateral recumbency using a hydraulic surgical table, the distal limb region was shaved, cleaned and examined using a real-time ultrasonic machine (Sonoscope 3[®], Kranzbühler, Germany) with a 7.5 MHz linear-transducer in transverse and longitudinal planes. Videotapes and a video copy processor served

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for documentation. The tendon sheath area and the adjoining digital joints were scanned, starting at the bifurcation of the digital flexor tendons and continuing to the distal end of the tendon sheath in the pastern region. The digital joint pouches were scanned in transverse and longitudinal planes from the dorsal, palmar/plantar, lateral and medial aspects. Echogenicity, echopattern of synovial effusion and of tendons, degree of distension, and demarcation of the synovial cavity from the peritenosynovial tissue, acoustic enhancement and flow-phenomena were assessed. Centesis of the affected digital flexor tendon sheath and macroscopical and bacteriological examination of the synovial samples completed the diagnosis. Clinical, centesis and intraoperative findings were compared with the sonographic results to establish the characteristic sonomorphology of the various types of exudative inflammation of the bovine digital flexor tendon sheath.

Results

A total of 56 synovial cavities of the digital area were affected in 33 cattle: 13 cattle suffered from a unilateral septic tenosynovitis, in 20 cattle at least one adjoining synovial cavity was involved: the contralateral digital flexor tendon sheath (8) or one or more of the ipsilateral digital joints (12). The patients showed a lameness grade 2 to 4 (of 4 grades) and variable large and painful swelling over the plantar/palmar digital and metatarsal/metacarpal region. As origin of septic tenosynovitis of the digital flexor tendon, sheath puncture wounds, laceration wounds and complicated sole ulcers were assessed. Radiography showed the soft tissue swelling in all cases, and increased width of a digital joint space in 11 patients.

In all 33 cattle, the distended digital flexor tendon sheath cavity and the involved digital joint recesses showed an effusion of varying echogenicity, depending on age and type of the exudative inflammation. The 3 compartments of the digital flexor tendon sheath were imaged as more or less distinctly demarcated from the surrounding soft tissue, depending on the echogenicity of the effusion. The compartments were not always distended similarly; in some cases only a distension of one compartment, or of two compartments or of a part of the outer proximal compartment only was ascertained.

By means of centesis, samples of 27 out of 33 cases could be aspirated. In 6 cases no samples were yielded; intraoperative inspection revealed fibrinous and purulent-necrotizing inflammations of the digital flexor tendon sheath and the tendons. Bacteriological examination showed positive results in 22 out of 33 cases.

The comparison of the centesis and intraoperative findings with the sonographic features showed the following: purely anechoic fluid accumulations in the affected digital flexor tendon sheath and in the digital

joint recesses with dorsal enhancement could be observed when plenty of serous and serofibrinous exudate was present. A heterogeneous anechoic, hypoechoic or partly echogenic content could be documented if clotted fibrino-flocculent debris in the serofibrinous synovial content or highly viscous purulent effusion was present. Flow-phenomena were revealed in all cases with liquid inflammatory effusion by imaging of the floating, echogenic and hyperechoic particles in the anechoic inflammatory synovial fluid. Anechoic to less hypoechoic areas without flow-phenomena and without dorsal enhancement were observed if there were clotted fibrinous masses in the digital flexor tendon sheath and in the involved joint recesses. With duration of the inflammation, clotted fibrinous masses showed an increased echogenicity due to organization. An increased amount of synovial content with a heterogeneous echogenicity and loss of the clear outline and normal shape of the flexor tendons was assessed in patients with advanced purulent and necrotizing tenosynovitis. Hypoechoic to echogenic clots adhering to the flexor tendons and to the wall of the flexor tendon sheath were sonopathological findings corresponding to fibrinous adhesions. Regional loss of the tendon echogenicity and of the strong linear pattern was assessed in advanced inflammatory processes where a purulent tendinitis besides the purulent tenosynovitis was present. In one patient with a purulent tenosynovitis caused by a puncture wound, an anechoic core lesion of 7 mm in diameter in both the superficial and the deep digital flexor tendons was detected.

Anechoic vessels of 3 to 5 mm in diameter were imaged in the palmar/plantar midline of the digital flexor tendon sheath area proximal to the accessory digits in cases of purulent and necrotizing inflammation of the digital flexor tendon sheaths. Further ultrasonic findings were anechoic zones in the subcutaneous tissue located between the echogenic skin surface and the clearly demarcated borders of the distended synovial cavities, representing an inflammatory edema.

Discussion

The superficial and the deep digital flexor tendon, the branch of the suspensory ligament to the superficial digital flexor tendon (manica flexoria) and the suspensory ligament can be distinguished as highly echogenic structures with a strong linear pattern of the parallel fiber bundles (Kofler and Edinger 1992, 1995, Kofler 1994). It has been reported that only cavities distended experimentally or with inflammatory fluid can clearly be differentiated sonographically (Denoix *et al* 1991, Redding 1994, Kofler and Edinger 1992, 1995). In healthy bovine limbs, the lumen and the borders of the digital flexor tendon sheath and the various compartments cannot be imaged with the exception of the dorsal

portion of the outer proximal compartment, which appears as a small anechoic area, clearly demarcated from the adjoining echogenic soft tissue (Kofler and Edinger 1995).

The application of diagnostic ultrasound in septic bovine tenosynovitis of the digital flexor tendon sheath allowed the imaging of all soft tissue structures in the distal limb and of the distended compartments (outer proximal, inner proximal and distal compartment) of the tendon sheath (Kofler 1994). The affected synovial cavities, distended due to accumulation of inflammatory effusion, could be clearly documented by ultrasonography in all patients. Due to soft tissue differentiation, the ultrasonographic investigation facilitated the preoperative diagnosis by helping to determine the extent of inflammation and the consistency of the inflammatory effusion in the digital flexor tendon sheath. Possible concurrent inflammation adjacent to the area being examined could be found, which had gone unnoticed at the clinical examination (Kofler and Edinger 1995). Moving the transducer during the sonographic examination in order to induce a fluctuation of the effusion ("sonopalpation") helps to differentiate between liquid effusion and semisolid or solid masses of clotted fibrin, which is important information for the choice of treatment. The ability to identify the character of effusion of infected tendon sheaths by this non-invasive technique is an important advantage of diagnostic ultrasound, particularly if centesis does not provide samples in cases of high viscous purulent effusion, clotted fibrinous masses or masses of necrotic tissue.

Ultrasonography is definitely superior to radiography when used for examining diseases of the digital flexor tendon sheath or other soft tissue disorders (Kofler 1994, Redding 1994, Kofler and Edinger 1995). For

evaluation of the synovial effusion, echogenicity, flow-phenomena and acoustic enhancement are suitable (Sattler and Harland 1988, Bonnaire *et al.* 1994, Chem *et al.* 1994, Redding 1994). The application of diagnostic ultrasound in bovine patients suffering from septic tenosynovitis of the digital flexor tendon sheath allows a more comprehensive clinical image of the disease and therefore a more accurate diagnosis. This is essential for appropriate planning of the therapy.

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