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## Rumen perforation caused by horn injury in two cows

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**Abstract:** Post-operative complications of trocarisation and rumenotomy are the most common causes of peritonitis associated with a rumen disorder. Since horn injury leading to rumen perforation has not previously been reported in the literature, two cows with this condition are reported. Small superficial skin lesions were observed in one of the cows and the other had a perforating skin lesion in the left abdomen. Both cows had signs of hypovolaemic shock. Ultrasonography revealed hypoechoic fluid, echoic lesions and occasional fibrinous septa caudoventral to the reticulum. Caudally the fluid extended to the left flank fold and occupied about one third of the peritoneal cavity. The area of the skin perforation in the left abdomen was swollen and the muscle layers could not be differentiated using ultrasonography. Diffuse fibrino-purulent peritonitis was diagnosed in both cows, and because of a poor prognosis, they were euthanased and necropsied. Perforation of the abdominal wall and rumen with diffuse fibrino-purulent peritonitis was present. Ultrasonography is a suitable tool to characterise the inflammatory lesions between the rumen and left abdominal wall and objectify the interpretation of clinical findings. Horn injury should be included in the rule outs for cattle with left abdominal skin wounds and diffuse peritonitis.

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1 Rumen perforation caused by horn injury in two cows

2

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## 18 **Abstract**

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20 of peritonitis associated with a rumen disorder. Since horn injury leading to rumen perforation  
21 has not previously been reported in the literature, two cows with this condition are reported.  
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31 inflammatory lesions between the rumen and left abdominal wall and objectify the  
32 interpretation of clinical findings. Horn injury should be included in the rule outs for cattle  
33 with left abdominal skin wounds and diffuse peritonitis.

34 **Keywords:** Ultrasonography, Cattle, Rumen, Perforation, Trauma, Horn injury, Peritonitis

## 35 **Background**

36 Disorders of the rumen are rarely associated with generalised or severe peritonitis in cattle.  
37 Cases are usually characterized by suppurative inflammation between the rumen and serosal  
38 surface of the left abdominal wall, or occasionally an empyema, which in severe cases can  
39 extend from the diaphragm to the pelvic inlet [1]. The most evident clinical signs are  
40 associated with localised or sometimes generalised peritonitis [1-4] and include decreased  
41 appetite and milk production, recurrent tympany, diarrhea or constipation, arched back,

42 weight loss and decreased rumen motility. Diagnosis can be confirmed by blind  
43 abdominocentesis at a site in the left paralumbar fossa or in a caudal intercostal space [1]; this  
44 allows the escape of foul-smelling gas and malodorous watery to viscous exudate. Before the  
45 introduction of ultrasonography into veterinary medicine, an exploratory laparotomy was the  
46 only method to determine the extent of the lesions *in vivo*. Today, ultrasonography is the  
47 method of choice for evaluation of peritonitis and for guiding collection of fluid via  
48 abdominocentesis [5]. Trocarisation and rumenotomy are the most common causes of  
49 peritonitis associated with a rumen disorder [1,2]. In rare cases, transmural necrosis associated  
50 with ruminitis can lead to perforation of the rumen wall. Horn injuries are uncommon because  
51 the majority of cows kept in freestall operations have been dehorned; in Switzerland, more  
52 than 90 % of dairy cows in freestall operations have been dehorned. Nevertheless, horned  
53 cows pose a significant risk of injury to other cows. As horn injury causing rumen perforation  
54 has not been reported yet, the goal of this study was to describe the clinical, ultrasonographic  
55 and pathological findings in two Brown Swiss cows with this type of injury. Both cows were  
56 referred to the Department of Farm Animals, University of Zurich, for examination.

## 57 **Case presentation**

58 Cow 1 was a six-year- old Brown Swiss cow from a freestall operation with 25 horned cows.  
59 The cow had calved unassisted 6 weeks before referral and had incurred a horn injury to her  
60 udder and left lateral abdominal wall from another cow two weeks before referral. Bloody  
61 milk was observed at milking, and anorexia, groaning and ruminal atony were noted two days  
62 before referral. At the time of admission to the clinic, the general health of the cow was  
63 markedly disturbed and anorexia and frequent bruxism were observed. There was  
64 enophthalmus, congestion of the scleral blood vessels and a decrease in skin turgor and skin  
65 temperature. The heart rate was markedly increased (104 bpm), and the rectal temperature  
66 was decreased (37.9°C). There was a distinct decrease in ruminal contractions, the rumen was

67 fuller than normal and its contents were hard. The withers pinch test elicited grunting, and  
68 abdominal guarding was present. Intestinal motility was decreased, and only a small amount  
69 of dry faeces was present in the rectum. Multiple, small, superficial skin wounds were  
70 observed on both sides of the body.

71 Cow 2 was an eight-year-old Brown Swiss cow from a freestall operation with 30 horned  
72 cows. The cow had calved 8 weeks before referral. The owner noticed a decrease in appetite  
73 several days before referral as well as superficial skin lesions on the left side of the body,  
74 which were thought to be due to a horn injury from another cow. Clinical examination at the  
75 time of admission revealed anorexia and severely disturbed general health. The cow had  
76 tachycardia (104 bpm) and a decreased rectal temperature (37.5°C). There was enophthalmus,  
77 congestion of the scleral blood vessels and a decrease in skin turgor and skin temperature. The  
78 rumen was fuller than normal and atonic, intestinal motility and the amount of faeces in the  
79 rectum were decreased and abdominal guarding was present. Transrectal palpation was  
80 difficult because of the increased size of the rumen and its hard contents. A perforating wound  
81 with a diameter of 0.5 cm was present in the 12th intercostal space at the level of the mid-  
82 thorax on the left side. There was swelling of the skin and mild subcutaneous emphysema in  
83 the region of the wound.

84 Haemoconcentration, leukopenia with a left shift, hypokalaemia, hypophosphataemia and  
85 mild metabolic acidosis were seen in both cows (Table 1). Other findings included  
86 hypoproteinaemia (Cow 1), hyponatraemia (Cow 2) and hypocalcaemia (Cow 1). A sample of  
87 rumen fluid collected with a stomach tube had a normal colour, odour and chloride  
88 concentration (cow 1, 26 mmol/l; Cow 2, 19 mmol/l), an increased pH (Cow 1, pH of 9; Cow  
89 2, pH of 8) and increased time (> 6 minutes) for methylene blue reduction testing in both  
90 cows.

91 Ultrasonographic examination of Cow 1 revealed a marked decrease in reticular motility and  
92 hypoechoic fluid with a heterogeneous appearance and echoic fibrin caudoventral to the

93 reticulum. Caudally, the fluid extended to the left flankfold and occupied the bottom third of  
94 the abdominal cavity. There was atony, mild dilatation and thickening of the wall of the small  
95 intestines, and fibrin was observed between loops of intestines. Ultrasonographic examination  
96 of Cow 2 also showed a marked decrease in reticular motility, and hypoechoic fluid with a  
97 heterogeneous appearance and echoic fibrin caudoventral to the reticulum (Fig. 1). The fluid  
98 extended to the left flankfold caudally and occupied the bottom third of the abdominal cavity  
99 (Fig. 2). Ultrasonography showed that the thickness of the skin was 2.8 cm cranial to the  
100 perforation and 3.3 cm in the area of the perforation in Cow 2. The skin and muscle layers  
101 could easily be differentiated in unaffected areas, but diffuse changes were seen around the  
102 wound and the individual muscle layers could not be differentiated (Fig. 3). Emphysema and  
103 fluid accumulation were also present. The ultrasonographic appearance of the small intestines  
104 was similar to that of Cow 1 with atony and thickening of the intestinal wall (Fig. 4).  
105 Abdominocentesis in Cow 2 yielded yellowish-green, turbid, odourless fluid with a specific  
106 gravity of 1.038 and a protein concentration of 55g/l. Radiographs of the reticulum did not  
107 show a reticular foreign body in either cow.

108 Suppurative fibrinous peritonitis was diagnosed, and because of the severity of lesions, both  
109 cows were euthanased and necropsied. A partially-healed scar, 4 cm in length, was seen in the  
110 left ventral abdomen approximately 25 cm cranial to the udder in Cow 1. The muscle layers  
111 underneath the scar were necrotic and lacerated up to the rumen wall, which had a perforation  
112 of 3 cm in diameter (Fig. 5). The rumen wall ventral and lateral to the perforation was covered  
113 with feed particles. Yellowish fibrino-purulent exudates were evident cranial to the  
114 perforation. The peritoneal cavity was filled with yellow, turbid, foul-smelling fluid mixed  
115 with feed. In Cow 2, the skin and abdominal wall of the last intercostal space at mid-level was  
116 perforated. The traumatised area was thickened, necrotic and emphysematous. There was a  
117 matching perforation in the rumen wall (Fig. 6) and extensive adhesions were present between  
118 the rumen and abdominal wall. A 6 x 12 cm blood clot was present in the area of the

119 perforation (Fig. 7). The peritoneal cavity and omental bursa contained yellow fluid and fibrin  
120 but no feed particles were seen. The definitive diagnosis was peritonitis attributable to rumen  
121 perforation.

122 Hypothermia, tachycardia, enophthalmus and reduced skin turgor were indications of shock,  
123 which was most likely the result of severe inflammation caused by rumen contents in the  
124 abdomen and bacterial infection in both cows. The clinical findings were similar to those  
125 reported in cows with peritonitis localised in the left abdominal cavity and associated with  
126 rumenotomy, caesarian section and rumen trocarisation. Distension of the left flank, as  
127 reported previously, was not seen in the two cows of the present study [5]. Cow 2 had an  
128 obvious perforating skin lesion and Cow 1 had multiple skin lesions suggesting that she had  
129 been injured by one or more cows. Compared to the number of reports on humans injured  
130 while in the presence of cows as well as during bull fighting [10-15], there are few  
131 descriptions of horn injuries in cattle. Implantation of a synthetic mesh has been described for  
132 repair of abdominal wall ruptures caused by horn injuries in cattle but without involvement of  
133 internal organs [6]. In three of four cows with perforating head wounds, a horn injury from  
134 another cow was thought to be the cause [7]. Horn injuries are common during transport of  
135 horned cattle [8]) and bruising occurs more often among horned slaughter cattle compared  
136 with cattle without horns. Injuries may occur at sale barns and during loading, shipping,  
137 unloading and penning before the cattle are slaughtered [9].

138 Ultrasonography of the left flank and caudal intercostal spaces revealed inflammatory lesions  
139 of varying severity between the rumen and left abdominal wall in both cows. The  
140 accumulated fluid had displaced the rumen medially, and the lesions appeared similar to those  
141 seen in cows with peritonitis associated with rumenotomy or rumen trocarisation [5]. A  
142 tentative diagnosis of trauma was easily made after seeing the abdominal wall lesions on  
143 ultrasonograms in Cow 2. In cattle with fluid accumulation between the rumen and left  
144 abdominal wall the differential diagnosis also should include complications of trocarisation,

145 surgery, severe reticuloperitonitis, omental bursitis and perforating abomasal ulcer. Left  
146 displacement of the abomasum should be ruled out when a structure is seen between the  
147 rumen and left abdominal wall [16]. However, for the experienced clinician, differentiation of  
148 peritonitis and abomasal displacement is not difficult.

149 The results of haematological analysis aided in determining the severity of the illness. Severe  
150 haemoconcentration in both cows was indicative of shock, and leukopenia with a left shift  
151 was a reflection of neutrophil demand in the peritoneal cavity that overwhelmed the  
152 production capacity of the bone marrow. Hypoproteinaemia in Cow 1 was attributable to loss  
153 of protein into the peritoneal cavity in association with peritonitis. Both cows had anorexia,  
154 which resulted in hypokalaemia and hypophosphataemia because of inadequate dietary intake.

## 155 **Conclusions**

156 This case report confirms that ultrasonography is an ideal tool for characterisation of lesions  
157 located between the rumen and left abdominal wall and aids in the objective interpretation of  
158 clinical findings. Horn injury should be part of the differential diagnosis in cattle with skin  
159 wounds and severe localised peritonitis.

## 160 **Competing interests**

161 The authors declare that they have no competing interests.

## 162 **Authors' contributions**

163 UB was responsible for oversight of the treatment of the cows and he wrote and initiated the  
164 submission of the manuscript. UB, CG, MS and DG carried out the clinical and  
165 ultrasonographic examinations. TS carried out the postmortem examinations. All authors have  
166 read and approved the manuscript.



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175 **References**

176 1. Dirksen G. Krankheiten von Gekröse, Bauchfell und Bauchwand. In: Dirksen G, Gründer

177 HD, Stöber M, editors. Innere Medizin und Chirurgie des Rindes. Berlin: Parey

178 Buchverlag; 2002. p. 667-95.

179 2. Radostits OM, Gay CC, Hinchliff KW, Constable PD. Diseases of the rumen, reticulum

180 and omasum. In: Radostits OM, Gay CC, Hinchliff KW, Constable PD, editors.

181 Veterinary Medicine. A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs, and

182 Goats. Philadelphia: Saunders Elsevier; 2007. p. 311-53.

183 3. Fecteau G. Peritonitis in the ruminant. In: Smith BP, editor. Large Animal Internal

184 Medicine. St Louis: Elsevier Mosby; 2015. p. 807-10.

185 4. Francoz D, Guard CL. Traumatic reticuloperitonitis (hardware disease, traumatic

186 reticulitis). In: Smith BP, editor. Large Animal Internal Medicine. St Louis: Elsevier

187 Mosby; 2015. p. 805-7.

188 5. Braun U, Pusterla N, Anliker H. Ultrasonographic findings in three cows with peritonitis

189 in the left flank region. Vet Rec. 1998;142:338-40.

- 190 6. Koller U, Lischer CL, Auer J. Implantation von synthetischen Netzen zum Verschluss  
191 von Bauchwandrupturen in der ventralen Flanke bei der Kuh: Eine retrospektive Studie  
192 über 16 Fälle. Schweiz Arch Tierheilk. 2001;143:351-8.
- 193 7. Braun U, Schweizer G, Pospischil A. Klinische Befunde bei vier Rindern mit offener  
194 Gehirnverletzung. Tierärztl Prax. 2003;31(G);183-6.
- 195 8. Minka NS, Ayo JO. Effects of loading behaviour and road transport stress on traumatic  
196 injuries in cattle transported by road during the hot-dry season. Livest Sci. 2007;107:91-  
197 5.
- 198 9. Strappini AC, Metz JHM, Gallo CB, Kemp B. Origin and assessment of bruises in beef  
199 cattle at slaughter. Animal. 2009;3:728-36.
- 200 10. Helbig H, Iseli HP. Traumatic rupture of the globe caused by cow horns. Eur J  
201 Ophthalmol. 2002;12:304-8.
- 202 11. Martínez-Ramos D, Miralles-Tena JM, Escrig-Sos J, Traver-Martínez G, Cisneros-Reig I,  
203 Salvador-Sanchís JL. Heridas por asta de toro en el Hospital General de Castellón.  
204 Estudio de 387 pacientes. Cir Esp. 2006;80:16-22.
- 205 12. Khan MM, Ahmed SM, Shakeel M, Hasan A, Singh SP, Siddiqi MM. Complication  
206 following primary repair of a penetrating bull horn injury to the trachea. J Emerg Trauma  
207 Shock. 2008;1:123-5.
- 208 13. Alvarez-Bandrés S, Jiménez-Parra JD, García-García D, Cebrián-Lostal JL, Torres-Varas  
209 L, Jiménez-Calvo JM. Extraperitoneal bladder perforation by bull horn. Arch Esp Urol.  
210 2011;64:75-6.
- 211 14. Gupta A, Sharma, C, Soni A, Gupta B, Thusoo M. Unusual lower genital tract injury  
212 caused by bull's horn: prolapse of small intestine through vagina - first case report in  
213 literature. Arch Gynecol Obstet. 2012;286:803-4.
- 214 15. Ibrahim O, Olusanya B. Occupational cow horn eye injuries in ibadan, Nigeria. Ann Med  
215 Health Sci Res. 2014;4:959-61.

216 16. Braun U. Ultrasonography of the gastrointestinal tract in cattle. *Vet Clin North Am Food*  
217 *Anim Pract.* 2009;25:567-90.

## 218 **Figures**

219 **Figure 1 - Ultrasonogram reticulum.** Ultrasonogram showing peritonitis caudal to the  
220 reticulum in cow 2. The view was obtained from the sternal area using a 5.0-MHz convex  
221 transducer. The three layers of the reticular wall (tunica serosa, tunica muscularis, tunica  
222 mucosa) are visible because of fluid accumulation. The abomasum is dilated and one echoic  
223 abomasal fold is seen. Hypoechoic fluid with a fibrin strand is evident caudal to the reticulum  
224 and ventral to the abomasum. 1 Ventral abdominal wall, 2 Musculophrenic vein, 3  
225 Diaphragm, 4 Reticulum, 5 Abomasum, 6 Echoic cell-rich fluid ventrally, 7 Fibrin strand, 8  
226 Hypoechoic cell-poor fluid, Cr Cranial, Cd Caudal.

227 **Figure 2 - Ultrasonogram showing peritonitis between the rumen and left abdominal**  
228 **wall.** Ultrasonogram showing peritonitis between the rumen and left abdominal wall in cow 2.  
229 The view was obtained using a 5.0-MHz convex transducer placed in the 12th intercostal  
230 space (lower third) on the left side. A large amount of hypoechoic fluid containing echoic  
231 fibrin is evident between the rumen and left abdominal wall. 1 Abdominal wall, 2 Fluid  
232 accumulation, 3 Fibrin, 4 Greater omentum, 5 Rumen wall, Ds Dorsal, Vt Ventral.

233 **Figure 3 - Ultrasonogram of the abdominal wall in the area of skin perforation.**  
234 Ultrasonogram showing the abdominal wall in the area of a skin perforation in cow 2. A 5.0-  
235 MHz convex transducer was used, and the muscle layers and abdominal wall cannot be  
236 differentiated because of trauma-induced changes. Gas inclusions and fluid also are  
237 apparent. 1 Abdominal wall, 2 Gas inclusions, 3 Fluid, 4 Rumen wall, Ds Dorsal, Vt Ventral.

238 **Figure 4 - Ultrasonogram in the right flank showing peritonitis.** Ultrasonogram obtained  
239 using a 5.0-MHz convex transducer placed in the ventral right flank region in cow 2. The  
240 intestines are mildly dilated, have a thickened wall and contain fluid. Echoic fibrin is evident  
241 between loops of small intestines. 1 Abdominal wall, 2 Small intestines with thickened wall, 3  
242 Fibrin between loops of small intestines, 4 Rumen, Ds Dorsal, Vt Ventral.

243 **Figure 5 - Surface of the rumen with a perforating horn injury.** Surface of the rumen in  
244 cow 1 with a perforating horn injury (arrow). The rumen wall surrounding the perforation is  
245 covered with feed particles, and suppurative fibrinous adhesions are seen cranially.

246 **Figure 6 - Surface of the rumen with a perforating horn injury.** Surface of the rumen in  
247 cow 2 with a perforating horn injury (arrow). The surface is markedly reddened and covered  
248 with feed particles.

249 **Figure 7 - Blood clot on rumen contents present at the site of rumen perforation** (cow  
250 2). The blood clot resulted from the injury and partially sealed the rumen perforation.

251 **Tables**

252 **Table 1 - Laboratory findings on the day of admission in 2 cows with rumen perforation**  
 253 **caused by a horn injury.**

Variable	Cow 1	Cow 2	Normal range
Haematocrit (%)	49	45	30-35
Total leukocyte count (x 10 <sup>3</sup> /μl)	2.5	4.1	5.0-10.0
Total protein (g/l)	52	64	60-80
Fibrinogen (g/l)	2	4	4-7
Urea (mmol/l)	7.2	3.9	2.4-6.5
ASAT (U/l)	121	65	20-103
γ-GT (U/l)	13	26	9-30
Sodium (mmol/l)	141	137	145-155
Potassium (mmol/l)	3.0	2.5	4-5
Chloride (mmol/l)	94	98	96-105
Calcium (mmol/l)	1.76	4.47*	2.3-2.6
Inorg. phosphorus (mmol/l)	1.23	1.02	1.3-2.4
Magnesium (mmol/l)	0.82	1.97*	0.8-1.0
Rumen chloride (mmol/l)	26	19	15-30

254

255 \* The cow had been treated with 500 ml of a calcium borogluconate solution containing  
 256 magnesium hypophosphite administered intravenously by the referring veterinarian a few  
 257 hours before admission to the clinic