

## RVC OPEN ACCESS REPOSITORY – COPYRIGHT NOTICE

This is the peer-reviewed, manuscript version of an article published in *Veterinary Record*.  
The final version is available online: <https://doi.org/10.1136/vr.105468>.

The full details of the published version of the article are as follows:

TITLE: Ultrasonographic visualisation of the mesenteric vasculature in horses with large colon colic

AUTHORS: Manso-Díaz, G., Bolt, DM., López-Sanromán, J.

JOURNAL TITLE: *Veterinary Record*

PUBLISHER: BMJ Publishing Group

PUBLICATION DATE: 20 September 2019

DOI: 10.1136/vr.105468

3  
4 **Title**

5 **ULTRASONOGRAPHIC VISUALISATION OF THE MESENTERIC**  
6 **VASCULATURE IN HORSES WITH LARGE COLON COLIC**

7  
8 **Authors**

9 Gabriel Manso-Díaz<sup>1\*</sup>; David M. Bolt<sup>2</sup>; Francisco Javier López-Sanromán<sup>1</sup>

10  
11 <sup>1</sup>Hospital Clínico Veterinario Complutense, Universidad Complutense de Madrid, Avda.  
12 Puerta de Hierro s/n, 28040 Madrid, Spain.

13  
14 <sup>2</sup>Equine Referral Hospital, Royal Veterinary College, Hatfield AL9 7TA, United Kingdom.

15  
16 **\*Corresponding author email:** [gmanso@ucm.es](mailto:gmanso@ucm.es)

17  
18 **Abstract**

19 **Background:**

20 Ultrasonographic visualization of the mesenteric vasculature of the large colon (LC) from the  
21 right side of the abdomen in cases of displacement and volvulus has been described.  
22 However, the LC can move freely within the abdomen and its mesentery can potentially  
23 contact both sides of the abdominal wall.

24 **Methods:**

25 Thirty-four horses presented with LC -related colic that had visible LC mesenteric  
26 vasculature visible on abdominal ultrasound were included. A control group was made  
27 including horses with confirmed small intestinal-related colic. Our objective was to evaluate

28 the visibility of LC mesenteric vasculature with transabdominal ultrasonography in horses  
29 with LC-related colic and to determine its diagnostic value.

30 Results:

31 The LC mesenteric vasculature was identified on the right side of the abdomen in 16/34  
32 horses with right dorsal displacement of the LC (RDDLC), 180° LC volvulus (LCV), 540°  
33 LCV or LC impaction. On the left side of the abdomen LC mesenteric vessels were identified  
34 in 17/34 horses with left dorsal displacement of the LC (LDDLC), 180° LCV or RDDLC.  
35 Vessels were visualized on both sides in one horse with a 180° LCV. Presence of LC  
36 mesenteric vasculature in the dorsal aspect on the left side of the abdomen was significantly  
37 associated with LDDLC.

38 Conclusion:

39 LC mesenteric vasculature can be visualised on transabdominal ultrasound from either side of  
40 the abdomen in horses with different forms of LC-related colic.

41

## 42 **Introduction**

43 Large colon (LC) disorders represent more than 44% of the causes of colic in horses,<sup>1</sup> with  
44 displacement and volvulus of the ascending colon being most commonly diagnosed.<sup>2</sup>  
45 Ultrasonography is a fast and non-invasive imaging modality that is widely used in the  
46 diagnostic work-up of abdominal discomfort in horses. In conjunction with other clinical and  
47 laboratory findings, ultrasonography helps in the pre-operative identification of the source of  
48 acute abdominal pain,<sup>3</sup> as it provides real time information about the presence and  
49 characteristics of peritoneal fluid, gastric size and contents, intestinal motility and contents,  
50 as well as about intestinal wall thickness and diameter. The latter is considered of paramount  
51 importance in smaller or very large equine patients that cannot undergo effective rectal  
52 palpation.<sup>4</sup> Most clinicians consider it highly advisable to include ultrasonography routinely

53 in the examination of the equine acute abdomen because it helps to better identify conditions  
54 that may require surgical intervention.<sup>5</sup>

55 Vascular supply to the LC is provided by two arteries: the colonic branch of the ileocaecal  
56 artery and the right colonic artery (figure 1). These two vessels course in the mesocolon  
57 along the mesenteric border of the LC to the pelvic flexure where they anastomose.<sup>6</sup> During  
58 transabdominal ultrasonographic examination of a normally positioned LC, the luminal  
59 contents create an acoustic shadow that prevents visualisation of deeper structures, such as  
60 these mesenteric vessels. Ultrasonographic visualisation of the colonic mesenteric  
61 vasculature is possible if the LC is displaced and its mesenteric surface is in contact with the  
62 right abdominal wall, thereby exposing the normally invisible mesenteric vessels.<sup>7,8</sup> This  
63 feature has been reported as a specific ultrasonographic indicator of either a right dorsal  
64 displacement of the large colon (RDDLC) and/or a 180° large colon volvulus (LCV).<sup>8</sup> The  
65 lack of a mesenteric attachment in the abdomen allows the LC to move freely within this  
66 cavity<sup>6</sup> and makes it susceptible to several types of displacement and/or a volvulus.<sup>1</sup> The  
67 mesenteric border of the LC could therefore potentially also come in contact with the left  
68 abdominal wall, which would allow for ultrasonographic identification of the mesenteric  
69 vessels from the left side or from both sides of the abdomen in selected conditions.

70 The objective of the present retrospective study was to evaluate the transabdominal  
71 ultrasonographic visibility of the LC mesenteric vessels in horses with large colon colic and  
72 to determine its diagnostic value. We hypothesized that the LC colonic vessels can be  
73 visualised from the left or right side or both sides of the abdomen in horses with large colon  
74 colic, depending on the type of condition.

75

## 76 **Materials and Methods**

### 77 *Study population*

78 The clinical records at the (masked for peer review) between January 2013 and December  
79 2017 were reviewed. Horses with large colon-related colic and complete medical records,  
80 including transabdominal ultrasonography findings, were included in the study. Details  
81 obtained for each case included sex, age, breed, ultrasonographic findings, treatment  
82 (exploratory laparotomy or medical management), intraoperative and/or post-mortem  
83 findings, as well as final diagnosis.

84 A control group was made including horses referred in the same period of time for surgical or  
85 necropsy confirmed small intestinal-related colic.

86

#### 87 *Ultrasonographic examination*

88 All horses were examined using an ultrasound machine equipped with a 2.5-5 MHz  
89 curvilinear and a 7-12 MHz linear transducers (Logiq 5 Expert, GE Healthcare, Solingen,  
90 Germany) on admission to the hospital. The skin was wetted with alcohol without previous  
91 clipping to facilitate contact and image acquisition. All complete transabdominal  
92 ultrasonographic examinations were performed by a single examiner (GMD) in similar  
93 fashion, working from caudal to cranial over both the left and right sides of the thorax and  
94 abdomen.

95

#### 96 *Image analysis*

97 Ultrasonographic images were reviewed by two examiners (GMD and JLSR) simultaneously  
98 using a DICOM image viewing software (Osirix 10.0, Osirix Image processing Software,  
99 Geneva, Switzerland). Examiners were blinded to clinical presentation, other imaging  
100 findings and surgical or post-mortem findings prior to assessment, the results of which were  
101 recorded as a consensus statement. Large colon mesenteric vasculature was identified as the  
102 presence of 2 or more hypoechoic circular structures situated directly adjacent to the colon

103 wall (figure 2).<sup>8</sup> Care was taken to differentiate the colon mesenteric vessels from the lateral  
104 caecal vessels, which were identified close to the body wall, starting in the middle portion of  
105 the right flank, caudal to the costal arch. They coursed cranioventrally, lateral to the caecum  
106 and caudal to the costal arch. In the ventral abdomen, they continued further craniomedially  
107 up to the level of the caecal apex (figure 3).

108 Additionally, the following parameters were recorded: Localisation referred to the side  
109 (left/right/both) and the level (dorsal, middle or ventral aspect) of the abdomen where the  
110 large colon mesenteric vessels were identified with ultrasonographic examination. The three  
111 levels of the abdomen were allotted using two horizontal and parallel lines: line 1 – from the  
112 shoulder joint to the coxofemoral joint and line 2 - from the elbow joint to the stifle joint.  
113 Therefore, the dorsal portion corresponded to the area dorsal to line 1, the middle aspect  
114 corresponded to the area between line 1 and 2, and the ventral portion corresponded to the  
115 area ventral to line 2. The intercostal spaces where the vessels could be visualised were  
116 recorded, as well as the length, stated as the number of intercostal spaces from where the  
117 vessels were identified. Finally, the direction the vessels were followed ultrasonographically  
118 from the flanks was noted (vertical or horizontal).

119

#### 120 *Data analysis*

121 Continuous data were tested for normality and summarized as mean  $\pm$  SD or median (Range).  
122 Categorical data were summarized. Case and control groups were compared by Chi-square  
123 test. Fisher's exact test was used to test for association between visibility and localisation of  
124 large colon mesenteric vessels (side and level) and final diagnosis. An additional variable  
125 was created by combining the side and the level where the vessels were identified and  
126 compared to the diagnosis. A *P*-level of  $\leq 0.05$  was considered statistically significant. All

127 statistical analyses were performed using a commercially available statistical software (SAS  
128 9.4 software, SAS, version 9.4 for Windows, USA).

129

### 130 **Results**

131 Fifty-four horses met the inclusion criteria. Evaluated were 34 case horses (mean age of 8.81  
132 years,  $\pm$  4.64 years; range 5 months to 25 years; 13 geldings, 11 stallions and 10 mares; 11  
133 Spanish Pure Breed Horse, 8 Spanish Sport Horse, 8 Cross Breed Horse, 2 Lusitano, 1  
134 Warmblood, 1 Thoroughbred, 1 Selle Francais, 1 Arabian and 1 Draft Horse) and 20 control  
135 horses (mean age of 11.70 years,  $\pm$  6.29 years; range 2 to 23 years; 8 stallions, 7 geldings and  
136 5 mares; 10 Spanish Pure Breed Horse, 5 Spanish Sport Horse, 2 Thoroughbred, 1  
137 Warmblood, 1 Selle Francais and 1 Arabian).

138

139 Of the 34 cases, 26 horses underwent exploratory laparotomy, 6 horses were treated  
140 successfully with medical treatment and 2 horses were euthanized and necropsy subsequently  
141 was performed. A tentative diagnosis was achieved in the horses treated medically based on  
142 the clinical presentation and clinical findings.

143 The complete results are summarized in Table 1. Diagnoses at surgery included RDDLC (n =  
144 14), 180° LCV (n = 8), 540° LCV (n = 1) and left dorsal displacement of the large colon  
145 (LDDLC) (n = 3). Horses with medical treatment included LC impaction (n = 2), RDDLC (n  
146 = 1) and LDDLC (n = 3). A 180° LCV and a RDDLC were diagnosed in the horses that  
147 underwent necropsy.

148 Of the 20 horses included in control group, 18 horses underwent exploratory laparotomy and  
149 2 horses were euthanized and necropsy subsequently was performed. Diagnoses included  
150 inguinal hernia (n = 6), epiploic foramen entrapment (n = 6), volvulus (n = 4), strangulation  
151 by pedunculated lipoma (n = 2), mesenteric rent (n = 1) and ileal impaction (n = 1). Vessels

152 were identified on the ventral portion of the right side of the abdomen in a single horse (1/20,  
153 5%) with a jejunum volvulus.

154 Of 34 horses included in case group, the LC mesenteric vasculature was identified on the  
155 right side of the abdomen in 16/34 horses and on the left side of the abdomen in 17/34 horses.

156 In one horse with 180° LCV, the vessels were visualised on both sides of the abdomen. The  
157 LC mesenteric vasculature was distinctly different from the caecal vessels when it was  
158 identified on the right side of the abdomen. The vessels were identified through at least 2  
159 intercostal spaces, between 9<sup>th</sup> and 17<sup>th</sup> rib. In all cases but one horse with RDLLC, the LC  
160 mesenteric vasculature had a horizontal direction. On both sides, vessels were localized at the  
161 dorsal (n = 6), middle (n = 25) and ventral (n = 3) aspects of the abdomen.

162 When vessels were identified on the right side of the abdomen, diagnoses included RDDLC  
163 (11/16 horses), 180° LCV (2/16 horses), 540° LCV (1/16 horses) and LC impaction (2/16  
164 horses). When vessels were identified on the left side, diagnoses included LDDLC (6/17  
165 horses), 180° LCV (6/17 horses) and RDDLC (5/17 horses). Vessels were seen in both sides  
166 of the abdomen in a single horse with 180° LCV. No statistical significance was identified  
167 between the diagnosis and the side where the vessels were identified.

168 The identification of the colonic mesenteric vasculature was significantly associated with  
169 horses presented with large colon-related colic (case group) ( $p < 0.0001$ ). Furthermore, the  
170 identification of this mesenteric vasculature in the dorsal aspect on the left side of the  
171 abdomen was significantly associated with LDDLC ( $p < 0.0001$ ).

172

## 173 **Discussion**

174 The results of this study confirm our hypothesis that the LC mesenteric vasculature can be  
175 also visible with transabdominal ultrasonography from the left side of the abdomen in cases



176 of horses with LC colic. In 50% (17/34 horses) of the cases, vessels were identified from the  
177 left side, and in one additional horse, they were visible from both sides.

178 Previous studies have described visualisation of the LC mesenteric vasculature on the right  
179 side of the abdomen in horses with RDDLC and 180° LCV.<sup>7,8</sup> In the present study, LC  
180 mesenteric vessels were also identified from the right side in a horse with a 540° LCV and in  
181 two horses with LC impaction. With an intestinal rotation of 540° in case of an LCV, the  
182 mesenteric surface of the colon is in contact with the right abdominal wall. This could  
183 explain why the colon mesenteric vasculature was visualised at this location in one horse.

184 LC impaction occurs when ingesta cause an intraluminal obstruction. This condition does  
185 usually not involve displacement or torsion of the intestine.<sup>9</sup> The fact that the LC mesenteric  
186 vasculature was supposedly identified in two patients with LC impaction in our study should  
187 be interpreted carefully. In both cases, vessels were observed in the ventral aspect of the right  
188 side of the abdomen. This was unusual, as the majority of colonic mesenteric vessels in the  
189 other cases in the study were identified in the middle aspect of the flanks. Based on this  
190 unusual location, these vessels could potentially also have represented the lateral caecal  
191 vessels. However, the lateral caecal vessels were always visible in the right flank in addition  
192 to this extra vessel, and had a more ventromedial position in comparison to these vessels in  
193 question. It is conceivable that these vessels represent a branch of the lateral caecal vessels,  
194 also known as the artery and vein of the arch (figure 3). This specific branch passes along the  
195 lesser curvature at the base of the caecum and continues on the lateral aspect of the origin of  
196 the large colon.<sup>6</sup> The physiological position of the LC within the abdominal cavity in the  
197 horses with LC impaction might have allowed the visualization of these vessels, in contrast to  
198 the rest of the horses that had some kind of LC malposition. However, the exact relationship  
199 between LC impaction and the visualization of this additional vessel is unknown and it might  
200 be coincidental, as one of the control horses also showed a vessel in a similar position. A

201 previous study has reported the ultrasonographic identification of an additional vessel in the  
202 ventral aspect of the right side of the abdomen in horses with a variety of LC disorders. The  
203 authors also concluded that these vessels may not always be part of the LC mesenteric  
204 vasculature.<sup>10</sup> Ultrasonographic visualisation of vessels at the very ventral aspect of the right  
205 abdomen should therefore be carefully interpreted, as the vessels of the arch could represent a  
206 normal finding and should not be confounded with the LC mesenteric vasculature. Their  
207 more ventral location and the concurrent identification of the lateral caecal vessels might help  
208 the examiner with correct differentiation and interpretation of this finding.

209 In this study, the LC mesenteric vasculature was identified on the left side of the abdomen in  
210 horses with various LC conditions, including 180° LCV, RDDLC and LDDLC. This  
211 ultrasonographic finding has not previously been reported. If a LCV involves an intestinal  
212 rotation of 180° or 540°, the mesenteric surface of the colon contacts the abdominal wall.  
213 However, depending on where the volvulus occurs (at the base of the LC, at the level of the  
214 caecocolic ligament or at the sternal and diaphragmatic flexures) and the degree of gas  
215 distention, the actual LC segment that contacts the abdominal wall, as well as the side on  
216 which this contact occurs, can vary. In this study three different presentations of horses with  
217 LCV were seen, with the vessels being visible from either the right or the left side of the  
218 abdomen, or from both sides at the same time in a single horse. Similarly, location of LC  
219 segments can vary with RDDLC, where different configurations have been previously  
220 described.<sup>11</sup> This could explain why the colonic vessels were identified from either side of the  
221 abdomen in the present study. We therefore think that visualisation of the LC mesenteric  
222 vasculature on either side of the abdomen cannot be used as the only feature to differentiate  
223 between LCV and RDLLC, as previously described.<sup>8</sup>

224 Interestingly, identification of the colonic vasculature in the dorsal aspect of the left side of  
225 the abdomen was significantly associated with LDDLC. In all (6/34) horses with LDDLC

226 included in this study, LC mesenteric vessels were visualised at a left dorsal location, either  
227 medially to the dorsal border of the spleen or dorsal to it. With entrapment of the LC within  
228 the nephrosplenic space, it can mainly rotate along its long axis, thereby exposing the  
229 mesenteric side that contacts the medial surface of the spleen or the left dorsal body wall  
230 (figure 4). This could explain the consistent ultrasonographic features identified in the cases  
231 of LDDLC in our study.

232 Although in the majority of our cases the LC mesenteric vasculature was identified in the  
233 middle aspect of the flank, the cranial to caudal position and the number of intercostal spaces  
234 from which visualisation was possible differed considerably. A thorough and complete  
235 transabdominal ultrasonographic examination is therefore recommended. We think that use  
236 of limited examination protocols, such as the FLASH technique,<sup>12</sup> may not be thorough  
237 enough for this purpose and, in some cases, the LC mesenteric vessels may be missed.

238 It is important to note that occasionally LC mesenteric vasculature can also be identified in  
239 the absence of intestinal displacement or a torsion. The normal colonic contents usually  
240 create a strong acoustic shadow that precludes examination of the mesenteric intestinal  
241 wall.<sup>13</sup> However, if there are ingesta with a high fluid content in the LC lumen, it can be  
242 possible to visualise the mesenteric side of a normally positioned colon and, thus its  
243 mesenteric vasculature. However, in this situation, the LC mesenteric vasculature is  
244 identified at a deeper position and not in proximity to the body wall (figure 5).

245 A potential limitation of this study was the inclusion of horses that had a positive outcome  
246 with medical treatment and therefore lacked the diagnostic gold standard of surgical  
247 exploration or necropsy. This group contained 2 LC impactions, 1 RDDLC and 3 LDDLC.  
248 The authors decided to include these cases to demonstrate that identification of LC  
249 mesenteric vasculature does not necessarily imply the need for surgery. It has previously

250 been shown that some horses with LDDLC or RDDLC can be successfully treated with  
251 medical treatment.<sup>1</sup>

252 In summary, determination of the position of the LC in horses with acute abdominal pain is  
253 very useful when formulating a preoperative diagnosis and prognosis. Ultrasonographic  
254 identification of the LC mesenteric vessels through the body wall when the mesenteric aspect  
255 is situated against it is a particularly helpful feature. Visualisation of these vessels in the right  
256 side of the abdomen can be a predictor of RDDLC or 180° LCV.<sup>7,8</sup> However, to the best of  
257 our knowledge, this is the first description of transabdominal ultrasonographic visualisation  
258 of the LC mesenteric vasculature through the left side of the abdomen and that this should be  
259 considered an indicator of either LDDLC, RDDLC or 180° LCV in horses with LC colic.  
260 Additionally, identification of LC mesenteric vasculature in the dorsal aspect of the left  
261 abdomen appears highly suggestive of LDDLC.

262

### 263 **Acknowledgements**

264 The authors thank Ricardo García Mata for performing the statistical analyses of the data.

265

### 266 **Funding**

267 The authors have not declared a specific grant for this research from any funding agency in  
268 the public, commercial or not-for-profit sectors.

269

### 270 **Competing interests**

271 None declared.

272

### 273 **Welfare and ethics**

274 This is a retrospective case series. Explicit owner informed consent for inclusion of animals  
275 in this study was not stated.

276

## 277 **References**

278 1. Abutarbush S., Carmalt JL, Shoemaker RW. Causes of gastrointestinal colic in horses  
279 in western Canada: 604 cases (1992 to 2002). *Can Vet J* 2005;46:800–805.

280 2. Mair TS, Smith LJ. Survival and complication rates in 300 horses undergoing surgical  
281 treatment of colic. Part 1: Short-term survival following a single laparotomy. *Equine*  
282 *Vet J* 2005;37:296–302.

283 3. Cavalleri JMV, Bienert-Zeit A, Feige K. Untersuchung des akut kolikkranken Pferdes  
284 – labordiagnostische und bildgebende Verfahren. *Tierärztl Prax* 2012;41:124–134.

285 4. le Jeune S, Whitcomb MB. Ultrasound of the equine acute abdomen. *Vet Clin North*  
286 *Am Equine Pract* 2014;30:353–381.

287 5. Scharner D, Bankert J, Brehm W. Vergleich rektaler und sonographischer  
288 Untersuchungsbefunde bei der Kolik des Pferdes. *Tierärztl Prax* 2015;43:278–286.

289 6. Sisson S. Blood-vascular system of the horse. In: Sisson S, ed. *The anatomy of the*  
290 *domestic animals*. 2nd edn: W. B. Saunders Company, 1930:665-666.

291 7. Grenager, NS, Durham MG. Ultrasonographic evidence of colonic mesenteric vessels  
292 as an indicator of right dorsal displacement of the large colon in 13 horses. *Equine Vet*  
293 *J* 2011;43:153–155.

- 294 8. Ness SL, Bain FT, Zantingh AJ, *et al.* Ultrasonographic visualization of colonic  
295 mesenteric vasculature as an indicator of large colon right dorsal displacement or 180  
296 degrees volvulus (or both) in horses. *Can Vet J* 2012;53:378–382.
- 297 9. Dabareiner RM, White NA. Large colon impaction in horses: 147 cases (1985-1991). *J*  
298 *Am Vet Med Assoc* 1995;206:679–685.
- 299 10. Esmans MC, Evrard L, Etienne A-L, *et al.* Visualization of additional vessels in equine  
300 transabdominal ultrasound s s ' ss  
301 aise, Reims, France. 2012:324–325.
- 302 11. Southwood LL. Large colon. In: Auer JA, Stick JA, Kümmerle, JM, *et al*, eds. *Equine*  
303 *Surgery*. 5th edn: Elsevier Inc, 2019:591-621.
- 304 12. Busoni V, De Busscher V, Lopez D, *et al.* Evaluation of a protocol for fast localised  
305 abdominal sonography of horses (FLASH) admitted for colic. *Vet J* 2011;188:77–82.
- 306 13. Reef VB, Whittier M, Allam L. Sonographic evaluation of the adult abdomen. *Clin*  
307 *Tech Equine Pract* 2004;3:294–307.

308

### 309 **Figure legends**

310 Figure 1

311 Anatomical diagram of the blood supply of the ascending colon and the caecum (medial  
312 view). 1- cranial mesenteric artery; 2 - lateral caecal artery; 3 - medial caecal artery; 4 - colic  
313 branch of ileocaecocolic artery; 5- right colic artery. RDC – right dorsal colon; RVC – right  
314 ventral colon; LDC – left dorsal colon; LVC – left ventral colon; C – caecum.

315

316 Figure 2

317 Transverse ultrasonographic image obtained on the right 11th intercostal space of a horse  
318 with RDDLC, dorsal is to the left. The large colon mesenteric vasculature is identified as two  
319 hypoechoic circular structures (arrowheads), situated directly adjacent to the colon wall  
320 (arrows). Part of the liver is visible (asterisk).

321

322 Figure 3

323 Anatomical diagram of the caecum and the large colon from the right side, cranial is to the  
324 right. 1 – lateral caecal artery; 2 – artery of the arch. RDC – right dorsal colon; RVC – right  
325 ventral colon; C – caecum; D – duodenum; RK – right kidney.

326

327 Figure 4

328 A - Diagram of the position of the large colon in relation to the spleen (asterisks) with  
329 LDDLC with entrapment of the LC within the nephrosplenic space (caudal view). B and C –  
330 transverse ultrasonographic images obtained from the dorsal portion of the left side of the  
331 abdomen in two different horses with LDDLC, dorsal is to the left. The large colon  
332 mesenteric vasculature can be identified (arrowheads) dorsally (B) and medially (C) to the  
333 spleen (asterisk).

334

335 Figure 5

336 Transverse ultrasonographic image obtained on the right 16th intercostal space of a horse  
337 with diarrhoea, dorsal is to the left. The right ventral colon is filled with fluid content  
338 (asterisk) which allows for the large colon mesenteric vasculature to be identified in a deep  
339 position (arrowheads).

340

341 **Tables**

342 Table 1. Complete signalment, ultrasonographic parameters, treatment and final diagnosis of  
 343 the horses included in case group. EL, exploratory laparotomy; MM, medical management;  
 344 RDDLC, right dorsal displacement of the large colon; LDDLc, left dorsal displacement of  
 345 the large colon; LCV, large colon volvulus.

Horse	Age	Breed	Gender	Side	Level	Length	Direction	Treatment	Diagnosis
1	10 y	Spanish Pure Breed	Mare	Right	Middle	4	Horizontal	EL	RDDLc
2	5 y	Cross Breed	Gelding	Right	Middle	4	Horizontal	Euthanasia	RDDLc
3	7 y	Spanish Pure Breed	Stallion	Right	Middle	3	Horizontal	EL	RDDLc
4	9 y	Cross Breed	Gelding	Right	Middle	4	Horizontal	EL	RDDLc
5	6 y	Spanish Sport Horse	Mare	Right	Middle	7	Horizontal	EL	RDDLc
6	25 y	Spanish Pure Breed	Stallion	Right	Middle	4	Horizontal	MM	RDDLc
7	4 y	Spanish Sport Horse	Mare	Right	Middle	3	Horizontal	EL	RDDLc
8	11 y	Spanish Pure Breed	Gelding	Right	Middle	3	Vertical	EL	RDDLc
9	5 m	Spanish Sport Horse	Gelding	Right	Middle	3	Horizontal	EL	RDDLc
10	6 y	Lusitano	Mare	Left	Middle	7	Horizontal	EL	RDDLc
11	11 y	Spanish Pure Breed	Stallion	Left	Middle	4	Horizontal	EL	RDDLc
12	8 y	Cross Breed	Gelding	Left	Middle	8	Horizontal	EL	RDDLc
13	10 y	Draft horse	Gelding	Left	Middle	6	Horizontal	EL	RDDLc
14	11 y	Spanish Pure Breed	Stallion	Left	Dorsal	2	Horizontal	EL	LDDLc
15	7 y	Spanish Pure Breed	Stallion	Left	Dorsal	4	Horizontal	MM	LDDLc
16	8 y	Spanish Pure Breed	Stallion	Left	Dorsal	5	Horizontal	MM	LDDLc
17	10 y	Thoroughbred	Mare	Left	Dorsal	8	Horizontal	MM	LDDLc
18	11 y	Cross Breed	Gelding	Left	Dorsal	5	Horizontal	EL	LDDLc
19	9 y	Warmblood	Mare	Right	Ventral	3	Horizontal	MM	Colon impaction
20	17 y	Arab	Stallion	Right	Ventral	4	Horizontal	MM	Colon impaction



21	18 y	Cross Breed	Gelding	Right	Middle	7	Horizontal	EL	LCV
22	4 y	Spanish Pure Breed	Stallion	Right	Middle	8	Horizontal	EL	LCV
23	6 y	Spanish Pure Breed	Stallion	Right	Middle	6	Horizontal	EL	LCV
24	11 y	Spanish Pure Breed	Stallion	Left	Middle	4	Horizontal	Euthanasia	LCV
25	5 y	Lusitano	Stallion	Left	Middle	5	Horizontal	EL	LCV
26	13 y	Spanish Sport Horse	Gelding	Left	Middle	8	Horizontal	EL	LCV
27	11 y	Cross Breed	Gelding	Left	Middle	6	Horizontal	EL	LCV
28	7 y	Spanish Sport Horse	Mare	Left	Middle	2	Horizontal	EL	LCV
29	6 y	Spanish Sport Horse	Gelding	Left/Right	Middle	6	Horizontal	EL	LCV
30	10 y	Spanish Sport Horse	Mare	Left	Middle	2	Horizontal	EL	LCV
31	7 y	Spanish Sport Horse	Gelding	Right	Middle	10	Horizontal	EL	RDDL
32	2 y	Cross Breed	Mare	Right	Middle	9	Horizontal	EL	RDDL
33	7 y	Selle Francais	Gelding	Left	Dorsal	11	Horizontal	EL	LDDL
34	7 y	Cross Breed	Mare	Left	Middle	6	Horizontal	EL	RDDL

346