

Anatomy of the Gross Intestine of the Capybara (*Hydrochoerus Hydrochaeris*)

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Abstract: Problem statement: The anatomy of the gross intestine and its mesentery of the capybara (*Hydrochoerus hydrochaeris*) have not been described completely. **Approach:** In the present study, eight adult capybaras were studied using gross dissection. **Results:** The cecum was the largest part of the intestine and was divided into base, body and apex. The cecocolic fold joined the cecum to the full extent of the proximal loop of ascending colon. The ascending colon was divided into two ansae, one proximal and one distal or spiral. The distal ansa had a spiral arrangement and was placed cranially to the right, covered ventrally by the apex of the cecum. This ansa had a centripetal gyrus to the left, a central flexure and a centrifugal gyrus turning to the right that was continuous with the transverse colon in the right colic flexure. **Conclusion:** The gross intestine of the capybara was different to other previously studied rodents.

Key words: Rodentia, abdominal organs, mesentery, requires concise definitions, peritoneal folds, anatomical nomenclature, anaesthetic administered intravenously, digestive system

INTRODUCTION

The digestive anatomy has been studied in only a few species of the order Rodentia. Previous studies show demonstrate that species belonging to the order Rodentia have great differences in their intestinal anatomy (Bonfert, 1928; Snipes, 1979a; 1979b; 1981, 1982a, 1982b; Perrin and Curtis, 1980; Snipes *et al.*, 1988; 1990; Nieters *et al.*, 2003; Kotze *et al.*, 2006; Pérez *et al.*, 2008; 2009; 2011). Especially the cecum and ascending colon shows large differences among rodent species.

There is no consensus on the anatomical nomenclature for this species. The description of the anatomy of the digestive organs and the mesentery of the rodents requires concise definitions, particularly regarded to the divisions of the intestine. Pérez *et al.* (2005; 2007) have described the divisions of the intestine and the peritoneal folds of the *Oryzomys cuniculus* and recently the intestine and peritoneal folds of the nutria (Pérez *et al.*, 2008), *Ctenomys pearsoni* (Pérez *et al.*, 2009) and *Chinchilla lanigera* (Pérez *et al.*, 2011).

The capybara or carpincho (*Hydrochaeris hydrochaeris*) is a hindgut fermenter whose digestive efficiency is comparable to that of ruminants on similar diets (Borges *et al.*, 1996). It is the largest caecum

fermenter and uses coprophagy as part of its digestive strategy (Borges *et al.*, 1996).

In relation to the anatomy of digestive system of this species, the stomach was studied by Moraes *et al.* (2002; 2005). Freitas *et al.* (2008) published one paper related to the small intestine of the capybara. Oshio *et al.* (2004) published other work about biometrical aspects of the capybara's body and intestines with emphasis on cecal development. In spite of this we did not find any description of the anatomy of the gross intestine of the capybara.

The objective of this study is to give a complete and detailed description of the gross intestine of the capybara, with a defined nomenclature, in order to improve the existing knowledge on this species.

MATERIALS AND METHODS

The study was performed using eight healthy adult capybaras (four females and four males). All animals were bought from a breeding farm licensed by the Ministry of Livestock and Agriculture. They were euthanized with an overdose of fixed anaesthetic administered intravenously.

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All animals were promptly dissected fresh, without fixation. The ventral abdominal wall of each animal was removed and after the observation of the topography of the organs and the peritoneal folds, the intestinal tract was separated after sectioning the pylorus just before the duodenum and separating it from its attachments to the dorsal abdominal wall. The rectum was tied off at its union with the canal anal and transected. Pictures were taken with a Nikon D 80 digital camera. Terms were used in agreement with the NAV (2005).

After having dissected and analysed the intestines, a list of NAV-adapted terms regarding these organs was made up.

RESULTS

The large intestine was divided into cecum, colon, rectum and anal canal. The colon was divided in ascending, transverse and descending colon (Fig. 1 and 2).

The cecum commanded the abdominal topography, there was the largest part of the intestine and was divided into base, body and apex (Fig. 1 and 2). Haustras or sacculations and four taeniae were observed on the cecum. Taeniae can be called dorsal, ventral, lateral and medial. The medial had fixed to the cecocolic fold (Fig. 1), which joined the cecum to the full extent of the proximal loop of ascending colon. The four taeniae ended up joining variably between them at the apex. The ascending colon of capybara was divided into two ansae, one proximal and one distal or spiral (Fig. 1 and 2). The proximal loop was traveling from left to right, cranially to the base and body of the cecum, which joined by the cecocolic fold. This portion had two teniae that ended before the start of the second part or spiral handle. The proximal ansa had a fixed topography dependent of the cecum. The distal or spiral ansa had a spiral arrangement and was placed cranially to the right, covered ventrally by the apex of the cecum (Fig. 1 and 2). This ansa had a centripetal gyrus to the left, a central flexure and a centrifugal gyrus turning to the right that was continuous with the transverse colon in the right colic flexure (Fig. 2). The ascending colon had small haustras in its entirety. Taeniae were present in the proximal ansa of the ascending colon, but not in the distal ansa. The ascending colon had internal musculomucous reliefs, arranged as two longitudinal reliefs connected by transverse reliefs of variable dimensions (Fig. 3). These reliefs extended from the cecum to the beginning of the spiral ansa. The transverse colon received the insertion of the deep wall of the greater omentum which was occupied by the left lobe of the pancreas. This omental insertion extended from the right colic flexure to left colic flexure.



Fig. 1: Ventral view of the abdominal organs of the capybara. 1: Cecum, 2: Proximal ansa of ascending colon, 3: Distal or spiral ansa of ascending colon, 4: Teniae of the cecum, 5: Small intestine, 6: Stomach



Fig. 2: Ventral view of the cranial abdominal organs of the capybara. 1: Cecum, 2: Proximal ansa of ascending colon, 3: Distal or spiral ansa of ascending colon, 4: Teniae of the cecum



Fig. 3: Internal view of the ascending colon. Double arrows to bottom: longitudinal reliefs. Arrow to the left: Transverse relief

From this came the descending colon that was supported by a fairly wide descending mesocolon, allowing great mobility to this part of the intestine. The following list of terms in the style of the NAV (2005) summarizes the different parts of the large intestine of the capybara.

Intestinum crassum:

- Cecum [Caecum]
- Basis ceci [caeci]
- Corpus ceci [caeci]
- Apex ceci [caeci]
- Curvatura ceci [caeci] major
- Curvatura ceci [caeci] minor
- Taenia ceci [Taeniae caeci]
- Haustra ceci [caeci]

Colon:

Colon ascendens:

- Ansa proximalis coli
- Ansa distalis coli
- Flexura coli dextra
- Colon transversum
- Flexura coli sinistra
- Colon descendens
- Rectum

DISCUSSION

This study is a further contribution to the anatomy of the capybara. According to our knowledge, this is the

first anatomical description of the gross intestine of the capybara until now.

In the rabbit, the ileum, cecum and a part of the ascending colon are coiled together forming a spiral with one and a half loops (Barone, 1996). However, in the capybara, the cecum, ileum and the ascending colon were more separated and only the proximal ansa of ascending colon was joined by the cecocolic fold to the cecum.

The cecum of rodents has been divided into ampulla ceci (Basis ceci), corpus ceci and apex ceci (Snipes, 1979a; 1979b; Perrin and Curtis, 1980; Snipes, 1981; 1982a; 1982b; Snipes *et al.*, 1988; 1990). In the capybara, we recognized the same parts. The fact that the cecum was voluminous agrees with the general trend in rodents (Perrin and Curtis, 1980; Kotze *et al.*, 2006).

The colon, in particular the ascending colon one, has received less attention in studies about rodents. We found that the parts of the colon were well differentiated topographically. This is in accordance with the terms established by the NAV (2005).

The ascending colon of the capybara had two ansae, proximal and distal. The ascending colon of the chinchilla had two ansae, with a proximal and a distal part and an intermediate part, but in the nutria we described two ansae, proximal and only the distal with two parts (Pérez *et al.*, 2008). The distal ansa of the nutria is analogous to the ansa coli of the tucu-tucu. The tucu-tucu had only one ansa in their colon (Pérez *et al.*, 2009). The disposition of the ascending colon is very variable among different rodents and the disposition presented in the capybara was typical of this species.

We recognize the transverse colon in the capybara, but Snipes *et al.* (1988) did not mention the transverse colon in their study about the nutria and Alogninouwa *et al.* (1996) did not mention the transverse colon in the grasscutter.

CONCLUSION

According to our observations the gross intestine of capybara is different to the other studied rodents. Further studies are necessary in regard to the internal reliefs of the ascending colon and their function.

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