www.roavs.com EISSN: 2223-0343
RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Reference values of gastrointestinal transit of barium sulfate suspension in Persian squirrel (*Sciurus anumalus*)

Mehdi Tavana[1*], Amir Ali Raissi[2], Seyedh Zeinab Peighambarzadeh[1] and Ali Bagherpour[1]

[1]Veterinary Department, Islamic Azad University, Shoushtar Branch, Khuzestan, Iran; [2]Radiology Department, Faculty of Veterinary Sciences, Islamic Azad University, Karaj Branch, Alborz, Iran

Abstract

Determination of normal gastric emptying time and small intestinal transit time are useful in detecting gastrointestinal motility disorders and partial obstructions of the pylorus or small intestine. This study was conducted to evaluate gastrointestinal transit time in Persian squirrel. Twelve clinically healthy adult Persian squirrels were prepared and kept for three weeks prior to study. After eighteen hour fasting, animals were tranquilized by using Acepromazine (1mg/kg). Plain lateral and ventrodorsal radiographs were obtained. 6 ml/kg BW of a 40% w/v barium sulfate suspension was administered orally to the squirrels. Lateral and ventrodorsal radiographs were taken at zero, 10, 20 and 30 minutes after barium sulfate suspension administration and then in 30 minutes intervals until eight hours after swallowing, and then at nine, 10, 12 and 24 hours. Blood tests were performed 5 days after the study. Contrast medium was noted in the small intestine immediately after administration in two of the twelve (16.66%) squirrels. Early gastric emptying time was started at 9.16±6.68 minutes. Delay gastric emptying time was started at 332.50±37.20 minutes. Early small intestine transit time was started at 50.00±19.54 minutes. Delay small intestine transit time was started at 475.00±38.01 minutes. There was no contrast media in large intestine after twenty forth hour radiographs. It is concluded that this dosage of barium sulfate suspension gave a diagnostic opacification of upper gastrointestinal tract in Persian squirrel.

Keywords: Gastrointestinal transit; barium sulphate; Persian squirrel

To cite this article: Tavana M, AA Raissi, SZ Peighambarzadeh and A Bagherpour, 2012. Reference values of gastrointestinal transit of barium sulfate suspension in Persian Squirrel (*Sciurus anumalus*). Res. Opin. Anim. Vet. Sci., 2(6), 421-424.

Introduction

Persian squirrel (*Sciurus anumalus*) is a small rodent which lives in oak forest of the North West and West provinces of Iran (Firouz, 2000). Squirrel is a wild mammal which is kept as a pet since last decade in Iran and therefore the numbers of referred cases to the clinics have been increased.

Radiography is used for diagnosis of abdominal disorders in exotic animals as well as squirrel. Plain radiographs show little or no detail of the outlines of internal organs, and the gastrointestinal tract is visible only if marked by gas or radiopaque foreign bodies (Kealy et al., 2011). Gastrointestinal contrast study is divided to into two type: upper gastrointestinal study (UGI study), a radiographic contrast study evaluating the esophagus, stomach and small intestine and lower gastrointestinal study (LGI study) commonly refers to as a barium enema, a radiographic contrast study evaluating rectum, colon and cecum (Lavin, 2002). Upper gastrointestinal study can provide both morphologic and functional information, through evaluation of emptying and transit times (Smith et al., 2001). Gastrointestinal contrast study has not been reported in squirrel at the present knowledge of authors. Upper gastrointestinal study may be done with positive, negative or a combination of positive and negative agents. Barium sulfate suspension is the most

***Corresponding author:** Mehdi Tavana, Veterinary Department, Islamic Azad University, Shoushtar Branch, Khuzestan, Iran

frequently used for gastrointestinal contrast studies (Wagner et al., 2003). The aim of this study was to describe the normal radiographic anatomy of the gastrointestinal tract of the Persian squirrel and the transient time through the gastrointestinal tract in this animal.

Materials and Methods

Twelve clinically healthy adult Persian squirrels (seven male and five female), with no evidence of any digestive disorder, weighing between 250-400 grams, were purchased from animal selling centre and kept for three weeks prior to study. Blood tests were performed 10 days prior to the study and no abnormality in hematological and biochemical factors was detected (Khazraiinia *et al.*, 2008). Before administration of contrast media the squirrels were fasted for 18 hours, and 20 mg per kilogram body weight dimethicone was given orally 2 hours before starting the procedure. To facilitate handling the animals with the lowest stress condition and to get good quality radiographs, the animals were tranquilized with Acepromazine (1 mg/kg), administered intramuscularly. Plain lateral (L) and ventrodorsal (VD) radiographs were taken prior to contrast study with focus-film distance (FFD) of 100 cm and Kilovolt peak (kVP) of 45-47, Milliamper per seconds (mAs) of 2.0, using a portable Sedcal X-Ray machine (Fig. 1 & 2). The radiographs were developed in a 120 second automatic processor.

Six milliliters per kilogram body weight (ml/kg B.W.) of a 40% weight to volume (w/v) barium sulfate suspension diluted with tap water was administered orally.

Lateral and VD radiographs were taken at zero, 10, 20 and 30 minutes after administration of barium sulfate suspension and then lateral and VD radiographs were taken every 30 minutes until eight hours after swallowing and then at nine, 10, 12 and 24 hours. All animals were kept for one week after experiment to note any abnormality in animals. Blood tests were performed 5 days after the study.

The early gastric emptying time (EGET) was defined as the time after administration of contrast media to its appearance in the duodenum. The delay gastric emptying time (DGET) was defined as the time from administration of contrast media until the final emptying of contrast media from stomach. The early small intestinal transit time (ESITT) was defined as the time after administration of contrast media to its appearance in the cecum. The delay small intestinal transit time (DSITT) was defined as the time from administration of contrast media until the final emptying of contrast media from small intestine.

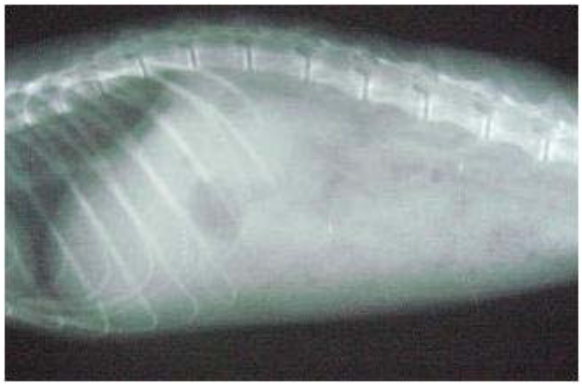

Fig. 1: Lateral view of plain radiograph

Fig. 2: Ventrodorsal view of plain radiograph

Results

The restraint and barium administration techniques were well tolerated. There were no abnormal clinical signs after one week of experiments. There were no abnormal blood biochemical and hematological changes. No reflux of barium sulfate was noted. No evidence of contrast medium aspiration was observed. Dosage of 6 ml/kg B.W. of a 40% w/v barium sulfate suspension gave a good opacification of upper gastrointestinal tract in Persian squirrel.

The stomach lies in the cranial part of abdomen. Stomach was seen approximately at the level of ninth to thirteenth ribs in L views (Fig. 3). The stomach is somewhat J shaped in VD views (Fig. 4). The cardia,

fundus, and body are lie left of the midline and the pyloric antrum and pyloric canal lie to the right side (Fig. 4). No evidence of gastric overdistension was observed.

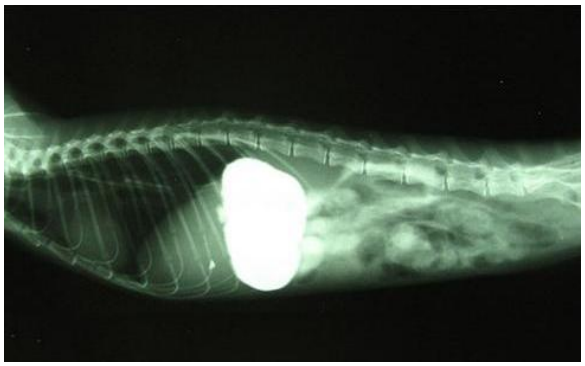

Fig. 3: Lateral view radiograph after barium swallow

Fig. 4: Ventrodorsal view radiograph after barium swallow

Contrast medium was noted in the small intestine immediately after administration in two of the twelve (16.66%) squirrels. In L and VD views early gastric emptying time (EGET) was started at 9.16±6.68 minutes (Table 1). In L and VD views delay gastric emptying time (DGET) was started at 332.50±37.20 minutes (Table 1). In all squirrels after DGET, the gastric mucosal surface had a smooth, uniform texture and with well-defined margin.

Table 1: Gastrointestinal Transit Times after barium swallow

Phase	Mean min.	SD min.	Minimum min.	Maximum min.
EGET	9.16	6.68	0.00	20.00
DGET	332.50	37.20	270.00	390.00
ESITT	50.00	19.54	30.00	90.00
DSITT	475.00	38.01	420.00	540.00

EGET: Early Gastric Emptying Time. DGET: Darly Gastric Emptying Time. ESITT: Early Small Intestine Transit Time. DSITT: Darly Small Intestine Transit Time.

In L and VD views early small intestinal transit time (ESITT) was started at 50.00±19.54 minutes (Table 1). In L and VD views delay small intestinal transit time (DSITT) was started at 475.00±38.01 minutes (Table 1). There was no contrast media in large intestine after twenty forth hour radiographs.

Discussion

Squirrel is a wild mammal which is not kept usually as a pet around the world. It became very popular to keep squirrel as a pet during last decade in Iran. Radiography is used to diagnose abnormalities like other species in squirrel.

Normal anatomy of some parts of this animal is reported (Thorington et al., 2000, Veshkini et al., 2010) and radiographic diagnosis of its disorders like nutritional secondary hyperparathyroidism and rickets was reported (Vajhi et al., 2006). Plain radiographs show little or no detail of the outlines of internal organs, and the gastrointestinal tract is visible only if marked by gas or radiopaque foreign bodies. Gastrointestinal tract can be investigated by mean of contrast radiography (Meyer, 2008), fluoroscopy (Wrey et al., 2006), ultrasonography (Shorvon et al., 1987), nuclear medicine (Heyman 1998; Balogh et al., 1999), computed tomography (Megibow et al., 1983; Kim et al., 2004) and magnetic resonance imaging (Kuriashkin et al., 2000) in animals and human. The barium meal always allowed a good functional evaluation of the gastrointestinal tract (Bello et al., 2006). Barium swallows are used to identify any abnormalities such as tumors, ulcers, hernias, pouches, strictures, and swallowing difficulties (Long et al., 2010) and verified the absence of stenosis or other morphologic alterations of enterotomized bowel. Anesthetic agents and many tranquilizers may considerably alter gastric emptying time and the transit time of barium through the intestine. Acepromazine has been shown to have little effect in this regard (Kealy et al., 2011). We tried to use the lowest possible dose of tranqulizer. Gastric

emptying time was complete in 270 to 300 minutes after swallowing of the barium sulfate. Small intestine had a much coiled appearance. Individual parts of the small intestine were not distinguishable.

The dosage of barium sulfate used in this study allowed good visualization of all parts of the squirrel gastro intestinal tract. A 6 ml/kg BW dose of barium sulfate is adequate for appropriate distension of the stomach and subsequent visualization of the gastrointestinal tract. There were no such complications during procedures and no illnesses were seen up to two weeks afterward in this study.

Acknowledgments

This work was supported by Islamic Azad University, Shoushtar Branch, Iran.

References

Balogh, L., Andócs, G., Thuróczy, J., Németh,T., Láng, J., Bodó, K. and Jánoki, G.A. 1999. Veterinary nuclear medicine. Scinitigraphical examinations– A review. *Acta Veterinaria Brno*, 68: 231–239.

Di Bello, A., Valastro, C., Staffieri, F. and Crovace, A. 2006. Contrast radiography of the gastrointestinal tract in sea turtles. *Veterinary Radiology & Ultrasound*, 47(4): 351–354.

Firouz, E. 2000. A Guide to the Fauna of Iran. Iran University Press, Tehran. Pp: 394-396.

Heyman, S. 1998. Gastric emptying in children. *Journal of Nuclear Medicine*, 39: 865-869.

Kealy, J.K., McAllister, H. and Graham, J.P. 2011. Diagnostic Radiology and Ultrasonography of the Dog and Cat. 5th edition, WB Saunders, Philadelphia, Pp: 80-97.

Khazraiinia, P., Rostami, A., Haddadzadeh, H. and Nassiri, S.M. 2008. Hematological Characteristics and Hemoglobin Typing of the Persian Squirrel (*Sciurus anomalus*), *Journal of Exotic Pet Medicine*, 17(1): 44-48.

Kim, S.H., Han, J.K., Lee, K.H., Yoon, C.J., Kim, Y.I., Lee, H.S. and Chol, B.I. 2004. Experimentally induced small-bowel tumor in rabbits: US-guided percutaneous 18-gauge core biopsy. *Journal of Radiology*, 231:150–155.

Kuriashkin, I.V. and Losonsky, J.M. 2000. Contrast enhancement in magnetic resonance imaging using intravenous paramagnetic contrast media: a review. *Veterinary Radiology & Ultrasound*, 41(1):4-7.

Lavin, L.M. 2002. Radiography in Veterinary Technology. 3rd edition, WB Saunders, Philadelphia, Pp: 265-290.

Long, C.T., Page, R.B., Howard, A.M., McKeon, P., and Felt, S.A. 2010. Comparison of Gastrografin to barium sulfate as a gastrointestinal contrast agent in red-eared slider turtles. *Veterinary Radiology & Ultrasound*, 51(1): 42–47.

Megibow, A.J., Balthazar, E.J., Naidich, D.P. and Bosniak, M.A. 1983. Computed Tomography of Gastrointestinal Lymphoma. *American Journal of Roentgenology*, 141(3): 541-547.

Meyer, J. 1998. Gastrografin as a gastrointestinal contrast agent in the Greek tortoise. *Journal of Zoo and Wildlife Medicine*, 29(2): 183-189.

Miao, F., Wang, M.L. and Tang, Y.H. 2010. New progress in CT and MRI examination and diagnosis of small intestinal tumors. *World Journal of Gastrointestinal Oncology*, 2(5): 222-228.

Shorvon, P.J., Lees, W.R., Frost, R.A. and Cotton, P.B. 1987. Upper gastrointestinal endoscopic ultrasonography in gastroenterology. *British Journal of Radiology*, 60(713): 429-438.

Smith, D., Dobson, H. and Spence, E. 2001. Gastrointestinal studies in the green iguana: technique and reference values. *Veterinary Radiology & Ultrasound*, 42(6): 515-520.

Thorington, R.W. and Darrow, K. 2000. Anatomy of the squirrel wrist: Bones, ligaments, and muscles, *Journal of Morphology*, 246(2): 85–102.

Vajhi, A.R., Rostami, A., Masoudifard, M. and Faskhoodi, D. 2006. Radiographic study of vertebral lesions in pet Persian squirrels suffering from rickets and nutritional secondary hyperparathyroidism (a retrospective study in 51 cases) (Full paper). 6th scientific meeting of European Association of Zoo- and Wildlife Veterinarians (EAZWV), 24 - 28 May, Budapest-Hungary.

Veshkini, A., Tavana, M., Sohrabi Haghdost, I., Nasroulahzadeh Masouleh, M. and Habib Savojbolaghi, S. 2010. Excretory urography by subcutaneous injection of iodixanol in Persian Squirrel (*Sciurus anomalous*). *Pakistan Veterinary Journal*, 31(1): 17-22.

Wagner, W.M. and Kirberger, R.M. 2003. Radiographic gastrointestinal contrast study in the ostrich (Struthio camelus). *Veterinary Radiology & Ultrasound*, 44(5): 546-552.

Wray, J.D. and Blunden, A.S. 2006. Progressive dysphagia in a dog caused by a scirrhous, poorly differentiated perioesophageal carcinoma. *Journal of Small Animal Practice*, 47(1):27-30.