Available online at www.sciencedirect.com
ScienceDirect
Research in Veterinary Science 84 (2008) 321–325
www.elsevier.com/locate/rvsc

The elecrophysiological bulbocavernosus reflex test in female dogs: Its technique and applicability

E. Turan [a,*], C. Unsal [b], I.G. Yildirim [a]

[a] Adnan Menderes University, Faculty of Veterinary Medicine, Department of Anatomy, PK: 17, 09016 Isikli-Aydin, Turkey
[b] Adnan Menderes University, Faculty of Veterinary Medicine, Department of Physiology, PK: 17, 09016 Isikli-Aydin, Turkey

Accepted 25 May 2007

Abstract

The intent of the study was to clarify the technique and the application of the electrophysiological bulbocavernosus reflex (EBCR) test in healthy female dogs. For this aim, 15 healthy female dogs were used in the study. The stimulations were made on the clitoris and the responses were recorded from the right side of the external anal sphincter muscle with a concentric needle recording electrode. The EBCR had response latencies between 18.99 and 25.69 ms with the mean value of 22.26 ms. The EBCR reflex test is not yet widely used for the evaluation of the functional integrity of sacral spinal cord segments and nerve roots in veterinary clinics. Our experiences indicated that the EBCR reflex test gives valuable data about sacral spinal reflex arc functionality and can be accepted as a routine diagnostic method in small animal clinics for evaluation of the sacral reflex arc.

Keywords: Bulbocavernosus reflex; Sacral reflex; Pudendal nerve; Dog

1. Introduction

The sacral reflexes term refers to electrophysiological recordable responses of perineal and pelvic floor muscles *via* electrical stimulation in the urogenital region (Vodusek and Fowler, 1999, 2004). The anal and bulbocavernosus reflexes are commonly elicited clinically in lower sacral segment (Oliver et al., 1997b; Vodusek and Fowler, 1999). The bulbocavernosus reflex was obtained clinically by manual compression of glans penis or clitoris. Its reflex response can be observed as contractions of bulbocavernosus and external anal sphincter muscles (Amarenco et al., 2003). This response is called as clinical or mechanical bulbocavernosus reflex (CBCR). The electrophysiological bulbocavernosus reflex (EBCR) is a recordable response of the bulbocavernosus and external anal sphincter muscles after electrical stimulation of the pudendal nerve *via* the dorsal nerve of the penis or clitoris (Bilkey et al., 1983; Vodusek and Fowler, 1999, 2004). In the other words, this is a measure of somatic clitoral or penile innervation (Turan and Bolukbasi, 2006). In the bulbocavernosus reflex afferent impulses are carried through the dorsal nerve of clitoris or penis to the sacral spinal cord and efferent impulses are conveyed through the pudendal nerve to the bulbocavernosus and external anal sphincter muscles (Lavoisier et al., 1989; Sethi et al., 1989; Oh, 1993; Bird and Hanno, 1998; Yang and Bradley, 2000). In human medicine, EBCR test is clinically relevant and widely used in the routine since it firstly is described by Rushworth (1967) to investigate urinary, anorectal and sexual dysfunctions when a sacral reflex lesion is suspected. Absence or prolongation of the reflex response suggests a lesion of the sacral reflex arc (Beck, 1999; Amarenco and Kerdraon, 2000; Yang and Bradley, 2000; Amarenco et al., 2003). While clinical bulbocavernosus reflex is suggested for the evaluation of the functional integrity of sacral spinal cord segments and nerve roots (Oliver et al., 1997b) also in veterinary

* Corresponding author. Tel.: +90 256 247 0700; fax: +90 256 247 0720.
E-mail addresses: eturan@adu.edu.tr, terkut@yahoo.com (E. Turan).

0034-5288/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.rvsc.2007.05.020

field. However, the EBCR found not a widespread usage for in this sense yet although it was expressed that the EBCR test could potentially become a routine diagnostic method for evaluation of sacral reflex arc in small animals, because of it has several advantages as the easy application and objective results. The normal latency value, technique and applicability of EBCR test have expressed in male dogs (Turan and Bolukbasi, 2006). But, no information could be found about the application and the technique of EBCR test in female dogs.

Since there are certain differences in perineal muscles localizations and external reproductive organs between male and female dogs, the application of the test may have some variations. The intent of this study was to clarify the application and the technique of the EBCR in healthy female dog and to determine its normal latency value, hitherto unreported.

2. Materials and methods

Latency of electrophysiologic bulbocavernosus reflex (EBCR) studies was performed in 15 healthy mongrel female dogs weighing an average of 18.1 ± 2.13 kg (range 15–22 kg). The age of the dogs ranged between 2.5 and 6 years with a mean age of 3.5 ± 1.04 years. The study was approved by Animal Ethics Committee of University of Adnan Menderes. For the neurologic examination of sacral reflex arc, the clinical bulbocavernosus was obtained in all dogs and then the general anaesthesia was induced with a combination 1.1 mg/kg xylazine (Rompun®; Bayer), 22 mg/kg ketamine (Ketanes®; Alke) intramuscularly. After the anaesthesia, each dog was placed in right lateral recumbency and between the cranial angle of scapula and tip of third finger of the left forelimb were measured as an extremity length (mean 56.33 ± 2.74 cm; range 50–60 cm). All examinations were conducted at 26–28 °C in constantly maintained climate convenient laboratory environment. And all dogs were stayed about 1 h before the recording in the laboratory. The rectal temperature was measured with a digital thermometer before the electrophysiological tests. Electrophysiological tests were performed using MP 30 Ultimate System® (BIOPAC, Aero Camino, USA). The data were analyzed using BIOPAC BSL PRO **3.6.7** software program. The settings of equipment were designed as follows: Filter setting; 0.5 Hz to 5 kHz, analysis time; 50 ms, duration; 0.1 ms, gain; 250 μV per division; stimulus interval of 3 s. Stimulus threshold intensity (STI) was defined as the least possible stimulus intensity (SI) that is necessary to obtain an evoked recordable response for the individual nerve. For this study, SI was applied as $2.5–3 \times$ STI and the ranges of the stimulus intensities were measured as 65–90 V. Five responses were averaged and the test repeated to ensure reproducibility. The latency was measured at the beginning of the compound muscle action potential (Fig. 1). The electrodes were positioned in each dog that was in right lateral recumbency. The bipolar surface electrode (BIOPAC, HSTM 01) was used to stimulate the clitoris. For the stimulation, the cathode was placed over the clitoris and the anode on the right side of vulva (Fig. 2a). Contact was assured by using electrode gel, after shaved the hair of vulva and cleaning the skin/mucosa with alcohol. EBCR latencies were recorded with concentric needle electrode from the right side of anal sphincter muscle (Fig. 2a). Dorso-ventral midline of the anus was determined as the first line and approximately 30° right lateral side of the first line was designated as the second line. The needle electrode was introduced to one cm distance, parallel to the direction of anal canal, to the anal orifice on the second line (Fig. 2b). In this way, the tip of the needle electrode was moved approximately 1.5–2 cm toward the muscle. One adult female dog cadaver used by students was obtained and the perineal region was dissected to determine localization of the constrictor vulvae and vestibule and external anal sphincter muscles and to explain the exact position of the needle recording electrode. The mean values ($\overline{X}$) and standard error of means ($S\overline{X}$) were also calculated from the latency values.

3. Results

The dogs were of similar body conformation as regards to their weights and lengths of the fore limbs, which were confirmed by the result of the Shapiro–Wilk test (Table 1). Before the electrophysiologic study we dissected the perineal and anal regions of one dog cadaver to determine the localization of muscles and decide to recording electrode placement. Left side of the cadaver was dissected while the skin of the right side was removed only. In this way, we could correctly define localization of the muscles. The external anal sphincter muscle surrounded the anus. It lied especially subcutaneous on the each lateral sides of the anus. Ventro-lateral sides of external anal sphincter muscle fibers blended with the constrictor vulvae muscle. In this site, muscles localized under the thick adipose tissue layer. Constrictor vulvae muscle extended between external anal sphincter muscle and vulvae. It was thin, especially at the vulvae level. The constrictor vestibule muscle located approximately middle region between the anus and dorsal commisura of vulvae, and it extended on the constrictor vulvae muscle. The constrictor muscles blended with each other to a slight degree. In addition, these muscles covered with the thick adipose tissue layer (Fig. 3a and b). After the dissection we envisaged to obtain EBCR responses from external anal sphincter and constrictor vulvae muscles. Because the exact determination of recording region on the skin, we chose lateral side of external anal sphincter and vulva level part of constrictor vulva muscle.

We have chosen clinically normal dogs and the rectal temperatures were normal baseline and varied from 38.50 to 39.40 °C in all dogs. Latencies, body weights, ages and length of forelimb and mean latency values were shown in Tables 1 and 2, respectively.