ORIGINS OF COLONIC PREGANGLIONIC PARASYMPATHETIC MOTONEURONS FROM THE CENTRAL NERVOUS SYSTEM: A WHEATGEM AGGLUTININ-HORSERADISH PEROXIDASE STUDY IN THE FERRET (MUSTELA PUTORIUS FURO).

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ABSTRACT

The Wheat gem Agglutinin-Horseradish Peroxidase (WGA-HRP) transneuronal nerve tracing technique was used to study the localization of colonic preganglionic parasympathetic neurons in the central nervous system of the ferret. The entire colon, from the ileocecal junction to the colorectal junction was subdivided into four segments and the muscular wall of each segment injected separately with the tracer. The ferrets used as controls were also subdivided into four groups. The first group was injected with normal saline, the second group with the tracer following bilateral truncal vagotomy, the third group intraperitoneally and the fourth group had tracer injection into the hepatic portal vein. The experimental as well as the control ferrets were allowed to survive for 24 to 96 hours after which they were anaesthetized and perfused sequentially with normal saline, buffered fixative, and buffered sucrose.

Serial transverse frozen sections were taken from the brainstem and the sacral segments of the spinal cord of the ferrets. These were then processed for WGA-HRP neurohistochemistry and analyzed under light and dark-field illuminations. The results of the study show that the dorsal motor nucleus of the vagus nerve (DMX) supplies the anterior 3 segments of the colon while the sacral segment of the spinal cord supplies the post 2 segments of the colon.

It is concluded that in the innervation of the colon there is an overlap between the areas supplied by the DMX and those supplied by the sacral segment of the spinal cord.

Key words: Colon; vagus; innervation; WGA-HRP; Ferret

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INTRODUCTION

The parasympathetic control of the entire postdiaphragmatic part of the gastrointestinal tract (GIT) and the associated glands has been widely studied and well documented in standard anatomy and physiology textbooks and research publications in journals (1-8). Several animal species and techniques have also been used in these studies, both for studies in the past. While earlier studies of this subject relied on the use of less sensitive and hence less reliable techniques such as microdissection, chromatolytic changes following nerve transection and recording of electrical activities following stimulation of target segments of the tract (6-8, 14-16) more modern approaches with highly sensitive techniques have yielded highly specific and more reliable results (9-17-18). Following these studies, there appears to be a consensus that the parasympathetic control of the GIT is shared between the cranial and sacral outflows of the parasympathetic division of the autonomic nervous system. Furthermore, the distribution of the parasympathetic cranial neurons innervating the GIT amongst the brainstem nuclei has also been studied extensively in various species (9-10, 12-13, 18). It can be derived from these studies that most of the anterior GIT structure receive innervation from the cranial component while the posterior GIT structure receive their nerve supply from the sacral segment of the spinal cord (6, 7). In spite of the wealth of knowledge regarding the sharing of the innervation of the GIT by the cranial and sacral outflow, considerable controversy still exist on the transitional zone along the GIT where the switch occurs between these two sources of innervation. Whereas some investigators have claimed that the "watershed area" is at the junction of the derivatives of the embryonic midgut and hindgut (19-21), authors of most textbooks have reported that the changeover occurs at the left colic flexure (2, 3, 5). Some other investigators have demonstrated that the cranial outflow extends far beyond the left colic flexure (6, 8, 9, 10, 22, 23, 24). The significance of knowledge of this transition zone is partly illustrated in the speculations that the left colic flexure and the proximal part of the descending colon are vulnerable to perforation following some
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OBSERVATIONS ON THE NUCLEAR CHROMATIN PATTERN IN CELLS OF A CASE OF CANINE CIRCUMANAL GLAND ADENOMA IN TRINIDAD.

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ABSTRACT

An incidence of canine circumanal gland adenoma (CGA) is reported, apparently for the first time, in the island of Trinidad and Tobago. The case involved an 11-year-old Rottweiler dog which was presented in relatively good health except for noticeable masses around the perianal region. Apart from routine histopathological investigation which enabled a definitive diagnosis of CGA with secondary vascularization, analysis of the nuclear chromatin texture was performed on the digitalized images of both reserve and hepatoid cells of the neoplasm. The mean nuclear pixel intensity value of the images of processed CGA reserve cells was significantly lower than those of the processed CGA hepatoid cells (P<0.1). Our observation based on the texture analytical data suggests a high degree of rate of multiplication of the reserve cells at the expense of degenerating hepatoid cells. The relevance of this finding is discussed within the context of vascular supply to the neoplastic cells.

Keywords: Dogs; Circumanal gland adenoma; Digital imaging; Pixel intensity values; Mitosis

INTRODUCTION

Neoplasia of canine circumanal glands (CCG) are generally of interest from the standpoint of the peculiarity of the normal gland which gives rise to four types of neoplasia, as well as the pattern of manifestation of this form of neoplasia which is comparable to mammary neoplasia in humans in terms of aetiology and incidence. Within the context of incidence, CCG neoplasia was earlier reported as ranking 3rd in frequency of all canine neoplasia in the United States (1). The predilection sites of the neoplasia can extend beyond the predominant perianal location of the normal CCG to distant body regions, such as the forelimb (2) and the spinal cord (3). In comparison with mammmary neoplasia of women, in which oestrogens have been linked with the aetiology, androgens have been proposed in the aetiology of CCG neoplasia (4). The incidence of CCG neoplasia has been reported as being higher in aged male dogs.

The normal CCG is hepatoid, with lobules which do not have lumina, but have ducts which remain non-patent as they fail to acquire lumina during the period of organogenesis (5). Rather, cysts occur within the lobules; these cysts being interpreted as unsuccessful attempts on the glands to acquire lumina. Studies utilizing CCG neoplasia as a neoplastic model in the canine population appear to be justified given the relatively high incidence of the neoplasia. It also appears justified for the human population, given the similarity of the neoplasia to mammary neoplasia in women. Paradoxically, the incidence of CCG in Trinidad and Tobago appears not to be remarkable, either due to lack of proper record-keeping or as a result of imprecise diagnosis. The present report represents the first of such report in Trinidad and Tobago as far as the authors are aware.

The authors, who also are currently embarked upon digital imaging and texture analytical research on different mammalian tissue, recognise the need to utilize CCG neoplasia as a model for other neoplasia. Apart from the interest generated in the present case, by virtue of its being apparently the first to be reported within Trinidad and Tobago, the present report also focusses on the nuclear chromatin pattern of the cells of CCG adenoma, employing modern digital imaging and texture analytical means. It is hoped that our methodology and observation will be applicable to resolving issues of other neoplasia.

MATERIALS AND METHODS

Clinical Evaluation

The 11-year-old male Rottweiler dog, named Panzer, was presented to the School of Veterinary Medicine Clinic, Faculty of Medical Sciences, Trinidad and Tobago, on September 20, 2003. The owner had reported subcutaneous perianal masses a few months