J. Expt. & Clin. Anat. 6 (1) 26-28 (2007)

JECA

Intrinsic Cardiac Ganglia of Goat

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ABSTRACT

Intrinsic cardiac nervous system plays important role in regulating heart functions both in normal and denervated heart as in case of heart transplant patients. Therefore, the distribution and detailed study of intrinsic cardiac ganglion assumes significance. The present study was conducted on five hearts of goat obtained within one hour of sacrifice of the animals. Light microscopic observations were made on formalin-fixed, 10 thick paraffin sections stained with Haematoxylin and Eosin and Silver stain. Cardiac ganglia were primarily located in the epicardial fat near the junction of superior vena cava and right atrium as circumscribed structures. Occasionally they were seen in the form of ganglionated nerve plexus. Occurrence of intramural ganglia was rather uncommon. In sections, ganglia appeared in variable shapes from being circular, oval, reniform, club-shaped or irregular. Quite often they were associated with a robust bundle of autonomic nerves, which split to invade and surround the ganglion. Most of the nerve cells in the ganglia presented features of large multipolar neurons and were surrounded by capsular cells. The number of neurons per ganglion varied from three to forty five. Interestingly, the general arrangement of intrinsic cardiac ganglia in goat resembled more closely to the human heart than many other animals and therefore requires further investigation.

Key words: Intrinsic cardiac ganglia, goat heart, neurons

Heart function is tightly regulated by the sympathetic and parasympathetic nervous system. The distribution of the intracardiac ganglia in the heart has been studied in several mammalian species (King and Coakley, 1958; Calaresu and St. Luis, 1967; Burkholder et al, 1992). The intracardiac ganglia are especially important because they are capable of maintaining normal heart function even after being completely denervated, as in the case of heart transplant patients (Ardell, 1994). With the development of surgical treatment of cardiac arrhythmia and management of myocardial ischemia, there is renewed interest in the intrinsic cardiac nervous system. Intrinsic cardiac nervous system is also known to be important both in the prevention and treatment of risky heart diseases (Dainius et al, 2003). Therefore, the distribution and detailed study of intrinsic cardiac ganglian assumes significance. This study was carried out to identify and determine the distribution of cardiac ganglia innervating distinct regions of the goat heart.

MATERIALSAND METHODS

The present study was conducted on five hearts of goat obtained from the slaughterhouse within one hour of their sacrifice. The goats included in this study were between 1-2 years old and weighed 12-16 Kg. The hearts were immersion fixed in 10% formalin for 48 hours. Small blocks of tissue were taken from: ventral aspect of right atrium, junction of superior vena cava & right atrium, dorsal inferior part of interatrial septum (AV node), ventral part of interventricular septum, and base of the heart. In total 30 blocks were processed for paraffin sectioning. Haematoxylin-Eosin and Silver, stained 10 thick sections were observed under light microscope.

RESULTS

There were many ganglia in the heart tissue and their sizes varied greatly. Most of them were found closely associated with the epicardial fat near the junction of superior vena cava and right atrium as circumscribed structures (Fig-1). Occasionally they were seen in the form of ganglionated nerve plexus. Smaller collections of ganglia were located on the

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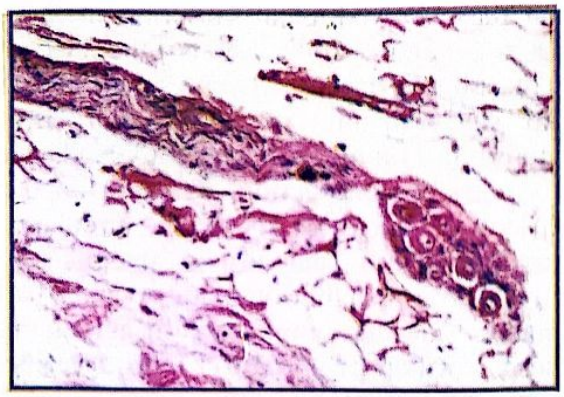

Fig-1: Photomicrograph from junction of superior vena cava and right atrium showing ganglia in subepicardial connective tissue as circumscribed structures associated with a robust bundle of autonomic nerves. H & E x 200

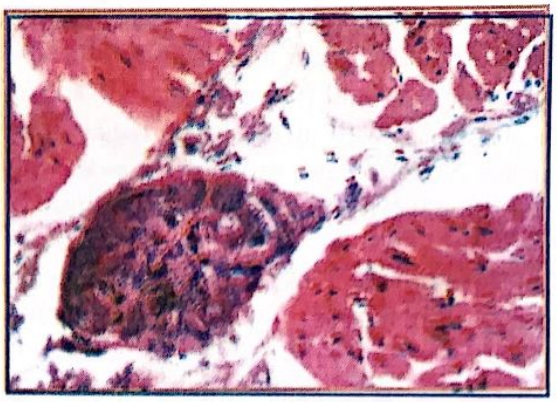

Fig-2: Photomicrograph showing intramural ganglia surrounded by cardiac. Neurons and capsular cells can be easily identified. H & E x 400.

Fig-3: Photomicrograph showing ganglia with two neurons associated with thick nerve bundle. H & E x 100.

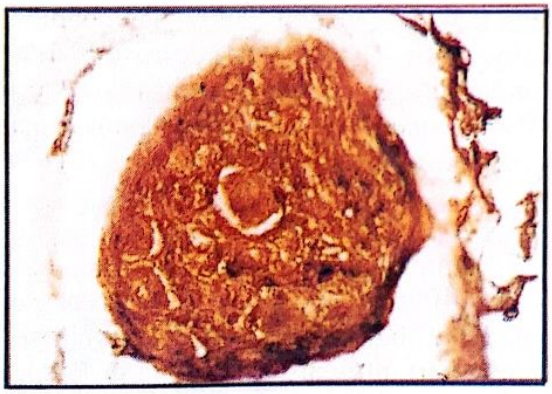

Fig-4: Photomicrograph showing rounded ganglia with many neurons and neurofibrils. Silver stain x 200.

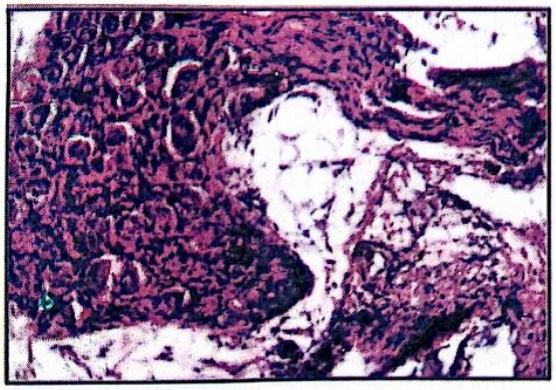

Fig-5: Photomicrograph showing large ganglia giving J-shaped appearance in the epicardial fat. H & E x 200.

Fig-6: Photomicrograph showing club shaped ganglia surrounded by capsular cells in the epicardium with multiple neurons. H & E x 200.

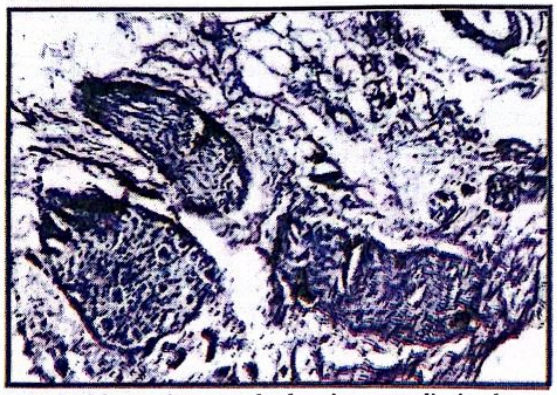

Fig-7: Photomicrograph showing ganglia in the form of ganglionated nerve plexus. H & E x 200.

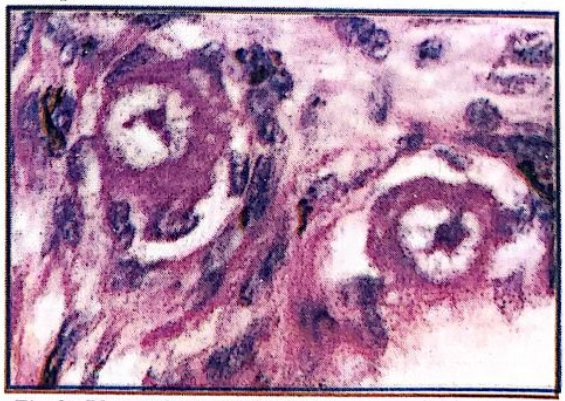

Fig-8: Photomicrograph showing ganglia in oil immersion. Ganglia cells showing characteristic features of neurons. H & E x 1000.

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interatrial septum and atrial appendage-atrial junctions. Ganglia were also found at the base of the great vessels and base of the ventricles. The right atrial free wall atrial appendages, trunk of the great vessels and most of the ventricular myocardium were devoid of cardiac ganglia.

In sections, ganglia appeared in variable shapes from being circular, oval, reniform, club shaped or irregular (Figs. 5, 6, 7). Quite often a robust bundle of autonomic nerves was seen to invade as well split to surround the ganglion. Most of the nerve cell in the ganglia presented features of large multipolar neurons and were surrounded by capsular cells. The number of neurons per ganglion counted in the photomicrographs varied from just three to forty five. Some occasional small intramural ganglia were also noticed.

DISCUSSION

Mammalian intrinsic cardiac neurons subserve different functions in different cardiac region. King and Coakley (1958) summarized the distribution of intracardiac ganglia in 19 species, including the rat. Later, this distribution has been studied by Calaresu et al (1967) in the cat and Burkholder et al (1992) in the rat.

In the present study attempt has been made to identify and determine the distribution of intrinsic cardiac ganglia innervating different regions of the goat heart. The general pattern of distribution of intrinsic cardiac ganglia of goat hearts was found to be in conformity with the description published on topography of intrinsic cardiac ganglia in the adult human heart by Sanjay Singh et al (1996). Exact localization of these ganglia suggested modifications to surgical procedures involving incisions through regions concentrated with ganglia in order to minimize arrhythmia and related complications. In the present study most of the intrinsic cardiac ganglia were found in the epicardial fat between junction of superior vena cava and right atrium as circumscribed structures occasionally in the form of ganglionated nerve plexus similar to those mentioned by Arora et al (2002).

It was observed by Luis et al, (1977), that the regions close to sinoatrial and atrioventricular nodes, ganglionic nerve cells and nerve fibers are present in abundance. In the present study, from many ganglia observed in the heart it was found that they showed great variation in their size, shape and aggregation. Most of them were found in the adipose tissues between superior vena cava and right atrium, dorsal inferior aspect of interatrial septum, base of great vessels and base of ventricles. In sections, ganglia appeared in variable shapes from being circular, oval, reinform, club shaped or irregular. These findings of distribution pattern and shapes of intrinsic cardiac ganglia are in agreement with those of Chen et al (1997) who described that intracardiac ganglia cells were divided into several groups with largest group located in dorsal inferior interatrial septum.

CONCLUSION

It was concluded that the general arrangement of intrinsic cardiac ganglia in goat resembled more closely to the human heart than many other animals. It appears logical that further study on the organization of the intracardiac nervous system will facilitate further understanding of regional autonomic control of the heart.

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