P: ISSN NO.: 2394-0344
E: ISSN NO.: 2455-0817

Remarking
Vol-II * Issue-V* October - 2015

Neurohistological Studies in the Heart of Large Pied Tail, *Motacilla maderaspatensis* Linn.

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Abstract

In the present studies the histology and innervation of the heart of largepied wagtail *Motacilla maderaspatensis* (Linn.) have been described. The sinuatrial node is clearly seen in the right atrium, where it lies in the outer connective tissue. It has some distinct large specialised cells present towards periphery and in centre also. The atrioventricular node is located in caudal part of the interatrial septum. It is quite distinct and some what conical in shape. The atriovevtricular bundle lies at the junction of interatrial septum and interventricular septum, little posterior to the atrioventricular node. The bundle bifurcales into right and left bundle branches. These branches are composed of specialised conducting cells and muscles. Purkinje fibers are observed in good amount in both atria and ventricles.

Keywords: Sinuatrial node (SAN), Atrioventricular-node (AVN), Atrioventricular bundle (AVB), Purkinje fibres (PF).

Introduction

In mammals, several references are available on cardiac conducting system. Knowledge about avian heart *is* less. Prakash (1956) found the sinuatrial node in the hearts of birds. Yousuf (1965) described SAN, AVN and atrioventricular bundle in the heart of house sparrow. Barker, Gourdic and Bond (2002) discussed the location of sinuatrial node in birds.

In the present studies, cardiac conducting system and innervation have been explained in the heart of *Motacilla maderaspatensis* (Linn.).

Materials and Methods

The hearts were excised in saline solution, carefully, alongwith the portion of the arches. Hearts were washed and then were fixed in Bouin's fluid. Blocks were made by usual wax embedding process. Serial sections were cut of thickness 8 to 10 micron in transverse and longitudinal planes. These were stained with acid fuchsin and ungewitter's silver impregnation technique.

Result

The components of specialised conducting tissues were observed. They were Sinuatrial node, the atrio-ventricular node and the atrioventricular bundle. Purkinje fibres were found in large number in association with the specialised conducting structures and also isolated structures in chambers of the heart.

The sinuatrial node (Fig. 1) is enclosed in an almost continuous nodal sheath and lies in connective tissue of right atrium. Specialised cells with dark stained nuclie are clear, perinuclear spaces have been observed. Loosely arranged Purkinje fibres and Nodal artery have been observed in its close proximity. The node shows as continuity with atrioventricular node through ordinary muscle fibres. The conicle and distinct atrioventricular node (Fig. 2) is situated in the caudal part of the interatrial septum. It is made up of ordinary cardiac muscle fibres, Purkinje fibres and specialised cells. Nodal artery is clearly seen. It communicates with the atrioventricular bundle directly through fine nerve fibres and connective tissue fibres. The atrioventricular bundle (Fig. 3) lies at the function of interatrial septum and interventricular septum, little posterior to atrioventricular node. The bundle has right and left branches, which reach over the ventricles of right and left side, partially in the myocardium and partially in the endocardium. The bundle has clear nucleus and perinuclear spaces along with and artery in its close proximity. Purkinje fibres (Fig. 4) are present in atria and more in ventricles. They are found in isolated loose groups but in interventriculum septum, they form compact strands.

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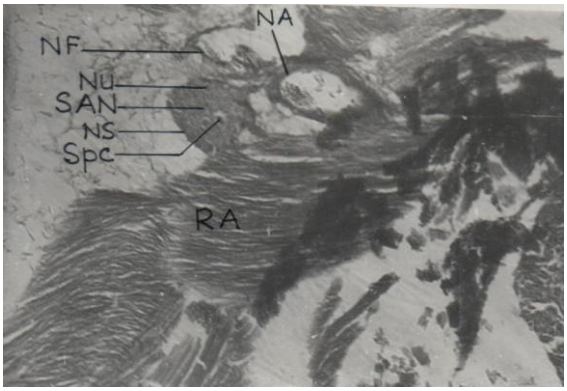

Fig. 1: T.S. of the heart of *Motacilla maderaspatensis* Gmelin. Showing sinuatrial node Acid Fuchsin stain x 100

Abbreviations

NA- Nodal Artery, NF- Nerve Fibres, NS- Nodal Sheath. Nu- Necleus, RA- Right atrium, SAN- Sinuatrial node, Sp.C - Specialised Cell

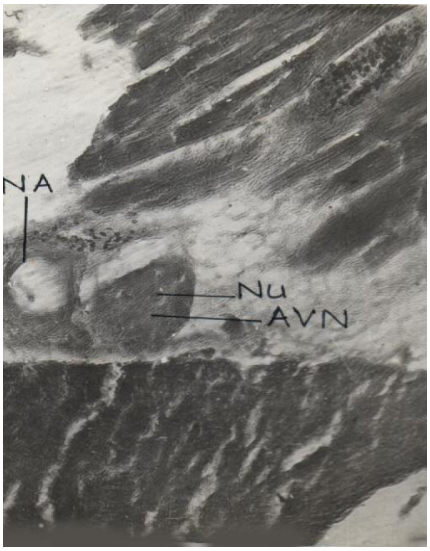

Fig. 2: T.S. of the heart of *Motacilla*, showing atrioventricular node. Acid Fuchsin stain x 100

Abbreviations

AVN - Atrioventricular node

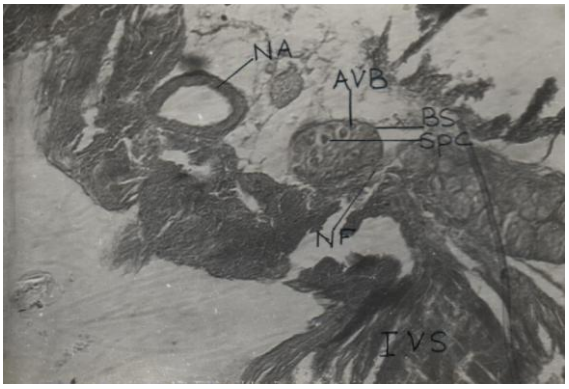

Fig. 3: T.S. of the heart of *Motacilla*, showing atrioventricular bundle Acid Fuchsin stain x 100

Abbreviations

AVB - Atrioventricular bundle
BS - Bundle sheath

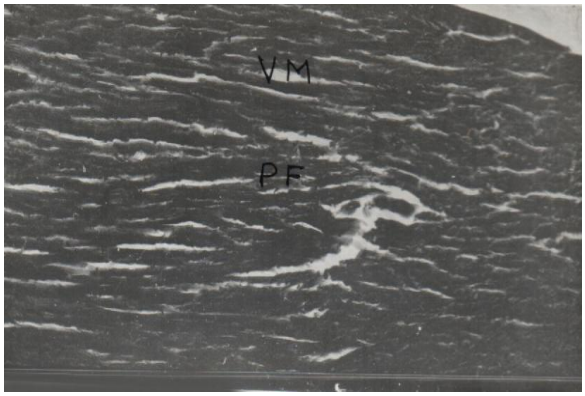

Fig. 4: T.S. of the heart of *Motacilla*, showing Purkinje Fibres in the ventral myocardium. Acid Fuchsin stain x 100

Abbreviations

PF - Purkinje Fibre
VM - Ventricular myocardium

The cardiac innervation comprises of nerve bundle, nerve branches, ganglia and fine nerve fibres (Fig. 5). Sinuatrial node and atrioventricular bundle is richly innervated. In atrioventricular node fire nerves have been observed. Fewer ganglia are observed in the atria. Numerous ganglia are seen in the ventricles.

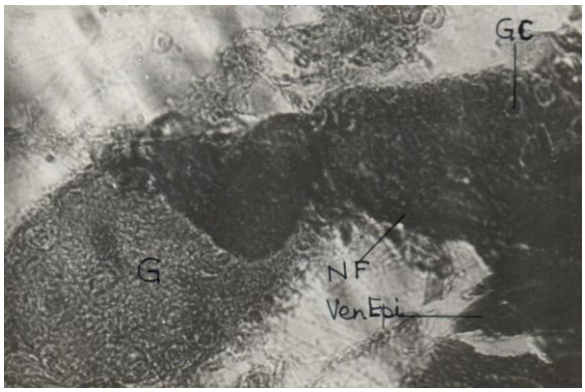

Fig. 5: T.S. of the heart of *Motacilla*, showing ganglion at ventricular epicardium.

Abbreviations

G - Ganglion, GC - Ganglion cell, NF - Nerve fibre, Ven. Epi - Ventricular epicardium

Discussion

Yousuf (1961) found all the conducting structures in the heart of quail coturnix coturnix. Yousuf (1965) noted the sinuatrial node at the cephalic end of itneratrial septum in the heart of sparrow. In Columba libia, Mathur (1973) reported that sinuatrial node is small structure. Barker, Gourdic, bond (2002) found that the location of sinuatrial node seems to be variable in birds because it is reported in various locations of the embryonic sinuatrial ring in various species.

The present findings confirm that the sinuatrial node is clearly seen, situated at the Crista terminatis close to the superior vena cava in right atrium. It lies in the outer connective tissue, enclosed in a thin continuous sheath, in *Motacilla maderaspatensis*. The node shows its continuity with atrioventricular node through ordinary muscle fibres. As confirmed by the following workers Yousuf (1965),

Mathur (1973), Mathur and Kumar (1979) and Barker, Gourdic and Bond (2002).

Glomset and Birge (1945), Glomset and Cross (1952) denied the presence of sepcialised conducting structures in the heart of mammals and birds in numerous publications. De Mayer (1952) observed the sinus portion of the conducting tissue disappears in the heart of fowl.

Prakash (1956) observed a clear atriovention culer node in the heart of Indian fowl. Yousuf (1965) found an atrioventricular node in the heart of Passer domesticus. Qayyum and Shaad (1976) defined atrioventricular node in Rose ringed parakeet. Srivastava *et al.* (1992) observed atrioventricular node in the heart of *Motacilla alba* (Linn.). Bjarke Jensen *et al.* (2012) studied the mammalian and avain hearts and found that mammalian and avain ventricles uniquely develop thick compact walls and septum and hence form a discrete ventricular conduction system. The present study supports the view of Prakash (1956), Yousuf (1965), Qayyum and Shaad (1976), Srivstava *et al.* (1992) and Bjarke Jensen *et al.* (2012). In these findings the AVN is located in the caudal part of the interatrial septum. It is quite distinct and conical in shape and made up of ordinary cardiac muscle fibres, Purkinje fibres and specialised cells. Szabo *et al.* (1986) worked on the structure of the atrioventricular conducting system in the avian heart. He could not find a morphologically definable atrioventricular node. Mathur and Kumar (1979) in the heart of Magpie-robin reported the absence of atrioventricular node.

The present findings supports the views of Prakash (1956), Yousuf (1965), and Srivastava *et al.* (1992); as that the atrioventricular bundle lies at the junction of interatrial septum and interventricular septum, little posters to the atrioventricular node. The bundle bifurcates into right and left bundle branches, which reach over the ventricles of right and left side.

Parto Tadjalli, Reza Ghazi and Mohd. Ali Salamat (2013) reported that Purkinje fibres in the ostrich heart are large, specialised cardiac muscle fibres. In this study Purkinje fibres are present in both atria and ventricles. They are numerously present in both the ventricles. They are found in isolated loose groups. In interventricular septum, they form compact strand.

The cardiac innervation comprises of nerve-bundle, nerve branches, ganglia and fine nerve fibers. SAN and atrioventricular bundle is richly innervated. In atrioventricular node, fine nerves have been observed. Fewer ganglia are observed in the atria. Numerous ganglia are seen in the ventricles.

Abbreviations

SAN- Sinuatrial node, AVN-Atrioventricular node, AVB-Atrioventricular bundle, BS-Bundle sheath, CT- Connective Tissue, G-Ganglion, GC-Ganglion Cells, IAS-Interatrial Septum, IVS-Interventricular Septum, Nev-Nerves, NB-Nerve Bundle, NF-Nerve Fibres, NS-Nodal Sheath, NU-Nucleolus, PF-Purkinje Fibers, PS-Perinuclear Space, RA-Right atrium, Spc-Specialised cells.

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