"Aquatic Mammals", Vol. 10, no. 1, April 1983 ISSN 0167—5427

THE CONDUCTING SYSTEM IN THE HEART OF THE COMMON SEAL *(PHOCA VITULINA VITULINA).*

CJ. van Nie, DVM, Vakgroep Anatomie & Biomechanica, Medische Faculteit, Vrije Universieteit, van der Boechorststraat 7, 1081 BT Amsterdam.

Introduction

The conducting system in the heart of mammals, birds and reptiles is a well known structure. TRUEX & SMYTHE (1965) reported about the difference in the character of this structure in a lot of animals. They developed a diagram in which the characteristics of the conducting system are classified. In the diagram the common seal is not present. The aim of this study is to investigate the conducting system of the common seal and to incorporate it in the diagram of TRUEX & SMYTHE. Since this is the first investigation of the conducting system of the common seal, a general survey - macroscopically as well as microscopically - will be presented.

Materials and techniques

The hearts are derived from dead animals. Most of the hearts were in a bad condition and filled up with blood. All hearts were immediately after the post-mortem examination embalmed in 4% formalin for at least four months. Before the macroscopical preparation of the system the hearts have been rinsed in tapwater and diluted NH_4OH 1%, so the formalin is neutralized and - by experience - the system can be prepared easily.
In 17 hearts the system has been prepared macroscopically by means of micro-neurosurgical instruments under a spotlight. From 5 hearts the main parts of the system have been investigated microscopically. The serial slices have been processed according to von Gieson and with hematoxylin.

Results

The sinuatrial node is a long narrow shaped and elongated structure, located in the superior part of the terminal sulcus of the right atrium. It extends in front of the cranial caval vein (fig. 1).. The node is composed by slender fusifrom transverse striated fibres, which form a dense network. Connective tissue fibres are present in and around the node. Transitional fibres have been observed in the environs of the atrial muscle fibres. Nerve tissue - fibres and perikaryons - have been found between the node and the first part of the cranial caval vein.*

*The macroscopical preparation of the sinuatrial node is not possible.

Legends to the pictures 1, 2, 3, 4 and 6

1. sinuatrial node
2. atrioventricular node
3. common bundle
4. right branch
5. left branch
6. Purkinje fibres
7. myocardial fibres
8. nerve fibres
9. perikaryon

Ao Aorta
cs orifice coronary sinus
la left atrium
lv left ventricle
pt pulmonary trunk
ra right atrium
rv right ventricle

Fig. 1. Diagram of the conducting system
crosses: nervous tissue
stippled: conducting system

The oval shaped atrioventricular node is flat and thin. It is situated to the left of the orifice of the coronary sinus and to the right of the membranous part of the heart, just above the fibrous ring (fig. 2). The node is covered by a thin layer of atrial septal muscle fibres, while it lies upon this kind of fibres too. The left part of the node is covered by a cartilage. This part of the node is continuous with the common bundle.
The atrioventricular node consists of a loose network of fine striated fibres. These fibres are a little bit broader and more cylindrical than those of the sinuatrial node. Transitional fibres may be observed.
Connective tissue is rare in the atrioventricular node.
An abundant mass of nervous tissues - fibres as well as perikaryons - is located between the orifice of the coronary sinus and the atrioventricular node.
The common atrioventricular bundle (fig. 1, 2) is hooded by the cartilage.
The left branch leaves the common bundle at the left border of the cartilage. The right branch is continuous with the common bundle (fig. 1, 2). The common bundle fibres are transversely striated, they are a little bit smaller than the normal cardiac muscle fibres. In and around the common bundle a lot of nervous fibres is present.
The left branch is band shaped (fig. 3),it is thin flattened. Its first part is covered by a thin layer of cardiac muscle fibres. The fibres of this branch are striated, in the proximal part the fibres resemble the cardiac fibres, distally they change in transitional fibres and finally in Purkinje fibres.
The right branch is proximally located in the muscular mass of the ventricular septum. The branch lies just beneath the endocardium distally. Its fibres leave the septum in the moderator band to pass over to the right ventricular wall. The fibres of the proximal part resemble those of the common bundle, the distal fibres - in the moderator band - show the characteristics of the

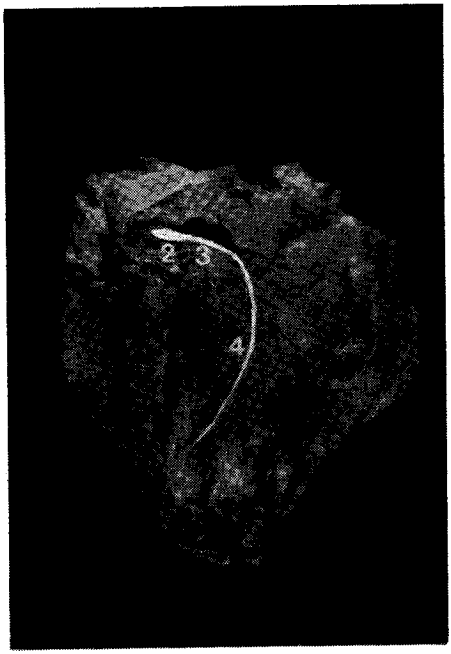

Fig. 2. Photograph of the right side of the heart

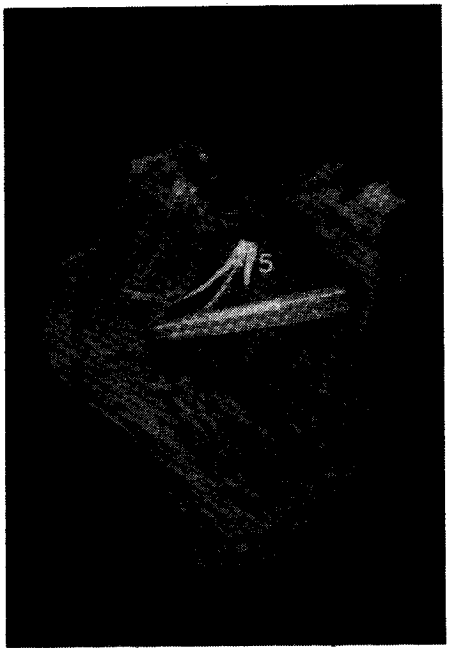

Fig. 3. Photograph of the left side of the heart

Fig. 4. Purkinje fibres, v. Giesonstain.

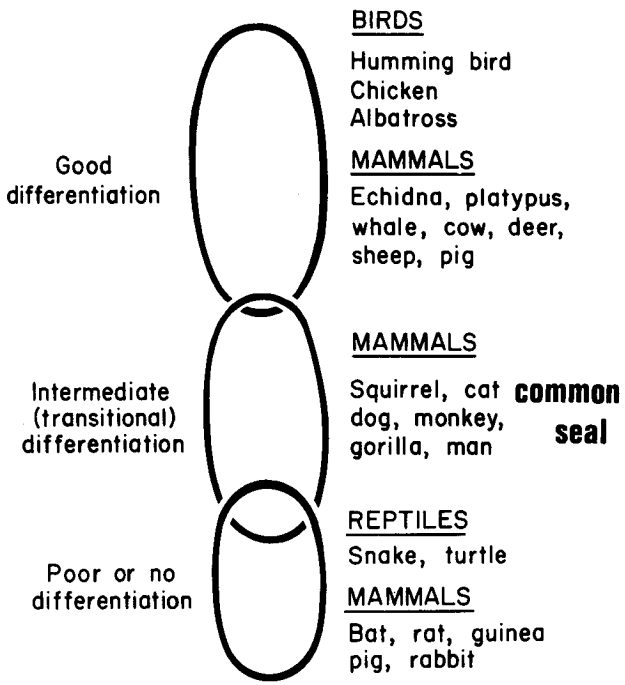

Fig. 5. Diagram of Truex ans Smythe (1965)

Purkinje fibres. In and around both the branches nervous fibres are present. The branches are enveloped in a sheath of connective tissue.
The Purkinje fibres in the heart of the common seal (fig. 4) display the characteristics of these fibres in other mammals, particularly in those of the dog. The fibres are broader and larger than the myocardial fibres. The nucleus is situated in a clear mass of sarcoplasm. The transverse striated myofibrils are relatively sparse, they are located in the periphery of the Purkinje fibres. The fibres are enveloped in a sheath of connective tissue, in this sheath some nervous fibres are present too.

Comment

A preliminary study - macroscopically as well as microscopically - of the conducting system in the heart of the common seal has been described in this short communication. The gross anatomical and topographical characteristics of the system are in concurrence with the classic picture of this system in mammals.
The microscopical features of the system do not differ widely from those of other animals. So it can be incorporated in the intermediate circle of the diagram of TRUEX & SMYTHE (fig. 5). A striking feature in this investigation is the abundancy of nerve cells (perikaryons and fibres). around some parts of the system (fig. 6). The physiological consequences of this finding are not yet clear.

Fig. 6. Nervous cells from the environse of the atrioventricular node, v. Giesonstain, magnification 120x

Summary

The conducting system in the heart of the common seal has been described. The system can be incorporated in the intermediate circle of the diagram of TRUEX & SMYTHE.
Around the system an abundancy of nervous tissue is present.

Acknowledgements

The author is grateful to Mrs. J. Voerman for typing the manuscript and to Mr. S.H. Speelman for making the photographs. The histologic slides have been prepared by Mrs. E. Vermeulen-van der Zee. The hearts were derived from seals from the sealasylum "Pieterburen", director Mrs. L. 't Hart, and the "Nivon", Arnhem, director Dr. J. van Haaften. The hearts were collected by Drs. J.S. van der Kamp, Veterinary pathologist, Groningen. The author thanks all of them for their collaboration.

Reference

TRUEX, C. and M.Q. SMYTHE, 1965. Comparative morphology of the cardiac conduction tissue in animals. Ann. N.Y. Acad. Sci. 127: 19-33.