

A COMPARATIVE STUDY OF THE MORPHOLOGY AND THE TOPOGRAPHY OF THE HEART OF THE *ARCTOCEPHALUS AUSTRALIS* (FUR OR URSINE SEAL) AND OF THE HEART OF THE *PHOCA VITULINA VITULINA* (COMMON OR HARBOUR SEAL) IN THEIR RELATION TO THE TYPE OF LOCOMOTION.

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Introduction

The inducement to this study was an investigation of the relation between the topography of the semilunar valves of the great arteries and the transposition of these vessels (van NIE & ROOS, 1976). A great variety of mammals, including man and the common seal, had been taken up in this plan. The relation between the heart and the great vessels in man and in the common seal was striking, whereas it is quite different from those of other mammals. The concurrence of the same type of transvers section of the thorax - dorso-ventrally flattened - in both mammals was striking too. A study of the morphology of the heart of the common seal (van NIE, 1982) shows that the topography of the heart of man and common seal resemble each other.

In 1982 a baby fur seal and a single heart of such an animal were sent in for dissection. The morphological differences between the thorax and the heart in these pinnipeds - fur seal and common seal - were evident. These observations could be confirmed by the papers from MUELLER (1941) about the heart and from HOWELL (1929) about the thorax. Though HOWELL too wrote about the type of locomotion in pinnipeds, he did not discuss the relation between the shape of the thorax, the shape and the topography of the heart and the type of locomotion. The aim of this investigation is to describe the relation mentioned in the fur seal, in the common seal and for comparison in the dog.

Materials and techniques

Four common seals, ten single hearts of such animals, one fur seal baby and one single heart of such an animal and three dogs were available for dissection and further examination. Gross anatomical observations have been carried out only. The type of locomotion was studied during observation in the zoos of Berlin, Amsterdam, Rhenen and Rotterdam and in the seal asylum of Texel.

Results

The transvers section of the thorax is latero-medially flattened in the fur seal and in the dog, while it is dorso-ventrally flattened in the common seal (Fig. 1).

The hearts of the fur seal and the dog resemble each other and those of other quadruped mammals (fig. 2 ^{a,b}). The median plane of those hearts is nearly equal with the median plane of the thorax. The facies auricularis forms the left side of the heart and so the facies atrialis forms the right side. Both hearts are globular, they are not flattened at all. The heart of the common seal is 90° turned counterclockwise, so the facies caudalis forms the left side of the heart and the facies cranialis the right side. In this position the heart of the common seal is

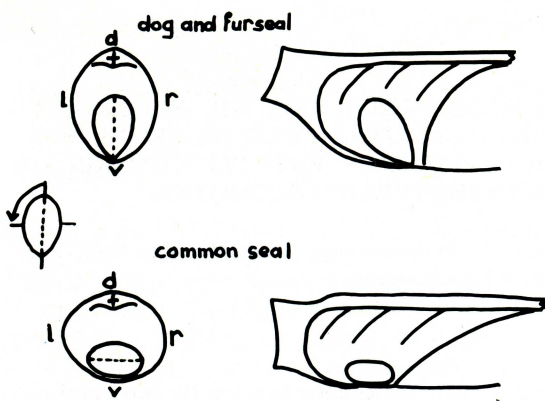


fig. 1 Diagram of the sagittal and transversal section through the thorax from a dog and fur seal and from a common seal.

flattened (fig. 1, 3 a,b).

The apex of the heart of the fur seal and the dog points to caudo-ventral, while those of the common seal points to caudal (fig. 1). The aortic arch of the fur seal and of the dog lies in a two dimensional plane - the median plane of the thorax -, that of the common seal fills up a three dimensional space.

The locomotion in the dog is typical quadruped, four legs are used in the locomotion and the thorax - the sternum - is free from the bottom during the locomotion.

The fur seal displays with its fore limbs a normal quadruped terrestrial locomotion, the sternum is free from the bottom. The hind limbs assist in the propulsion of the body.

The terrestrial locomotion of the common seal is caterpillarlike, during the propulsion neither the forelimbs nor the hindlimbs are active, while the sternum stays on the bottom

Comment

MUELLER (1941) describes the differences between the hearts of the fur seal and the common seal. The flattened aspect - in dorso-ventral direction - of the heart of the common seal has been described too; however MUELLER did not observe the 90° turning counterclockwise of the heart of the common seal. A link with the shape of the thorax and the type of locomotion is not described.

HOWELL (1929) reported about the musculature of the pinnipeds and about the type of locomotion. The difference in the shape of the bodies has been displayed by HOWELL very well. In his drawings the characteristics of the thorax as well as the type of locomotion in both the animals have been displayed. HOWELL, however, did not describe the link with the topography of the heart. In the present study the link between the shape of the thorax, the shape and topography of the heart and the type of locomotion is quite acceptable.

The order of the three characteristics remains unknown. But it is clear: the shape of the transvers section of the thorax and the shape and the topography of the heart are closely related.

So our choice must be: The shape of the thorax is prevalent to the locomotion or reversely the locomotion is primer to the shape of the thorax.

Only a study of the evolution of the Pinnipedia can solve the problem.

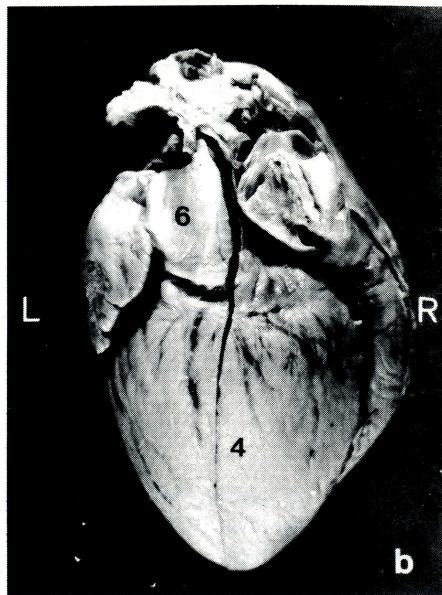
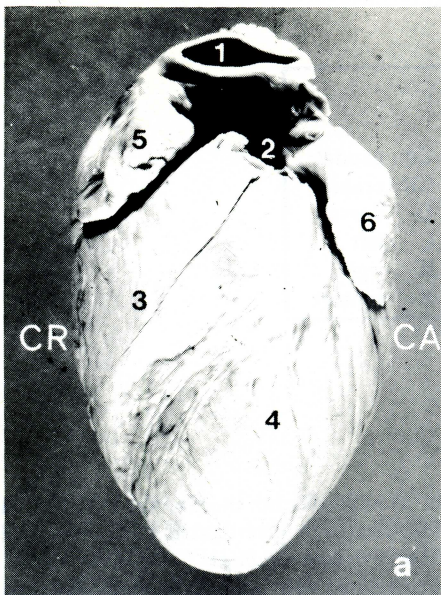


fig. 2 Heart of the fur seal
 a. facies auricularis (left side of the heart)
 b. facies caudalis (caudal side of the heart)

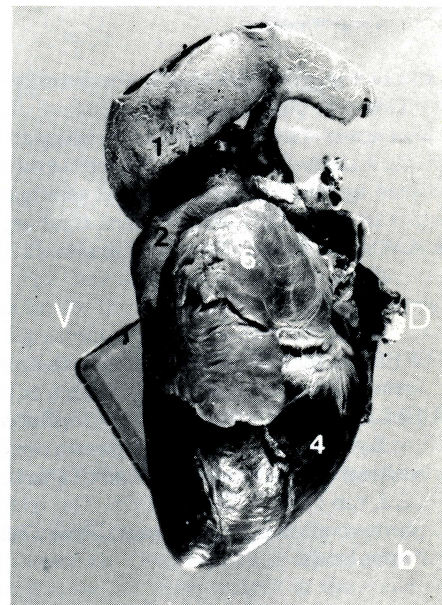
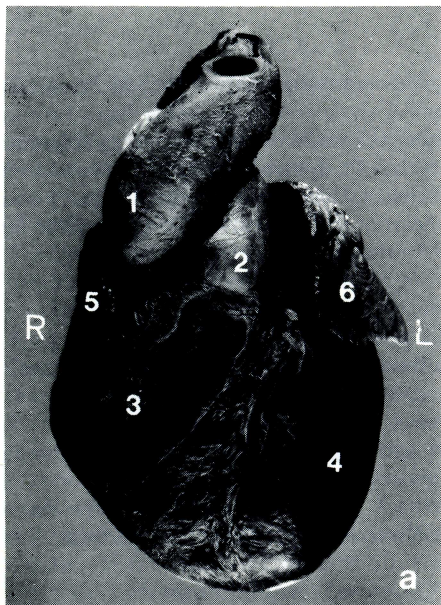


fig. 3 Heart of the common seal
 a. facies auricularis (ventral side of the heart)
 b. facies sinistra (left side of the heart)

Legends to figures 2 and 3

1	aorta	CA	caudal
2	pulmonary trunk	CR	cranial
3	right ventricle	D	dorsal
4	left ventricle	L	left
5	right atrium	R	right
6	left atrium	V	ventral

Summary

The relation between the shape of the transvers section of the thorax, the shape and topography of the heart and the type of locomotion has been investigated in the fur seal (*Arctocephalus australis*) and in the common seal (*Phoca vitulina vitulina*).

A quadruped terrestrial locomotion in the fur seal is correlated with a latero-medially flattened transvers section of the thorax and a global heart; while a caterpillarlike terrestrial locomotion in the common seal is correlated with a dorso-ventrally flattened transvers section of the thorax and a turned flattened heart.

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Heart and locomotion in the common seal and the fur seal C.J. van Nie