التصريف الوريدى للجهاز الظهري للصدر
في بعض الندبيات

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أجريت هذه الدراسة على 7 عمالق رمادية، 30 فار، أيلول، 1969،
3 حقنات صغيرة. وقد استخدم المجهر التشريحي (×130) في دراسة
الأوردة الدوائية جمجمة الدم من الجهاز الظهري للصدر. وجد
أن الأوردة الدوائية (Ayzgos - vein) توجد في جميع الندبيات
التي استخدمت وأنها يقسم جميع الدم على معظم الأوردة الظهريه
الانضغاطية.

وقد قورنت نتائج هذه الدراسة بنتائج الدراسات الأخرى التي
أجريت طبيعية للندبيات المختلفة.
THE VENOUS DRAINAGE OF THE DORSAL THORACIC WALL IN SOME MAMMALS
(With 5 Figures)

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SUMMARY

The present work is done on seven grey foxes, thirty albino rats, fifteen rabbits and thirteen microtus (rhinopomadidae). The venous drainage of their dorsal thoracic wall is described completely. It was found that, most of the dorsal intercostal veins are received by the azygos vein. Neither hemiazygos nor accessory hemiazygos veins present in these mammals.

INTRODUCTION

Compared to higher mammals, little attention is paid to the venous drainage of the dorsal thoracic wall in lower mammals. McClure (1906), in didelphys, Tylor and Webber (1956) and Harrison (1970) in cats, Wells (1968) in rat and Cook (1965) in laboratory mouse gave little information about this subject. The present work is done to give a complete identification for the veins draining the dorsal thoracic wall in lower mammals. In addition to this, the present results are compared with those obtained in lower and higher vertebrates and to throw some light on the evolution of the azygos venous system.

MATERIALS AND METHODS

Seven grey foxes, fifteen rabbits, thirty albino rats, and thirteen microtus (rhinopomadidae) are used in the present study. All animals are adults. Grey foxes were shot and collected from the fields in the vicinity of Assiut University. While other animals were anaesthetised with ether. All animals are injected with coloured latex (Drury et al., 1967) and kept in 10 per cent formaldehyde solution for seven days to hasten the settling of the cast.

The viscera, lungs and heart are carefully removed. The first thoracic vertebra is identified and used as a landmark from which other thoracic vertebrae are counted.

By means of a dissecting binocular microscope, the dorsal intercostal veins and the veins draining them are identified and studied.

An outline of the ventral aspect of the dorsal thoracic wall, showing different vertebrae and ribs, of the different mammals is drawn. Mimeographed copies of these outlines are made and used to record the result (Seib, 1932). The veins are drawn with regard to their relative size and their bony relations.

RESULTS

GREY FOX

Dorsal Intercostal Veins:

Each intercostal space has a dorsal intercostal vein. The dorsal intercostal vein arises about the middle of its own intercostal space. It passes medially until it reaches the azygos vein or the precava, according to its position, where it terminates. The most rostral veins terminate in pairs, but the remaining ones terminate separately (Fig. 1).

Each dorsal intercostal vein situated along the caudal border of the corresponding rib rostral to the accompanying artery and nerve.

Each dorsal intercostal vein receives several innominate muscular veins from the adjacent muscles. In addition it receives the lateral cutaneous and the collateral veins from the skin and muscles of the lateral thoracic wall. It also receives, the dorsal vein, (Fig. 2), which drains skin and muscles of the dorsum, the spinal cord and the vertebral column.

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The dorsal intercostal vein and its collateral tributary anastomose laterally with the ventral intercostal veins.

The first two dorsal intercostal veins, one each side, terminate by a common stem into the precava (Fig. 1). The third and fourth veins on the left side behave also as the preceding veins. The remaining dorsal intercostal veins and the dorsal costo-abdominal veins are received by the aygys vein (Fig. 1).

The dorsal costo-abdominal vein arises by the confluence of two veins; a dorsal abdominal vein from the dorsal muscles of the abdomen and a costal vein extending along the caudal borders of the last rib. It runs medially in series with the dorsal intercostal veins, and terminates into the aygys vein (Fig. 1).

Aygys Vein:

The aygys vein is formed as the direct rostral continuation of the median lumbar vein (Fig. 1).

It enters the thorax through the aortic hiatus of the diaphragm where it lies dorsal to the aorta. It continues rostrally along the mid line of the vertebral column near its termination, it deviates slightly to the right (Fig. 1). Finally, it swerves ventrally around the root of the right lung to open into the precava, just fore piercing the pericardium, opposite the body of the third thoracic vertebra.

During its course, the aygys vein is present ventral to the vertebral column, ventral longitudinal ligament, right dorsal intercostal arteries, dorsal to the oesophagus, thoracic aorta and medial to the sympathetic trunks. As it swerves ventrally to reach the precava, it crosses the right side of both the oesophagus and trachea.

The aygys vein receives oesophageal veins in addition to the before mentioned tributaries.

It anastomoses with the first two or three pairs of lumbar veins through the small median lumbar vein. (Fig. 1). It is present venral to the first two or three lumbar vertebrae.

RABBIT

Dorsal Intercostal Veins:

The dorsal intercostal veins are similar to those described in grey fox except in their mode of termination. The first four left dorsal intercostal veins terminate into the left rostral intercostal vein. The first two right dorsal intercostal veins terminate into the right rostral intercostal vein. The remaining dorsal intercostal veins and the dorsal costo-abdominal veins open into the aygys vein (Fig. 3).

Each rostral intercostal vein passes rostro-ventral to the necks of the corresponding ribs. Finally opens into the corresponding precava (Fig. 3).

Aygys Vein:

It is similar to that described in grey fox except that it opens into the right precava opposite the rostral border of the third thoracic vertebra (Fig. 3).

ALBINO RAT

Dorsal Intercostal Veins:

The dorsal intercostal veins are similar to those described in grey fox and rabbit except for their termination. The first two dorsal intercostal veins, of each side, form the rostral intercostal vein. The latter passes rostro-ventral to the neck of the first rib to open into its corresponding precava. The third and fourth, on the right side, open in common into the right precava. The remaining dorsal intercostal and the dorsal costo-abdominal veins open into the aygys vein. The last two dorsal intercostal and dorsal costo-abdominal veins, on each side, form a common vein which joins the aygys vein opposite the body of the tenth thoracic vertebra (Fig. 4).

Aygys Vein:

It is similar to that of grey fox and rabbit except for its relations and termination. It lies to the left of the middle of the vertebral column (Fig. 4). Unlike that in grey fox and rabbit, it lies ventral to the left dorsal intercostal arteries. As it swerves ventrally to reach its termination into the left precava, it crosses the left sides of the trachea and oesophagus.
Dorsal Intercostal Veins:

The dorsal intercostal veins are similar to those described in the previous mammals except for the mode of termination. The first two dorsal intercostal veins, on each side, drain into the corresponding rostral intercostal vein which opens into the corresponding precava. The remaining dorsal intercostal and the dorsal costoabdominal veins open separately into the asygos (Fig. 5).

Asygos Vein:

The asygos vein is nearly similar to that described in gray fox except it termination. It terminates into the right precava at the level of the body of the second thoracic vertebra (Fig. 5).

DISCUSSION

In most vertebrates, the venous drainage of the posterior wall of the thorax, passes chiefly through the asygos system.

In birds, the asygos system was not developed (McLure, 1906). This was explained by the disappearance of the anterior portions of the corresponding postcardinal vein and the complete absence of the supracardinal veins which were essential in the formation of the vena asygos, (Lillie, 1930); Patten, 1958 and Romanoff, 1960). The same opinion was considered by Weichert, (1950) in reptiles, Huetten, 1949, in the frog.

In reptiles (Weichert, 1958) and in birds (Baumel, 1975) the venous drainage of the posterior thoracic wall passes mainly through the internal vertebral sinus which corresponds to the asygos system.

In the present study, the venous drainage of the posterior thoracic wall, passes mainly through the asygos vein. There is neither accessory hemiazygos nor hemiazygos vein. This is similar to didelphys (McLure, 1906) and to cat (Tylor and Weber, 1956 and Harrison, 1970). The absence of the accessory hemiazygos veins was explained by Huttin (1920), who attributed it to atrophy of the cranial part of the left supracardinal vein.

Position of the vena asygos: In gray fox, rabbit and bat, the vena asygos lies on the right side of the front of the vertebral column.

This is similar to the cat (Tylor and Weber, 1956 and Harrison, 1970), dog (Miller, et al., 1964) pithecus rhesus (Seib, 1932) and to man (Seib, 1934; Davies and Davies 1926).

In rat, the vena asygos lies on the front of the left side of the vertebral column. This is similar to didelphys (McLure, 1906) and laboratory mouse (Cook, 1965).

Origin Of Vena Asygos:

In gray fox, rabbit, albino rat and bat, the vena asygos is found to be the direct continuation of the median lumbar vein.

The same observation was detected by McLure (1906) in didelphys; Miller et al. (1964), in dog; Seib, (1932), in pithecus rhesus and Seib, (1934) and Davies and Davies (1962) in man. Seib, (1934) termed the lumbar vein, the ascending lumbar, while Davies and Davies (1962) termed it, the lumbar asygos. Both of them correspond to the median lumbar vein of the present study. Seib, (1934) found that in 6% of cases the vena asygos was the direct continuation of the right subcostal vein. In cat, the vena asygos arises from the junction of several small veins which originate in the musculature of the rostral part of the dorsal wall of abdomen (Tylor and Weber, 1956).

Intersegmental Veins: In the present study the intersegmental veins of the first and second right spaces, form a common trunk, the right rostral intercostal vein which opens into the right precava. It corresponds to the intercostalis prima dextra in pithecus rhesus (Seib, 1932). In man, only the first intersegmental vein which joined the brachiocephalic vein, while those of the second and third spaces form the superior intercostal vein which joins the vena asygos (Seib, 1934; Davies and Davies, 1962). The present study also shows that the intersegmental veins of the first and second left spaces form the left rostral intercostal vein which joins the left precava. But in the rabbit, the left rostral intercostal vein extends to the fourth space. It corresponds to the intercostalis prima sinistra in pithecus rhesus (Seib, 1932). In man the first intersegmental vein joins the left brachiocephalic vein, while the second and third form the left superior intercostal vein which also joins the left brachiocephalic vein (Seib, 1934; Davies and Davies, 1962).

As regards to the rest of the intersegmental veins of the right side, the present study shows that most of them open into the vena asygos. The same observation was also detected in most mammals (Miller et al., 1964), in dog (Seib, 1932) in pithecus rhesus, and (Davis and Davis, 1962 in man). As regards to the rest of the intersegmental veins of the left side, the present study shows also that most of them open directly into the vena asygos. This is similar to didelphys (McClure, 1906) and to cat (Tylor and Weber, 1956).

In pithecus rhesus (Seib, 1932) and in man (Seib, 1934 and Davis and Davis, 1962) the intersegmental veins from the fourth to the eighth spaces join the hemiazygos while those of the lower spaces join the accessory hemiazygos vein.

CONCLUSION

1) In higher mammals (man) the asygos system is composed of a vena asygos, hemiazygos and an accessory hemiazygos veins. The vena asygos is developed from the proximal part of the right postcardinal and the cranial part of the right supracardinal veins. While the hemiazygos and accessory hemiazygos veins are developed from the cranial part of the left supracardinal vein (AREY, 1965).

2) In lower mammals (fox, rabbit, cat, rat) there is neither hemiazygos nor accessory hemiazygos vein. This is due to the disappearance of the cranial part of the left supracardinal vein. So most of the intersegmental veins on the side open directly into the vena asygos.

3) In reptiles and birds there is no asygos system at all. This is due to the disappearance of the cranial part of the postcardinal and complete absence of the supracardinal veins. The intersegmental veins open into the internal vertebral veins.

REFERENCES


ABBREVIATIONS

T.V.: Thoracic vertebra.
L.V.: Lumbar.
Az. V.: Azygos vein.

Ic. V.: Dorsal intercostal vein.
Ant. Ic. V.: Rostral intercostal vein.
B.C.V.: Brachiocephalic vein.
D.v.: Dorsal vein.

Int. J.V.: Internal jugular vein.
L.Cu.V.: Lateral cutaneous vein.
S.V.: Spinal vein.

S.V.: Spinal vein.
Col. V.: Collateral vein.

EXPLANATION OF FIGURES

Fig. 1: A diagram of the venous drainage of the dorsal thoracic wall of grey fox.

Fig. 2: A diagram of the fifth right dorsal intercostal vein and its tributaries, in grey fox.

Fig. 3: A diagram of the venous drainage of the dorsal thoracic wall of rabbit.

Fig. 4: A diagram of the venous drainage of the dorsal thoracic wall of the albino rat. Note the* the asygos vein was present to the left of the midline of the vertebral column.

Fig. 5: A diagram of the venous drainage of the dorsal thoracic wall of microbat.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5