

Summary

Anatomy of the Coronary Arteries in Fetal Pigs: Comparison with Human Anatomy

The essay investigated the origin, number, location and distribution of the coronary arteries in fetal pig, also compared the similarity and different with adult pigs or humans. The authors highlight that the coronary arteries in fetal pigs were more suitable for comparison with humans when pigs are used as experimental animals for studying the coronary vessels. The authors point that it provided reliable information about the distribution and ramifications of the coronary artery, and could be an important reference for investigation of clinical treatment of the coronary arteries.

Heart transplantation is limited by the shortage of donors, and heterologous organ transplantation has long been envisioned as an alternative. The distribution of the coronary circulation in pigs is said to be similar to that in humans, however, a few studies have detailed the distribution and ramifications of the coronary circulation. In adult pig, the abundant adipose tissue in the coronary sulci makes it difficult to completely preserve the coronary arteries during dissection, while the hearts of fetal pigs have little fat and are easy to dissect.

The fatty tissues and cardiac veins were removed to expose the coronary arteries in 94 hearts. Firstly, the names and location of collateral branches of the left and right coronary arteries were described specifically. Then, the average number of the coronary branches in the LC and RC were recorded. Also, the terminal ramification location of obtuse branches, acute marginal and left posterolateral branch were described. Lastly,

the number and origin of sinoatrial nodal branch and atrioventricular nodal artery were described, and the dominants of coronary circulation were assessed.

As a discussion, the similarity between humans and pigs was that bifurcation is more frequent than in other species, whereas trifurcation and tetrafurcation are more common in humans than fetal pigs. However, fetal pigs were generally similar to humans. The LC supplied significantly more branches to the left ventricle than the RC, and the AIV gave off significantly more branches to the left ventricle than the right ventricle. Similarly, there were more numerous left septal branches than right septal branch in humans. In addition, the PIV supplied less of the posterior surface of the left ventricle than that of the right ventricle irrespective of coronary dominance. The incidence of a long Cx was more variable in both pigs and humans than in fetal pig. In adult pigs, the obtuse marginal branch was longer than in fetal pigs. There were similar results of length of the acute marginal branch in fetal pigs and humans. The sinoatrial nodal artery originated from the RC approximately 70%, but there are differences regarding origin from the Cx or bilateral origin between humans and fetal pigs or adult pigs. Furthermore, in fetal pigs the AVN came from the right posterolateral branch in the vast majority of hearts and arose directly from PIV of the RC at a very low frequency. The incidence of right coronary artery dominance was slightly lower and co-dominance was slightly higher in fetal pigs than in humans.

In conclusion, the present study provided the first detailed evidence about the branches and distribution of the coronary arteries in fetal pigs, based on comprehensive dissection and analysis of all coronary branches.

1. The LC had more collateral branches than the RC. In addition, the LC supplied more branches to the left ventricle than the RC, and the AIV gave off more branches to

the left ventricle than right ventricle. The PIV supplied more branches to the posterior surface of the right ventricle than the left ventricle, irrespective of coronary dominance.

2. The AIV gave off more septal branches than the PIV, and the AIV was more important for the blood supply of the ventricular septum.

3. In fetal pigs, the posterior interventricular sulcus branch always originated from the RC, while the Cx always ended at the posterior left ventricle and rarely extended to the posterior interventricular sulcus.

4. The AVN always arose from the RC in both fetal and adult pigs, but it was also supplied by the Cx in humans.

5. Left and right atrial branches were detected in all fetal pigs.

6. The termination of the left posterolateral branch, which arises from the Cx, has hardly been mentioned in prior reports. The distribution of the left posterolateral branch supplying the posterior left ventricle was an important criterion for coronary dominance of the LC.

7. In fetal pigs, anastomosis was found between the left and right conus branches, which are nutrient arteries of the pulmonary cone.

8. Others collateral branches were not significantly different between fetal pigs and humans, including the acute marginal branch, obtuse marginal branch, and SAN, and coronary dominance also did not differ significantly.

The fetal pig hearts used by this study had little fat, and the coronary arteries were perfused with red latex. Accordingly, the branches of the coronary arteries, especially small ramifications, were easily exposed and analyzed without damage. Compared with adult pigs, dissection of the coronary arteries in fetal pigs can more faithfully reflect the overall porcine coronary vasculature. The coronary arteries of fetal pigs were also more

suitable for comparison with human hearts, and could provide standard parameters for experimental studies of the coronary vasculature in pig models or important reference data for investigating clinical treatment of the coronary arteries. Finally, our information provides a reliable basis for assessing the distribution and ramifications of the coronary arteries, and is useful for clinicians and surgeons to comprehensively understand the coronary circulation.