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BLOOD SUPPLY OF EPICARDIAC GANGLIONATED NERVE PLEXUS IN PIG MODEL

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Background

At present, almost nothing is known about the anatomy of the epicardiac ganglionated nerve plexus (epiGP) circulation. The detailed data on blood supply of epiGP would allow both to explain the disorders of the autonomic system of the heart in a case myocardial infarction and to expand the possibilities of intracardiac interventions preserving the blood circulation of the cardiac epiGP.

The study aim - to determine sources of blood supply to epiGP and to identify morphologic pattern of epicardiac blood vessels (epiBVs) supplying the epiGP.

Materials And Methods

- 34 hearts of newborn pigs were used in this study:
  - ✓ 12 hearts were filled with ink solutions distinct in color;
  - ✓ 11 hearts were stained histochemically for acetylcholinesterase (AChE);
  - ✓ Coronary arteries (CAs) of 17 hearts were filled with low viscosity epoxy resin;
  - ✓ different in color ink was injected into abdominal aorta of five animals;
- Heart preparations were analyzed with a stereomicroscope.

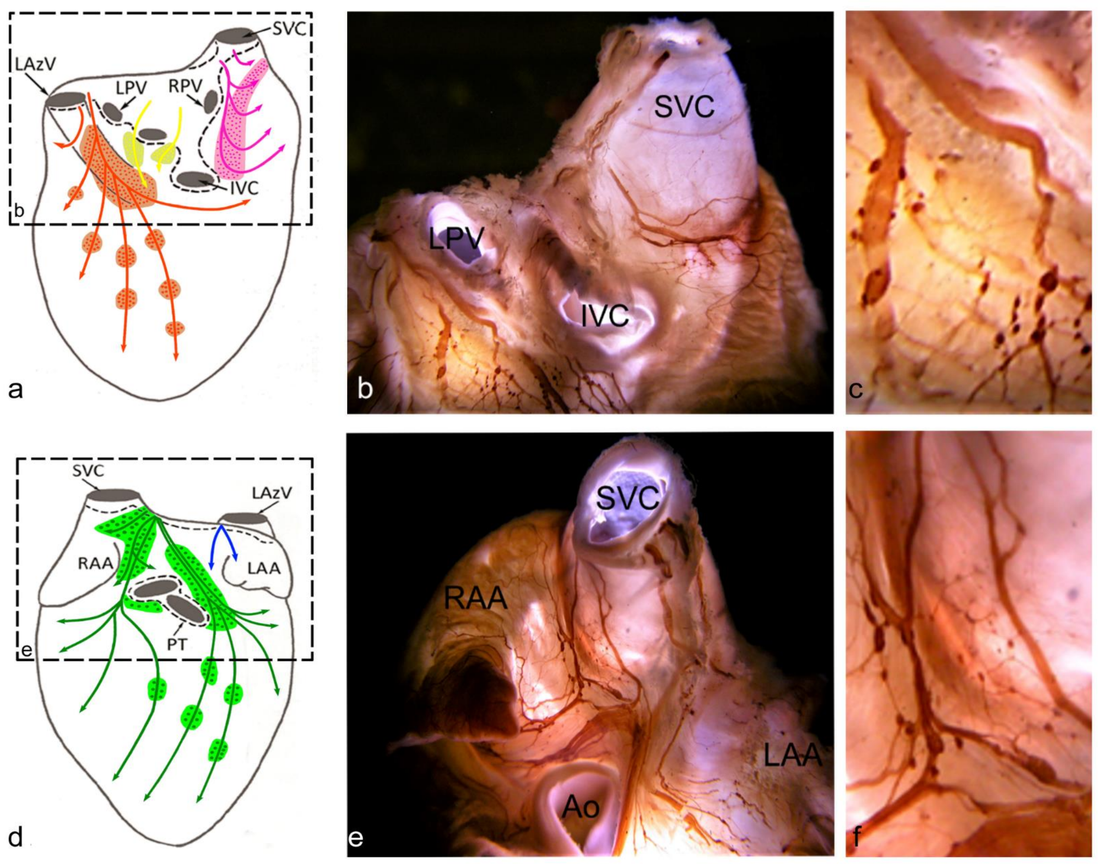

Fig. 1 Scheme of dorsal (a) and ventral (d) view of pig epiGP stained histochemically for AChE (b-c and e-f) to illustrate the distribution of epicardial nerves and ganglia.

Conclusion

In large regions of the pig epicardium, epiGP is supplied by blood via both CAs and non-CAs. This finding explains the superior survival and functioning of epiGP in a case of myocardial infarction.

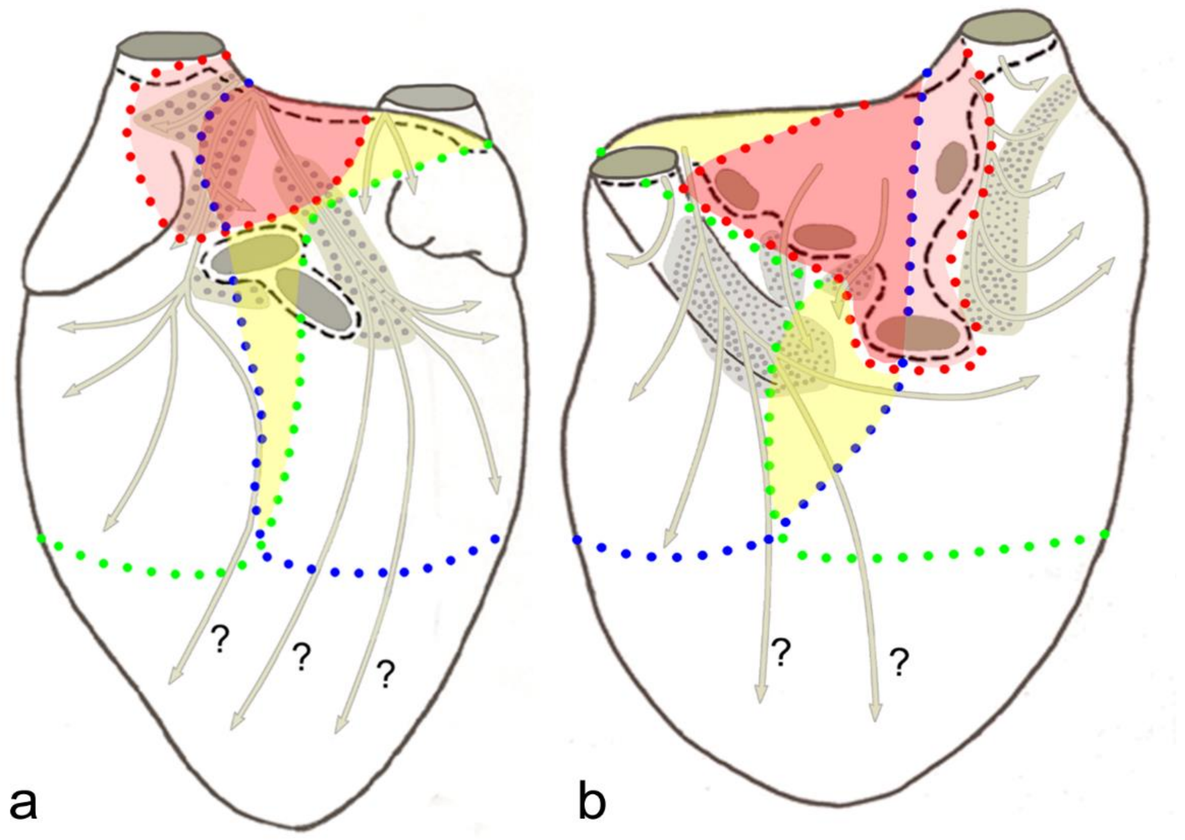

Fig. 4. Schematic drawing of the ventral (a) and dorsal (b) side of the newborn pig heart demonstrating the blood supply for epiGP via the left CA (blue dotted line), the right CA (green dotted line) and non-coronary arteries (red dotted line). Yellow areas delineate epicardial regions that are supplied by blood from two (left and right CA) arterial pools. Light purple areas delineate epicardial regions that are supplied by blood from two (right CA and non-CA) arterial pools. Light red areas delineate epicardial regions that are supplied by blood from three (left and right CA and non-CA) arterial pools. Question marks mean the areas that are needed further examinations.

Results

- Blood supplies the pig epiGP through both CAs and non CAs that pass into the pig heart together with accessing mediastinal nerves (Fig. 2).
- Non-CAs do supply both the nerves and the ganglia of epiGP distributed on both atria, especially within boundaries of the heart hilum and at the root of right cranial (superior caval) vein (Fig. 2 c, d).
- Several branches from different CAs may overlap supplying the blood for the same epicardiac nerves and ganglia (Fig. 2 b).
- Contrarily to epicardiac nerves, epicardiac ganglia are usually supplied by a sole artery only (Fig. 3 c, d).
- The branches of CAs supplying the epiGP are mostly of fifth-sixth succession (Fig. 3 a, b).

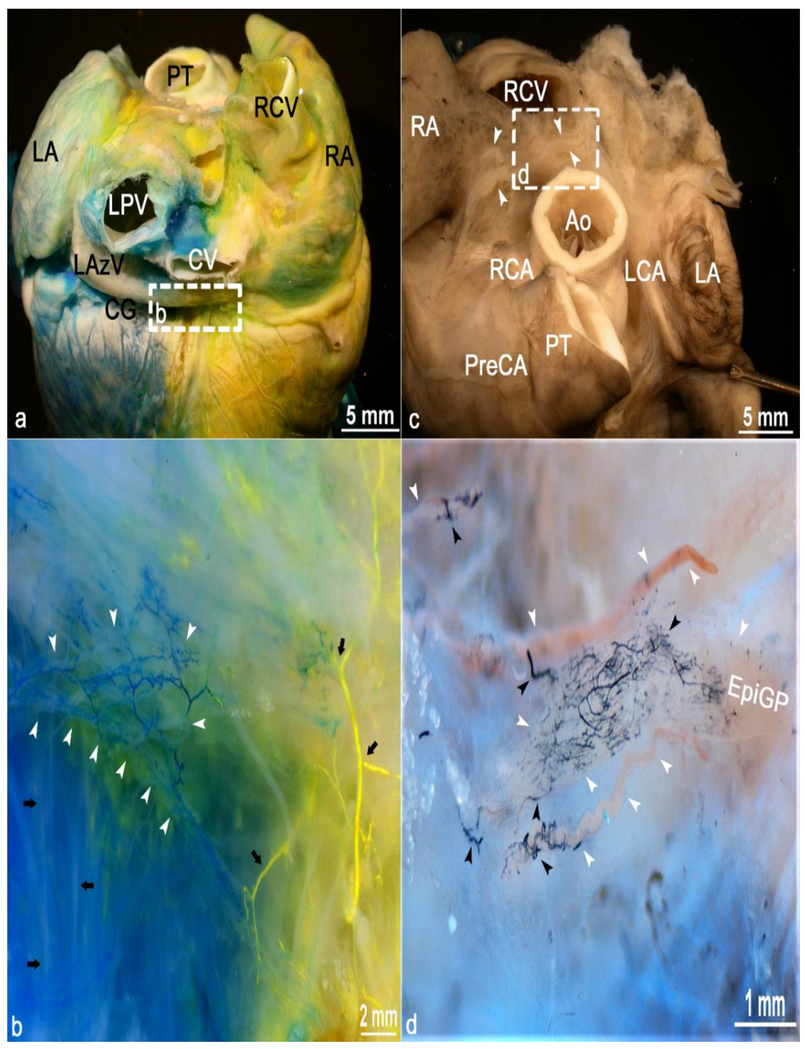

Fig. 2. Macrophotograph (a) and stereomicroscopic image (b) illustrating the blood supply of epicardial nerves and ganglia from CAs in pig hearts injected with ink of different colors: the right CA- yellow, the left CA - blue. Black arrows indicate the branches of the right and left CAs., while white arrowheads –nerves.
Panels c and d illustrate the blood supply of epicardiac nerves and ganglia from non coronary arteries in pig hearts injected with Indian ink. White arrowheads indicate nerves; black arrowheads point to epiGP blood vessels stained via non-CAs.

Fig. 3. Images a and b demonstrate the blood supply to the epiGP via branches of the CAs of different sequences. 1r - 6r denote the sequence of branches of CA; black arrowheads indicate ganglia; black arrows point to the 5th row branches of the CA; white arrowheads mark the nerves; white arrows - branches of the coronary arteries; yellow arrows indicate the 6th row CA branch.
Panels c and d illustrate epicardial ganglia vascularized by a sole artery only. Black arrowheads indicate ganglia, black arrows - the blood vessel supplying the ganglion, white arrowheads – nerves, yellow arrows - the 3rd row large branch of the left CAs.