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Chronic cardiac pacing induces structural and functional remodeling in the porcine postnatal developing heart

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Introduction: the impact of chronic cardiac pacing in paediatric patients requires further elucidation. We investigated the effect of chronic pacing during porcine postnatal cardiac development.

Methods: nineteen new-born pigs with normal LV function were divided into controls (no pacing; n=5) atrio-right ventricular pacing (RVP, n=7) and atrio-left ventricular pacing (n=7). After a six fold increase body weight, we performed echocardiography, left and right ventricular myocardial biopsies. Only data from the control and RVP groups were analyzed.

Results: compared to controls, RVP animals showed a significant ($p < 0.05$) decrease in LV ejection fraction, and a significant increase in left atrial size. RV pacing resulted in myocardial disarray and in a significant increase in the myocardial fibrosis score (figure). A significant increase in stress-response kinase ERK1/2 was also observed ($p < 0.05$). No significant difference in global or regional expression of SERCA2a ATPase, total caspase 3 and connexin 43 was identified. Finally, we found a dramatic alteration in myocardial mitochondrial function, with a significant reduction of maximal oxygen consumption and a positive response to cytochrome c test ($p < 0.05$), which indicates an alteration of the outer mitochondrial membrane integrity.

Conclusions: RVP during postnatal cardiac development in the porcine heart results in marked changes in cardiac structure and function. The analysis of the LV pacing group may answer the question whether the negative impact of ventricular pacing can be minimized by LV pacing.

