THE CARDIAC STATE DIAGRAM AS A NOVEL APPROACH FOR EVALUATION OF PRE- AND POST EJECTION PHASES OF THE CARDIAC CYCLE IN ASPHYXIATED FETAL LAMBS

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ABSTRACT

The CSD method is based on a new model for how the heart performs its pump and regulatory functions [1,2]. This model states that the heart pumps and auto-regulates the flow of blood according to the DAPP technology, which is a new type of pump technology with very efficient pump characteristics.

The DAPP technology and therefore also the heart performs its functions optimally based on a dynamic process in the hearts inflow, outflow and internal flow. Therefore the starting and end point of the different cardiac events and changes in dynamic and static energy generated by the heart’s AV-plane (piston) movements transferred to pressure and flow into, inside and out of the heart. This definition of cardiac phases is novel and does not coincide with the previously described phases since the DAPP-technology has not previously been known.

1. Objective

To investigate myocardial wall motion, using echocardiography and colour-coded tissue velocity imaging and generate Cardiac State Diagram according to a recently new developed program for evaluation of the duration of the Pre- and Post Ejection phases, in the cardiac cycle in asphyxiated fetal lambs.

2. Method

Six near term lambs were partly exteriorized and monitored using echocardiography and colour-coded tissue velocity imaging while brought through asphyxia to cardiac arrest. Arterial blood sampling for lactate and blood gas measurements were simultaneously performed, the first sample taken before cord occlusion and then every 5 min until cardiac arrest. The heart’s mechanical function of the fetal lamb was evaluated in newly developed software GHLab based on the assumption that the heart’s pumping and regulating functions acts according to a new pump-principle today recognized as the Dynamic Adaptive Piston Pump principle. The results from the software are displayed in an easy to interpret Cardiac State Diagram.

3. Results

All fetal lambs showed a prolongation of the Pre- and Post Ejection phases at the same time when the most pronounced change in lactate and pH occurred. The percentage change of the duration of the Pre- and Post Ejection phases were significantly longer in all fetal lambs, 49% (p<0.001) and 38% (p<0.049) respectively. The heart’s mechanical function was interpreted and visualized in a Cardiac State Diagram where the cardiac events are detected and displayed.

4. Conclusion

As asphyxia progresses in fetal lambs, the duration of the Pre- and Post Ejection phases increased and the Cardiac State Diagram has the potential of being a comprehensible tool for detecting fetal asphyxia.

References