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ABSTRACTS**

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20 HEAT TRANSFER MODEL BASED ON THERMOGRAPHIC IMAGING OF THE HEART IN OPEN CHEST CONDITIONS

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Intraoperative infra-red thermography (IRT) of the heart attracted the attention of scientists and clinicians for many years. IRT until now it is not widely used in the clinical practice, in spite of many experimental studies. The most important question of qualitative information regarding coronary flow was not so easy to solve from the only visible side of the heart in open chest conditions of surgery. In the same time, modern devices and information technologies are giving new solutions, which can be useful during CPB.

The aim was expansion of available information about protection of the myocardium and the state of its vascular bed using heat transfer model based on the pericardial temperature propagation in circumstances of CPB.

In 12 cases of aortic and heart valves surgery, **methods** of the heart IRT control was used with FLIR i7 thermograph in spectral range of 8-14 microns on the basis of not cooled matrix of 320×240 elements size and with temperature sensitivity of 0.1°C . The method of comparative analysis for thermograms of myocardium allows to obtain the thermal picture for open heart in ranges from $+4^{\circ}\text{C}$ up to $+37^{\circ}\text{C}$ in conditions of CPB in ranges $+28^{\circ}\text{C} - +37^{\circ}\text{C}$.

Results

A numerical model of heat transfer during extracorporeal circulation in the form of a system of ordinary differential equations was created. It allows to estimate the parameters of temperature propagation and temperature gradients at the surface of the myocardium at the time of registration of thermal images of the heart.

IRT of the heart during CPB showed a correlation of temperature values at the beginning and the end of the process of cooling and warming, as well as a significant difference HLM reading system sensors and thermal field on the surface of the myocardium IRT.

The 3D numerical heat transfer model in the myocardium takes into account real specific heat of human heart, the initial temperature distribution and free convection mechanism in the myocardium, and also allows to calculate the rate of cooling of the myocardium and to determine the presence of ischemic lesions on the surface of the myocardium.

Conclusion

Comparison of the model with real patients IRT shows that this method can provide additional important information regarding temperature and vascular uniformity in time of myocardial cooling and heating. This method increasing safety of myocardium protection and assistive in solutions of weaning from CPB.