Physiological measurement

Simulation method for cardiac stroke volume estimation by intracardiac electrical impedance measurement

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Abstract—*Using the electrical impedance measurement technique to investigate stroke volume estimation, three models of the ventricle were simulated. A four-electrode impedance catheter was used; two electrodes to set up an electric field in the model and the other two to measure the potential difference. A new approach, itself an application of the quasi-static case of a method used to solve electromagnetic field problems, was used to solve the electric field in the model. The behaviour of the estimation is examined with respect to the electrode configuration on the catheter and to catheter location with respect to the ventricle walls. Cardiac stroke volume estimation was found to be robust to catheter location generating a 10 per cent error for an offset of 40 per cent of the catheter from the chamber axis and rotation of 20° with respect to the axis. The electrode configuration has a dominant effect on the sensitivity and accuracy of the estimation. Certain configurations gave high accuracy, whereas in others high sensitivity was found with lower accuracy. This led to the conclusion that the electrode configuration should be carefully chosen according to the desired criteria.*

Keywords—*Catheter configuration, Catheter location, Electric field, Electrical impedance, Intracardiac measurement, Stroke volume, Ventricular volume*

Med. & Biol. Eng. & Comput., 1992, **30**, 473–480