

TITLE: Continuous monitoring of myocardial VO_2

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INTRODUCTION: The measurement of coronary blood flow and oxygen content for the determination of myocardial oxygen consumption (MVO_2) are tedious. Indwelling fiberoptic catheters utilizing reflexion oximetry to continuously monitor blood oxygenation (O_2 sat) may be a considerable progress for determination of MVO_2 . This study was designed to evaluate the feasibility of direct on line monitoring of MVO_2 in a canine right heart bypass preparation, with a custom designed fiberoptic probe. Of particular interest was the question whether deliberate pharmacologic manipulations of MVO_2 are detected by this device and if so, to what extent data thus obtained could be used to monitor the induction of cardioplegia.

MATERIALS AND METHODS: A 250 mm long, 1.5 mm O.D. flexible fiberoptic probe was placed into the coronary sinus of 18 dogs during right heart bypass. Total coronary sinus blood flow (CBF) was measured directly. In addition, radioisotope labelled microspheres were used to measure regional myocardial blood flow and validate data. While maintaining heart rate and coronary perfusion pressure constant, myocardial oxygen demand was altered by administration of isoproterenol, thiopental, halothane or propranolol.

RESULTS: In preparations where measured left ventricular O_2 consumption (LVVO_2) was decreased from 7.4 ± 2.5 ml O_2 /100g LV wall (LVW)/min to 2.6 ± 2.5 ml O_2 /100g LVW/min ($p < 0.001$), CSO_2 sat increased from $44\% \pm 11$ to $79\% \pm 12$ ($p < 0.001$) (Fig.1). Left ventricular blood flow (LVBF) did not change significantly. When LVVO_2 increased from 6.1 ± 2.2 ml O_2 /100g LVW/min to 10.7 ± 3.3 ml O_2 /100 LVW/min ($p < 0.0001$), CSO_2 sat did not change but LVBF increased from 83 ml/100g LVW/min to 171 ml/100g LVW/min ($p < 0.005$).

CONCLUSION: The results show that: 1) Data obtained in vitro with the fiberoptic probe correlate with in vitro measurements obtained with other well established methods (Van Slyke) (Fig. 2).

2) CSO_2 sat increased only during maneuvers to lower myocardial oxygen demand. 3) Preparations which had high ($>80\%$) CSO_2 sat during induction of cardioplegia had significantly better post bypass functions than those where CSO_2 sat remained low ($<65\%$) during induction of cardioplegia. 4) We found that the fiberoptic probe was easy to use and helpful during attempts to lower MVO_2 .

FIG 1

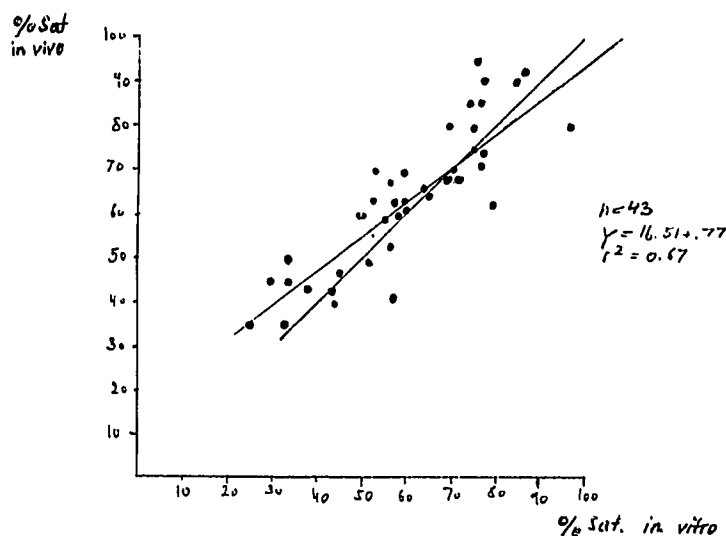


FIG 2

