

Title: TISSUE pH MEASUREMENTS IN PATIENTS UNDERGOING CARDIAC SURGERY

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Introduction: The recent development of miniature pH electrode (Roche Medical Electronics, Inc.) for continuous in vivo pH measurement has been a challenge for numerous investigators during the past decades. Several studies carried out in animals as well as human fetuses during labor have concluded that tissue pH values obtained by this micro-electrode are in good correlation with the pH values of capillary, arterial and venous blood samples. Currently as there are no studies to indicate its usefulness in clinical anesthesia, the present study was planned to assess the tissue pH (tpH) measurements intraoperatively with respect to its correlation with arterial and venous blood pH changes.

Methods: Eight adults undergoing cardiac surgery for coronary artery bypass and/or valvular replacement procedures were studied during a standardized anesthetic management. Wide flanged spiral tpH electrode (Roche) was implanted near the left shoulder and tpH was measured with Roche tissue pH monitor (the Model 638) and recorded continuously with Roche recorder (Model 333). Arterial (radial artery cannula) and mixed venous (pulmonary artery sample through S-G catheter) blood samples were drawn at several intervals before, during and after cardiopulmonary bypass (CPB) procedures for the analysis of pH and blood gases. Tissue pH readings were compared with arterial and mixed venous pH values.

Results: The correlation coefficient between tpH and arterial pH was highly significant ($r = 0.98$, $p < 0.001$) prior to the onset of CPB (Figure 1). The tpH readings remained slightly higher than mixed venous pH values. The tpH values approached the corrected arterial or venous pH readings during CPB and hypothermia. During the rewarming period, tpH values reflected the closer trend towards the venous pH values ($r = 0.81$) compared to arterial pH values ($r = 0.72$).

Discussion: In the present study data is presented on the reliability of a new commercially available tissue pH monitor in comparison to simultaneously studied arterial and mixed venous pH values in hemodynamically unstable cardiac patients during major cardiac surgery. There was a significant correlation between arterial and mixed venous pH and continuous tissue pH values during different phases of the surgical procedure in patients undergoing major cardiac surgery. It is possible that this method of surveillance could be highly useful in clinical anesthesia to monitor the tissue perfusion and acid-base status in critically ill patients on a moment to moment basis.

References

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Figure 1

