TITLE: COMPARISON OF CARDIAC OUTPUT FROM CONTINUOUS TRANSTRACHEAL DOPPLER WITH STANDARDIZED THERMODILUTION

AUTHORS: J.A. Peper, M.D.; J.D. Biervliet, M.D., A.P. de Jong, M.D., J.J. Kloek, M.D., F.W. van Hardevelt.
AFFIL.: Dpts. of Anesthesiology and Cardio-thoracic Surgery, Academic Medical Center, Amsterdam, The Netherlands.

Introduction. Knowledge of the internal diameter and mean blood velocity in the ascending aorta allows calculation of left ventricular (LV) cardiac output minus coronary bloodflow.
This study evaluated accuracy and practicability of a continuous cardiac output device with a Doppler transducer tipped endotracheal tube (EDT) measuring both aortic diameter and blood velocity [1].
Methods. The study, approved by the hospital ethics committee, involved 10 patients undergoing coronary artery bypass surgery.
EDT diameter (d_{edt}) was compared to directly measured outer aortic diameter minus wall thickness measured from excised aortic wall (d_m).
Doppler cardiac output from EDT (CO_{edt}) was compared with a standardized thermodilution technique which involved automatic injection of 5 ml cold saline at 4 equidistant moments in the ventilatory cycle [2] (CO_{th}).
Feasibility was expressed as time and attempts needed to (re)position the tube until the maximum Doppler flow signal was obtained.
Data were analyzed using linear regression to correlate CO_{edt} with CO_{th} and d_{etd} with d_m. Since real cardiac output was unknown, limits of agreement were calculated for a single difference [CO_{edt}-CO_{th}] to the mean difference [3].
Results. The correlation between CO_{edt} and CO_{th} is presented in the figure (r=0.85). The limits of agreement ranged from +1.4 to -0.74 L/min. Correlation between d_{edt} and d_m was poor. In general EDT underestimated aortic diameter. Archieving the correct EDT position took 10 - 20 min. and 3 - 4 attempts.
Discussion. CO_{edt} underestimates cardiac output as measured by thermodilution. This would be expected since CO_{edt} measures LV output minus coronary flow. CO_{edt} variability may partly be explained by changes in EDT position. A change in the angle of the Doppler beam interferes with Doppler shift and thus with blood flow calculations. When a fixed EDT position could be maintained CO_{edt} fluctuations were minimal. Turbulent flow along the curved aortic arch results in underestimation of aortic diameter. However, this will not result in underestimation of CO_{edt}, since forward flow is only present in areas without turbulence, thus creating a reduced functional aortic diameter.
Conclusion. The EDT device produces reliable estimations of cardiac output, but requires a stable endotracheal tube position. Accuracy and feasibility may be enhanced by displaying the flow signals, which will facilitate positioning of the endotracheal Doppler transducer.

References.
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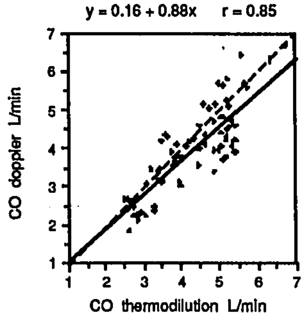

A531

TITLE: END TIDAL CO2 MONITORING DURING PREHOSPITAL CARDIOPULMONARY RESUSCITATION

AUTHORS: A. Rozenberg, P.A. Carli, M. Bousquet, O. Lamour, G. Barrier
AFFILIATION: Anesth. Dept. , SAMU, Hôpital Necker, 75015 Paris, FRANCE.

Assessing the efficacy of ongoing cardiopulmonary resuscitation (CPR) and advanced cardiac life support (ACLS) in the prehospital setting is very difficult. Recently End Tidal Carbon Dioxide partial pressure (ETCO2) monitoring had been used for the treatment of cardiac arrest in emergency rooms and hospital wards (1). The aim of this study was to evaluate if capnometry may be usable in the prehospital setting and compare ETCO2 values obtained in successfully resuscitated and non resuscitated patients.

Methods: with institutional approval 25 consecutive patients were prospectively studied on field after cardiac arrest. CPR was begun by Emergency Medical Technicians and continued with ACLS according to American Heart Association protocols by a medical resuscitation team (including at least one anesthesiologist). As soon as the patient was intubated, ETCO2 was continuously recorded by a portable infrared capnometer (POET Criticare System Inc.). ETCO2 data were analysed by a microcomputer. In order to provide a strict ventilatory control the patient was immediatly connected to a portable mechanical ventilator Patients age, sex, initial cardiac rythm , continuous EKG and circumstances were recorded. A chart of resuscitations efforts with precise timing of drugs administration, clinical status of the patient, duration of prehospital treatment was established. Special attention was focused on bicarbonates administration responsible of misleading ETCO2 increase during CPR (2). The patient was considered as successfully resuscitated if he was alive with stable blood pressure, on admission to the hospital. Patients were shared in groups according to the success of resuscitation : group 1 resuscitated group 2 nonresuscitated. Statistical analysis used unpaired student's t test for continuous variables and data were expressed as mean ± SD.

Results : One patient (sucessfully resuscitated) was excluded of the study because of the rupture of the cuff of the endotracheal tube. The 24 remaining patients were 10 in group 1 and 14 in group 2. The two groups were similar except for the initial cardiac rythm (significantly more VF in group 1). The maximum ETCO2 value recorded was higher in group 1 patients (58 ± 14 mmHg) as compared to group 2 (21 ± 5 mmHg) $p < 0.001$. Maximum ETCO2 was observed in group 1 just before the return of spontaneous circulation, time to reach this maximum value was 92 ± 302 sec from the beguinning of the recording was in group. Initial ETCO2 value was higher in group 1 (20 ± 8mmHg) as compared to group 2 (13 ± 8mmHg) $p < 0.05$

We conclude that in the prehospital setting ETCO2 monitoring is simple to perform and is a guide to resuscitation effort.

References :
1- JAMA, 262 : 1347 - 1351, 1989
2- JAMA, 257 : 512 - 515, 1987