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NON-INVASIVE DETERMINATION OF ARTERIAL OXYGEN SATURATION IN CYANOTIC CONGENITAL HEART DISEASE

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We evaluated non-invasive transcutaneous pulse oximetry (NIPO) in 28 pediatric pts, ages 3 mos.-11 yrs, wts. 2.5-36 kgs. with moderate to severe cyanotic congenital heart disease (CyCHD) during cardiac catheterization, intra-operatively during closed heart surgery and in the ICU. O₂ saturations (sats) from (NIPO), using the Nellcor Pulse Oximeter #100, were compared with simultaneously obtained arterial blood samples analyzed by the IL282 CO-oximeter. Comparison of 94 data pairs showed excellent agreement between the 2 methods over a wide range of O₂ sats (38-90%) with r=.93 SEE 3.62. Even in the low range of O₂ sats (38-75%) 34 data pairs showed good agreement between the 2 methods, r=.81 SEE 5.14. The accuracy of the NIPO was independent of the pts wt., heart rate or blood pressure. In 3 pts, the sharp decrease in O₂ sats allowed the diagnosis of hypoxic tetralogy spells before the onset of any clinical findings. Intra-operatively the use of NIPO confirmed the patency of aorto-pulmonary shunts and changes in arterial O₂ sats accompanying general anesthesia. Post operatively in the ICU, NIPO allowed accurate management of ventilatory support during varying hemodynamic states. Thus, in children with CyCHD, NIPO is an accurate method of determining O₂ sats and contributes to improved management during cardiac catheterization, heart surgery and recovery in the ICU. This study establishes a new application of NIPO in the care of children with CyCHD.

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A CAUSE OF SPURIOUS HYPOTENSION IN NEWBORN.

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Normative values of intra-arterial blood pressure (ABP) in newborns were obtained using a strain gauge connected to an umbilical artery catheter without interposition of continuous infusion devices. Currently values on which treatment decisions are based, are obtained while systems for continuous infusion of fluids - (intraflow-IF), even though ABP values from these different techniques have not been compared. We evaluated 170 pairs of direct umbilical ABP measurements obtained, with and without IF systems, from 16 infants, BW range 730-4790 gm, during the first week of life. Mean systolic blood pressures were 4 and diastolic 4.2 mmHg lower while using IF systems than without (p<.001). The size of the infant and the infusion capacity through the IF system influence the magnitude of the observed differences. The smaller the infant with lower blood pressure and the greater the capacity of the IF system, the lower will be the ABP values obtained. Under these conditions hypotension will be overdiagnosed, leading to overtreatment especially of the very immature infant. In order to avoid iatrogenic disease in these infants, if IF systems are used, ABP values should be obtained with and without IF before therapy for hypotension is initiated.

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EFFECT OF LIQUID HEPARIN ON PCO2 MEASUREMENT IN MICRO BLOOD SAMPLES. Aaron J. Cohen, Nick Maffeo, Michael F. Epstein, Departments of Newborn Medicine and Pulmonary Medicine, Brigham & Women's Hospital, Boston, MA.

Anticoagulation of micro blood samples with large volumes of liquid Na heparin (LSH) affects the accuracy of PCO2 measurement. To estimate the magnitude of this effect we measured PCO2, varying the CO2 level, sample size and type of heparin. Whole blood was equilibrated to three levels of CO2 concentration: 7% (PCO2=50 torr), 5% (≈35 torr) 2% (≈16 torr). Samples of .25ml, .35ml and .50ml were drawn into tuberculin syringes containing either dead space LSH (wet), dry crystal heparin (dry), or no heparin (NO). 203 samples were analyzed on a Corning 168 Blood gas Analyzer, and a weighted linear statistical model was fit to the data. PCO2 was found to depend on heparin treatment (p<0.0002), PCO2 (p<0.0001), and their interaction. (p<0.0012). Because of this interaction, separate multiple comparisons were performed at each PCO2 level and differences in mean PCO2 between heparin treatments were estimated. (p<0.05=Scheffé's test).

	7%	5%	2%
No -wet (torr)	2.52*	2.91*	0.61*
No -dry (torr)	-0.21	1.39	0.63*
dry-wet (torr)	2.73*	1.53	-0.02

We find that although the use of LSH does result in a lower PCO2 measurement, especially at PCO2 levels ≈ 50mmHg, limitation of LSH to dead space volume and use of blood sample of 0.25-50ml, results in no clinically important inaccuracies.

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SEVERITY OF ILLNESS SCORING FOR PEDIATRIC INTENSIVE CARE UNIT PATIENTS WH CRAFT, DC GROSSMAN, DK RUNYAN.

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Examination of Pediatric intensive care outcomes has been hampered by the absence of a simple retrospective classification of illness severity. Variation in utilization and referral patterns between institutions complicates direct comparison. After modifying the Clinical Classification System (MCCS) to facilitate retrospective review of records, we conducted a historical cohort study of 1651 consecutive PICU admissions at the North Carolina Memorial Hospital. Using criteria present in the first 24 hours, patients were assigned to classes I-IV to reflect increasing severity of illness. The patients ranged in age from 1 day to 20 years of age. Children less than 1 year old represented 39% of the admissions and 44% of the Class IV patients. Mortality in this group was 14.2%. Overall mortality among all ages was 10.3% for all services and 14% for pediatrics. No deaths were observed among the 411 admissions in Classes I and II. The 330 patients in Class III had 1.8% mortality and the 880 Class IV patients had a 16.5% mortality. Cumulative mortality to one year after admission for Class IV children rose to 23.8%. Using logistic regression, analysis of ten variables thought to be associated with outcome revealed that only cardiopulmonary arrest and mechanical ventilation were significantly predictive of death with relative risks of 15.2 and 8.6 respectively. The MCCS appears to be a useful system for the retrospective classification of illness severity among PICU patients.

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PREDICTORS OF OUTCOME IN ACUTE MENINGOCOCCAL INFECTIONS.

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The risk of serious complications and mortality due to acute meningococcal infection has stimulated interest in identifying predictors of outcome. In order to identify abnormalities predictive of complications, organ system failure (OSF), and mortality, we retrospectively reviewed patients admitted with acute meningococcal infection during a recent 5 yr period. OSF was defined according to the following: cardiovascular-hypotension or inotropic infusion; respiratory-mechanical ventilation or PaO₂/FiO₂ <120; neurologic-coma; hematologic-DIC or WBC <4000; renal: creatinine >2mg/dl or BUN >100mg/dl. Complications included purpura fulminans, DIC, seizures, pulmonary edema, myocardiopathy, hypotension, cerebral edema, SIADH, cranial nerve palsy, and subdural effusion. The presence of >2 of the following risk factors was associated with increased morbidity and mortality: 1. poor peripheral perfusion; 2. purpura; 3. acidosis (HCO₃ <15); 3.4. coagulopathy (prolonged PT or PTT); 5. WBC 10,000 cells/mm³.

Patients With:	Complications	OSF	Mortality	Total
≥ 2 Risk Factors	16*	15*	4*	24*
< 2 Risk Factors	8	0	0	60
	24 (29%)	15 (18%)	4 (4.8%)	84

* p < 0.001 by chi-square test

The occurrence of > 2 risk factors upon admission was a sensitive indicator of increased risk for complications, OSF and mortality.

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AGE RELATED CHANGES IN CHEST GEOMETRY DURING CONVENTIONAL CARDIOPULMONARY RESUSCITATION IN PIGLETS. J. Michael Dean,

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Conventional cardiopulmonary resuscitation (CON-CPR) generates little cardiac output in adult animals, but changes of chest geometry during CPR have not been studied. In infants and children, chest distortion occurs during CPR. We studied changes in chest geometry during CON-CPR in infant, 1-month, and 3-month old piglets. 17 piglets (7 infant, 6 one month, 4 three month old) were anesthetized and catheters were placed in the thoracic aorta, left ventricle, and right atrium. Anteroposterior (AP) and lateral (LAT) chest diameters were recorded, and ventricular fibrillation was induced. CPR was performed with a Michigan Instruments thumper, with 60% duty cycle, 1:5 compression to ventilation ratio, low airway pressure (20-30 mmHg), at rates of 100 (infants) or 60 (others) per minute. Compression force was varied to increment thumper piston displacement by 0.5 cm steps, and measurements recorded. In all ages, the AP/LAT ratio was greater than unity. 3-month piglets had less compliant chests, and despite thumper forces in excess of 700 newtons (Nt), only 20% total chest displacement could be generated. This was insufficient to produce adequate vascular pressures, and thoracic ejection fraction was negligible. Permanent chest deformation occurred in infants and 1-month old animals, which permitted adequate ejection from the thoracic cavity to generate high vascular pressure. The cross-section of the chest is an ellipse, and no ejection occurs until the AP/LAT ratio is less than 1. In 3-month animals, this threshold was barely reached, and negligible vascular pressures were generated. In infants, the AP/LAT ratio is less than 1, and no threshold would be expected. This may explain why CON-CPR is successful in clinical experience and suggests that CON-CPR may be the appropriate mode of CPR in infants.