

NEAR-DROWNING IN BRITISH COLUMBIA

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Near-drowning is a cause of major neurological damage in children. Following reports of unexpected survival, vigorous measures to control intracranial pressure and minimize cerebral metabolic requirements became popular (the "HYPER" regimen). Our approach has been supportive (no barbiturate coma or hypothermia) to achieve optimal oxygenation and cerebral perfusion while minimizing potential insults which raise intracranial pressure. We stress prompt resuscitation with re-warming to normothermia, fluid restriction, and diuresis. Head elevation and judicious sedation are used to avoid adverse effects on intracranial pressure from noxious stimuli.

Our results are comparable to other centers. Sixty-one percent drowned in baths, hot-tubs or swimming pools, 36% in lakes or streams, and one child in the sea. The age range was from 5 months to 12 years (mean 3.2 years). Of 31 patients admitted over 46 months, 71% survived. Using Conn's classification, 10 Group A (awake) patients had a 100% intact survival. Of 5 Group B (blunted) patients, 4 survived and 1 died. From 16 Group C (comatose) patients, 4 survived (all C-1) with good neurological function, 4 were handicapped and 8 died.

Important prognostic factors include cold water submersion, early resuscitation at the scene, short duration of resuscitation, transport which avoids secondary insult and meticulous intensive care.

HIGH RISK PAEDIATRIC INTER-HOSPITAL TRANSPORT

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While neonatal transport is widespread and relatively standardized, paediatric transport is newer with more varied requirements for optimal management, equipment and personnel. Over a recent 14 month period (ending 30/9/86), our center coordinated inter-hospital transfer of 400 children.

Thirty percent were neonates, with a total of 59% less than 1 year, 19% between 1-4 years, 12% between 4-8 years, and 10% older than 8 years. Major diagnoses were trauma, infection, seizures, hypoxic-ischemic injury and congenital anomalies. Eighty-two percent of the calls were emergent and 60% of children required admission to the Intensive Care Unit. Six (1.5%) died during resuscitation prior to transfer, and no children died in transit. Sixty-three percent were transported by air.

Problems occurred on 20% of transports, of which 8% were predicted (due to the severity of illness, equipment limitation or poor weather). Significant problems occurred more frequently when patients were escorted by adult paramedics as compared to infant trained crews. Thirty percent of patients required major interventions by the transport team for stabilization prior to transfer and 5% required major interventions enroute.

The logistics of coordinating paediatric emergency transport are complex because of the diversity of diagnoses, physical size, medication and equipment, requiring dedicated physician staff with a transport team trained to manage paediatric patients.

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CARDIAC OUTPUT DETERMINATION IN CRITICALLY ILL CHILDREN: PULSED DOPPLER vs THERMODILUTION TECHNIQUES
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To determine the usefulness of the noninvasive pulsed Doppler in critically ill children, we calculated cardiac output by using this technique and compared the results with values obtained by the thermodilution method.

Ten critically ill children who required invasive hemodynamic monitoring with a flow-directed Swan Ganz catheter were selected for this study. The subclavian vein was catheterized in all patients and a #5 Swan Ganz catheter was introduced in 5 patients (ages 8 to 16 years). Fifty-two cardiac output determinations were performed with a Gould SP 1435, 115 VAC, 50-60 Hz thermodilution computer. Simultaneously, patients' ascending aortic blood flows were determined using a Cardioflo (R) pulsed Doppler cardiac output computer (105-125V, 60 Hz by Cardionics, Inc.). A pediatric 3.5 MHz transducer, 6mm diameter, with bidirectional nonfocused capabilities was utilized via a transcutaneous suprasternal approach. After determining Doppler probe position and penetration depth, maximum velocity signals were obtained and a Hewlett Packard adapted fluoroscope was used to determine adequacy of ascending aortic wave forms.

The diameter of the aorta was measured by m-mode echocardiography and dialed into the computer, which calculated cross-sectional diameter of the aorta ($A = \pi d^2 \div 4cm^2$). Ascending aortic blood flow (cardiac output) was then derived by using the formula: $FLOW = VELOCITY \times CROSS-SECTIONAL DIAMETER$.

Thermodilution cardiac output values were compared with aortic flow calculated from Doppler signals. Linear regression analysis of cardiac output measurements showed to correlate significantly. Linear regression = 0.98, Y intercept = 0.98105x + 0.0687, with a range of 1,620-7,610 ml/min.

We conclude that pulsed Doppler determination of cardiac output is a reliable, effective and safe noninvasive method to measure cardiac output in critically ill children.

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EFFECT OF PENTOBARBITAL THERAPY IN OUTCOME OF NEARLY DROWNED, FLACCID COMATOSE CHILDREN

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The effect of pentobarbital therapy was studied prospectively in 31 nearly-drowned, severely comatose children in a flaccid state of coma who were randomized into two treatment groups. Group A: 16 children who received hypothermia (H) and i.v. pentobarbital (P) achieving serum levels > 25 mcg/cc within 48 hours from admission. Group B: 15 children who received hypothermia but pentobarbital was completely excluded. All patients received "conventional therapy" (i.e., PaCO₂ 20-25 torr, PaO₂ 100 torr, fluid restriction pancuronium bromide, furosemide or mannitol). Analysis of variance failed to detect difference for age, estimated time of submersion, arterial pH, core temperature (T_{re}), cerebral perfusion pressure (CPP) and mean intracranial pressure (ICP) among the patients prior to entering pentobarbital therapy.

In Group A, 6 patients (37%) had complete recovery (CR) and were neurologically intact, 6 patients (37%) had severe brain damage (BD) and 4 (25%) expired. In Group B, 6 children (40%) had CR, 6 (40%) survived with BD and 3 (20%) expired. Mortality rate, survival with BD and CR were not statistically different between the two groups ($P > 0.05$ by Chi square analysis).

The results of this study support our previous claim that neurological outcome in nearly-drowned, flaccid comatose children is not influenced by pentobarbital therapy, and therefore, current practice of barbiturate therapy in this group of patients may not be justified. In addition, better outcome reported in the literature with pentobarbital combined with hypothermia regimen, may be attributed to the effect of hypothermia alone.

MANIFESTATIONS OF THE ICU SYNDROME IN CHILDREN.

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The ICU Syndrome, manifested by anxiety, depression, hallucinations, and delirium, has been reported to occur in children but has not been well documented. The purpose of this study was to determine factors associated with the development of ICU Syndrome in children. Forty-three children between the ages of 6 and 17 years were studied, 18 in ICU and 25 on general wards. The Hospital Observed Behavior Scale (HOBS) was developed to describe acute adverse psychological reactions in four areas: anxiety, depression, delirium, and withdrawal. The Diagnostic Interview for Children and Adolescents (DICA) was administered to each subject and the DICA-P to each subject's parent to elicit any pre-existing psychopathology. Additional data collected included demographics, diagnosis, prognosis, previous admissions, duration of parental visitation (PV), amount of sleep, and medications. Good interrater reliability was found for the HOBS ($r=0.63$, $p < 0.000001$). Sixteen subjects demonstrated behavior clinically consistent with the ICU Syndrome, 11 ICU and 5 ward subjects. The mean HOBS scores were statistically different for those with and without the ICU Syndrome (9.3 ± 4.1 vs. 3.9 ± 3.6 ; $p < 0.0005$). Factors positively correlated with the mean HOBS were pre-existing anxiety disorder and race (black); negatively correlated was PV ($p < 0.10$). We conclude that the ICU Syndrome may be reliably diagnosed using HOBS and that it may occur in patients in both ICU and ward settings.

CAREER SATISFACTION IN PEDIATRIC INTENSIVISTS

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Intensive care units are stressful environments with a high staff burnout rate. Many pediatricians have expressed career dissatisfaction. The 127 members of the critical care section of the American Academy of Pediatrics were surveyed on career information and practice patterns. Attitudinal scales previously validated with physicians were used. For the 55 respondents (42% of those surveyed), half or more of their time was spent in critical care by 42 (76%).

Pediatrics as a career was dissatisfying to 29% of pediatric intensivists, a much higher proportion than found in academic pediatricians. Many, whether satisfied or not, reported feeling stressed (91%) or tense (66%). Those who had been defendants in malpractice suits were more likely to be dissatisfied and tense ($p < .05$). Those at Children's Hospitals were more often in a group practice and satisfied ($p < .03$). Intensive care was dissatisfying as a career for 22%. Despite their salary (mean of \$99,000, SD \$45,000) being greater than in academic pediatrics, intensivists most frequently cited financial reasons as a basis for dissatisfaction. Excessive work demands were also frequently listed. The hours worked in house (60h/wk) were greater than the national average of hours worked for physicians.

Prior studies showed that time spent in various activities relates to satisfaction. Patient care occupied 47% of pediatric intensivists' time. They feel professionally growing (74%) in their careers and spent time in both research (13%) and administration (18%).