COPICON Congress 2011

27 - 31 July 2011, Durban International Convention Centre

Critical Care abstracts

SHORT-TERM REDEPLOYMENT: WHAT ABOUT THE IMPACT ON THE NURSE'S EXPERTISE?

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Introduction: Short-term redeployment of nurses is usually used within hospital units in order to 'balance the numbers' or to cover the shortage of staff in the different units. Often nurses in the intensive care unit (ICU) are deployed to other units, if there is not enough staff or their own unit is not busy.

Background: Every nurse allocated in a new or different area needs to be orientated. Redeployment can be a very stressful, depending on the area of allocation. Without orientation the nurse's performance may be counterproductive. Often management does not consider patient needs and staff expertise before implementing short-term redeployment.

Objective: To explore and describe the challenges encountered by the unit managers in the management of ICUs.

Method: A qualitative, exploratory descriptive design was used. The sample consisted of registered nurses working in the ICUs, and stratified sampling was used. Data were collected through in-depth individual and focus group interviews, which were audio recorded and transcribed verbatim. Data were analysed using the descriptive analysis method of Tesch (1990).

Results: Two themes emerged from the findings in relation to short-term redeployment. The findings indicated that the ICU nurses were concerned about short-term redeployment to other units.

Conclusion: There is a need for consultation and policy regarding short-term redeployment.

MALARIA IN THE INTENSIVE CARE UNIT OF A TERTIARY HOSPITAL IN A NON-ENDEMIC AREA OF SOUTH AFRICA: A 9-YEAR RETROSPECTIVE DESCRIPTIVE STUDY

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Background: Malaria remains a significant concern globally. The Western Cape experience is not well documented. We aimed to describe the demographic and clinical features of severe malaria in patients admitted to an ICU in this non-endemic area. We aimed to identify clinical and laboratory indicators of poor prognosis.

Methods: A retrospective descriptive study was conducted on all adult patients admitted to the medical ICU of Tygerberg Hospital from January 2002 to December 2010. A comparative group of ICU patients without malaria was randomly identified.

Results: 16 patients were admitted (29.1±13.1 years, 14 males) over the 9-year period, 69% of whom were Somalian. The all-cause ICU mortality rate was 43.8%. Age ≥30 years ($p>0.01$), APACHE II score >15 ($p=0.03$), severe thrombocytopenia (platelets <50×109/l, $p=0.01$), acute oliguric renal failure with a creatinine level >264 µmol/l ($p<0.01$), cerebral malaria ($p=0.02$), disseminated intravascular coagulopathy (DIC) ($p=0.02$) and metabolic acidosis ($p<0.01$) were found to be significant predictors of mortality.

Conclusion: Severe malaria is uncommon in the Western Cape, affecting mostly young male asylum seekers and East African immigrants. Age, APACHE II score, thrombocytopenia, requirement for blood transfusion, oliguric renal failure, cerebral malaria, DIC and metabolic acidosis predict mortality.

ACHIEVING ZERO TOLERANCE FOR CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS (CLABSI) IN A MULTIDISCIPLINARY ICU

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Bacteraemia in critically ill patients is potentially life threatening and may often be attributed to a CLABSI.

Aim: After the incidence of CLABSI in our unit exceeded the state average we initiated strategies to achieve zero tolerance for CLABSI.

Method: A project officer was appointed to drive the process through education and best practice principles. Monthly meetings were held with the Executive Director, ICU leadership team and Infection Control. Medical staff completed a credentialling process using a simulator and maximal barrier precautions for central venous catheter (CVC) insertion were achieved using a checklist. A Persist Plus Triple Pack cleaning solution and antiseptic-impregnated CVCs were introduced with a daily needs assessment process. Regular audits of compliance were introduced and ongoing surveillance measuring compliance with the bundle continued. In September 2010 chlorhexidine, 'Biopatch' and 2% chlorhexidine-impregnated patient body wipes were introduced. Ongoing communication and reporting were maintained.

Results: The ICU CLABSI rate dropped from 3.8 per 1 000 device days to zero infection over an 18-month period.

Conclusion: In our unit zero tolerance for CLABSI was achievable with a strategic multidisciplinary action plan.

VORICONAZOLE THERAPEUTIC DRUG MONITORING (TDM) IN CRITICALLY ILL PATIENTS

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Introduction: Voriconazole is a novel antifungal agent indicated for the treatment of severe fungal infections. The drug is primarily eliminated via hepatic metabolism by the hepatic cytochrome CYP2C19. There is considerable variability in serum levels of voriconazole due to drug-drug interactions, liver dysfunction, patient age, non-linear pharmacokinetics, and genetic polymorphisms of cytochrome CYP2C19. The recommended serum steady-state trough level is 2 - 6 mg/l.

Aim: To measure voriconazole levels following the recommended intravenous dose in a general population of ICU patients.

Method: Voriconazole serum steady-state trough levels were measured in 25 patients after a loading dose of 6 mg/kg 12-hourly × 2 doses, followed by 4 mg/kg 12-hourly × 4 doses.

Results: The median level was 4.2 mg/l (range 0.2 - 18.4 mg/l). 15 patients (60%) had therapeutic levels (2 - 6 mg/l), 5 patients (20%) had sub-therapeutic levels (<2 mg/l) and 5 patients (20%) had toxic levels (>6 mg/l). 17 patients had liver dysfunction and in 6 patients a drug-drug interaction was suspected.

Conclusions: 60% of ICU patients have therapeutic voriconazole serum levels with the current recommended dosing schedule. Sub-therapeutic and toxic levels are common. Routine voriconazole TDM in critically ill patients is recommended.

ANTIOXIDANT SUPPLEMENTATION IN THE CRITICALLY ILL – A SYSTEMATIC REVIEW

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Critical illness is associated with increased free radical production combined with reduced antioxidant capacity resulting in oxidative stress. Antioxidant nutrient supplementation therefore seems appropriate. However, many small studies failed to show benefit on clinically important outcomes. Since a previous meta-analysis on the topic, several further studies have been published.

Aim: To perform a meta-analysis of the published literature to determine the effect of antioxidant supplementation on outcomes in the critically ill.

Methods: Scientific databases were searched for randomised controlled trials investigating effects of antioxidant supplementation in the critically ill and reporting clinically relevant endpoints.

Results: Thirteen studies of selenium and mixed antioxidant supplementation met the criteria, of which 6 had not been included in previous meta-analyses. Selenium supplementation was associated with a trend toward decreased mortality (OR 0.717, p=0.106), while no mortality benefit was associated with mixed antioxidants (OR 0.731, p=0.371). However, mixed antioxidants were associated with shorter hospital stay (OR 0.71, p=0.002), fewer infectious complications (OR 0.494, p=0.024) and shorter duration of mechanical ventilation (OR 0.259, p=0.023). These effects were not seen with selenium supplementation alone.

Conclusion: Supplementation of a combination of antioxidant nutrients is associated with clinical benefits in critically ill patients.

HYPOGLYCAEMIC EPISODES IN CRITICALLY ILL PATIENTS BEING MANAGED WITH AN INSULIN INFUSION PROTOCOL: A PROSPECTIVE STUDY

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Following studies reporting adverse effects of unmanaged hyperglycaemia among the critically ill, many ICUs initiated insulin infusion protocols to control blood glucose strictly. However, some subsequent studies raised controversy around potential harm associated with increased hypoglycaemia risk.

Aim: To investigate hypoglycaemia in critically ill patients managed using a formal glucose control protocol involving rate-controlled intravenous insulin infusion.

Methods: Anonymised clinical records were prospectively audited by independent investigators for protocol adherence (goal glucose 44 - 7.9 mmol/l) and hypoglycaemic episodes.

Results: Audit data totalled 271 patient days. A median (IQR) of 60% (46 - 74) of total ICU time was spent within the goal blood glucose range. Hypoglycaemic episodes (glucose <4.4 mmol/l) totalled 119. A median (IQR) of 4.2% (0 - 10) of total ICU time was spent hypoglycaemic, which was statistically lower (p<0.0008) than time spent hyperglycaemic (glucose >8 mmol/l) and normoglycaemic. Hypoglycaemic time correlated positively with number of episodes where insulin infusion rate was not reduced for hypoglycaemia and when intravenous glucose was not administered during hypoglycaemia (Spearman's r=0.35, p<0.05 and r=0.74, p<0.05, respectively).

Conclusion: Hypoglycaemia occurred but was of overall short duration, was related to deviations from the protocol for responding to hypoglycaemia, and did not result in adverse neurological outcomes.

CLINICAL LEARNING OF CRITICAL CARE NURSING STUDENTS FROM TWO DIFFERENT PROGRAMMES IN THE ETHEKWINI METROPOLITAN AREA

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Introduction: Clinical learning of student nurses is vital and an integral part of any nursing education programme.

Aim: To analyse clinical learning of critical care nursing students from two different programmes.

Method: This study used both qualitative and quantitative methods. Participants included six lecturers and 56 students. Data were collected through interviews and a structured questionnaire.

Results: The findings revealed a number of pre-conditions to be considered for effective clinical learning, including institutional characteristics, lecturer and student characteristics. The students' prior experience before engaging in the programme, availability and adequacy of learning experiences and level of expertise of clinical mentors as well as the teaching learning process emerged as important. The differences were noted in the summative assessments, where one institution used an objective structured clinical examination (OSCE) and the other used case presentations and other innovative methods. Challenges included preparedness of some of the students from underdeveloped countries and from rural hospitals to undertake the course, unavailability of learning contracts between the students and facilitators spelling out expectations from both parties, and level of expertise of clinical mentors.

Conclusion: Clinical learning of critical care nursing students remains a challenge to both students and facilitators.

EVIDENCE-BASED PHYSIOTHERAPY PROTOCOL CARE IS SAFE AND EFFECTIVE: A PRELIMINARY STUDY

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Introduction: Uncertainty regarding the optimal physiotherapy service provided in a surgical ICU exists.

Objectives: Establish safety and estimated effect of protocol care (PC) compared with usual care (UC).

Methods: Sequential time block design. All patients admitted to the ICU were allocated to receive PC (*N*=96) or UC (*N*=97) based on unit admission date. PC was provided by dedicated unit therapists guided by a validated evidence-based protocol, and UC by hospital therapists.

Results: PC patients were less likely to be intubated (RR 0.16, 95% CI 0.07 - 0.71, RRR 0.84, NNT 5.02, p=0.005) or fail extubation (RR 0.23, 95% CI 0.05 - 0.98, RRR 0.77, NNT 6.95, p=0.04). Mean difference in the daily unit TISS-28 score was 1.99 (95% CI 0.65 - 3.35) points (p=0.04), and in time from unit discharge to hospital discharge 3.97 (95% CI 0.35 - 6.5) days (p=0.05). There was no difference in risk rate of an adverse event occurring (p=0.34), ventilation time (p=0.50), hospital (p=0.20) or ICU (0.98) length of stay, or unit (p=0.28) or hospital mortality (p=0.25).

Conclusions: An evidence-based physiotherapy protocol for management of patients in a surgical ICU was feasible and safe, and has the potential to lower the cost of ICU care and facilitate the functional recovery of patients after discharge from the unit.

CRYSTALLOIDS OR COLLOIDS FOR RESUSCITATION IN TRAUMATIC SHOCK?

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Despite decades of controversy, no previous randomised double-blind controlled study has been performed comparing isotonic colloids with crystalloids in resuscitating traumatic shock.

Aim: To study the effect of resuscitation with 0.9% saline versus HES130/4 on shock reversal, gastro-intestinal function and renal complications in severe trauma.

Method: 115 patients with severe trauma requiring more than 3 litres of crystalloid were randomised to receive blinded saline or HES solutions until resuscitated to predetermined end-points. Blunt (*N*=42) and penetrating (*N*=67) trauma groups were randomised separately. Patients were followed up for 30 days.

Results: Six patients were excluded. In the penetrating group HES patients required less fluid (5.1±2.7 l v. 7.4±4.3 l, p=0.001), and had lower lactates at 4 hours (1.5±0.8 v. 3.5±1.8 mmolL-2, p=0.001) and less renal failure (0% v.16%, p=0.018) than the saline group. Maximum SOFA scores were significantly lower in the penetrating HES group.

In the blunt group the injury severity score on study entry was significantly greater in the HES group. There were no outcome differences. There was no difference between any groups with regard to recovery of bowel function or mortality.

Conclusion: Resuscitating with HES was associated with less renal failure and faster lactate clearance in penetrating trauma.

WHAT FACILITATES AND HINDERS THE STABILISATION OF A CRITICALLY ILL CHILD IN THE EMERGENCY UNIT AT RED CROSS WAR MEMORIAL CHILDREN'S HOSPITAL, CAPE TOWN, SOUTH AFRICA? A DESCRIPTIVE ETHNOGRAPHIC STUDY

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Care of the critically ill child in the medical emergency room is complex. Appropriate early stabilisation is dependent on a myriad of factors in this unpredictable environment.

Objectives: To identify and describe factors that facilitate and hinder optimal stabilisation of the critically ill child in the emergency department.

Methods: The study was conducted in the emergency unit of the hospital. Data were collected through direct observations of all activities around 15 children from triage red through transfer out of the area. The methodology of ethnography underpinned the study.

Results: A child could not be observed in isolation. The complex nature of 'other activities' influenced stabilisation. These included: *interruptions* to staff or care (telephone calls, intermittent emergencies and sporadic admissions of children requiring immediate attention), *care demands v. the available capacity* (number of staff v. number of patients, bottlenecking, overcrowding), *communication norms* and patterns (direction, content, type of communication), and the *practice of non-technical skills.*

Conclusions: This research developed a process to provide baseline data on activities in this area with the intention of highlighting what facilitates and hinders stabilisation. This is crucial to understanding the emergency department environment and provides appropriate contextual information for the comprehension of adverse events, enabling improvement in patient care and working conditions.

EPIDEMIOLOGY OF SEPTIC SHOCK IN PAEDIATRIC INTENSIVE CARE

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Objectives: To describe the epidemiology of septic shock admissions to a paediatric intensive care unit (PICU).

Method: 605 consecutive PICU admissions from March to August 2010 were reviewed. Prospective descriptive data were collected on 156 (25.8%) patients admitted in septic shock to the PICU.

Results: Sepsis was proven in 84.8%. The median age was 6 months, 11.2% were HIV infected and 68% were malnourished. Primary sites of infection were pulmonary (64%) and gastro-intestinal tract (38%).

On PICU admission 85.6% had PaO_2/FiO_2 <300, 93.6% needed ventilation, 63.2% required inotropic support, 85.6% had BE >-5 and 46.4% lactate >4, 39.2% were oligouric, 98.4% were hypotensive and 16.8% suffered cardiac arrest during the first 24 hours in the PICU (mostly peri-intubation). 6% were classified as cold shock, 50.4% fluid refractory, 87% catecholamine resistant, and 20.9% as refractory shock. 99.2% developed multi-organ failure. Median duration of ventilation, inotropic support and PICU stay were 5, 2 and 6 days, respectively. Mortality was 27.6% and the standardised mortality ratio 1.1.

Conclusions: Despite international treatment guidelines, septic shock remains a major cause of mortality in this population. In order to reduce mortality we need to improve early recognition, emergency treatment, safe intubation, and PICU access.

EMERGENCY MANAGEMENT OF PAEDIATRIC SEPTIC SHOCK

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Objectives: To audit emergency management of septic shock admissions to a PICU against international treatment guidelines.

Method: 605 consecutive PICU admissions from March to August 2010 were prospectively reviewed.

Results: 156 (25.8%) patients (median age 6 months) were admitted with septic shock. PICU mortality was 27.6%. 74.4% received antibiotics before hospital admission. See tables below and overleaf.

Conclusion: ACCM/PALS time-sensitive guidelines were not achieved. Most patients received inadequate fluid resuscitation before PICU admission. Treatment guidelines need adaptation for developing countries where CVP, $Scv0_2$ and CI are not readily available.

Emergency department treatment

	Median time from emergency department presentation to:	ACCM/ APLS guidelines	
1st fluid bolus	45 min	5 min	Median 20 ml/kg
Intubation	165 min	15 min	22% cardiac arrest on intubation
Starting vaso-active drugs	210 min	15 min	42% on vaso-active drugs
1st antibiotic dose	105 min	5 min	
PICU admission	4 h	60 min	

First 24 hours' treatment in PICU

Time from PICU admission to:	Median time	
1st fluid bolus	60 min	Median 40 ml/kg
Intubation	30 min	92% ventilated
Starting vaso-active drugs	0 min	71% on vaso-active drugs
1st dose steroids for haemodyamic support	6 h	ACCM/PALS guideline 60 minutes
1st antibiotic dose	210 min	

PREDICTORS OF MORTALITY DURING THE FIRST 24 HOURS OF SEPTIC SHOCK IN PAEDIATRIC INTENSIVE CARE UNIT (PICU)

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Objectives: To assess predictors of mortality in children admitted to a PICU in septic shock.

Method: 605 consecutive PICU admissions were prospectively reviewed from March to August 2010.

The following predicted mortality significantly on multiple regression:

	Alive (*N*=113) Median	Died (*N*=43) Median	*p*-value
No. of health care workers seen before PICU admission	2	3	0.004
Time to 1st fluid in emergency department	45 min	65 min	0.06
Time to start vaso-active drugs in emergency department	110 min	315 min	0.03
Admission Fio_2	0.7	1.0	0.02
Admission MAP	11	13	0.001
Admission A:a gradient	303	424	0.04
Admission glucose	6.3	3.6	0.001
Admission pH	7.2	7.1	0.0001
Admission base deficit	-7.2	-11.2	0.03
Admission lactate	2.1	4.4	0.004
Cardiorespiratory arrest during 1st 24 hours in PICU	12	15	0.0003
Steroids for haemodynamic support	18	20	0.001
Measles	14	15	0.002

Results: Prospective descriptive data collected on 156 (25.8%) patients admitted to a PICU in septic shock. Median age was 6 months.

Conclusions: In order to reduce septic shock mortality in the PICU, we need to improve access to the PICU and improve early resuscitation.

REVERSING COAGULOPATHY IN A PORCINE MODEL OF ACUTE ISCHAEMIC LIVER FAILURE USING A BIO-ARTIFICIAL LIVER

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Severe coagulopathy is a major problem in acute hepatic failure. A bio-artificial liver (BAL) using cultured hepatocytes perfused via an extracorporeal circuit is a promising therapy.

Aim: To evaluate the effect of a BAL on coagulopathy in a porcine model of acute ischaemic hepatic failure

Methods: A total of 20 Landrace pigs were studied, 10 in the control arm and 10 in the BAL arm. Coagulopathy was measured using thrombo-elastography. Samples were taken at baseline, at the start of the anhepatic phase and 2-hourly thereafter. An extracorporeal circuit was used to perfuse cultured human hepatocytes suspended in alginate beads.

Results: Four pigs developed severe coagulopathy. In the 2 of these that received the BAL, the r-time improved from 11.8 minutes to 7.2 minutes and from 14.9 minutes to 8.7 minutes, respectively.

Conclusion: The BAL appears to be a promising treatment modality to attenuate the effects of acute liver failure.

A RETROSPECTIVE REVIEW OF PATIENTS ADMITTED TO THE PAEDIATRIC ICU AT RED CROSS WAR MEMORIAL CHILDREN'S HOSPITAL DURING 2010 WITH THE CLINICAL DIAGNOSIS OF MEASLES OR MEASLES-RELATED COMPLICATIONS

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Objectives: To evaluate the outcomes of children with measles-related disease (MRD) admitted to a PICU and the effect on PICU resources and elective surgery during the recent measles epidemic.

Methods: All patients admitted with MRD from January to December 2010 were included. Patient demographics, severity of illness on admission, duration of PICU admission and mortality were retrospectively recorded. Costs were calculated using bed days utilised and estimated daily PICU admission cost.

Results: 1 294 children were admitted over the study period, 53 (4%) with MRD (mean age 7.8 months). Pneumonia was the most common reason for admission (69%) and the main cause of mortality. Non-MRD mortality was 8.8% compared with MRD mortality of 32% (standardised mortality rate 0.7 and 1.7, respectively). Patients with MRD occupied 315 bed days with a mean duration of stay of 5.9 days (6.8 in survivors v. 4.1 in non-survivors) at an approximate cost of R12 700/bed day (overall cost R4 000 000). During the study period, 67 children requiring elective surgery and 87 other children were refused PICU admission, 75 of these during the peak of the measles epidemic.

Conclusion: MRD was associated with significant morbidity and mortality, high costs and a marked reduction in major elective surgery.