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Guest Editorial

Signs and Sounds of Pediatric Intensive Care Nursing

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Recently I watched a documentary on a measles campaign in Madagascar where they aimed to have all children vaccinated within a few weeks time. It was stated that children, specifically those with malnutrition and low resistance, were not likely to survive the vaccine preventable disease measles. Directly after this impressive and emotional (yes yes, partly a media trick to donate) documentary I went to my computer to search for evidence. Were the figures of the mortality rates the journalists told me true? Frankly spoken the figures where beyond my wildest dreams. Measles was the leading cause of child mortality in 2000, exceeding half a million deaths.[1] Although the mortality rate in children under five is decreasing, it is estimated that around 10 million children die each year in the developing world. After reviewing all this evidence on various websites[1-3] my next questions were; do they have a pediatric intensive care unit (PICU) in Madagascar? What kind of diseases do they treat? And do nurses in developing regions have special professional needs?

Needs… I realize that the word 'needs' was extensively discussed at the last board meeting of the World Federation of Pediatric Intensive and Critical Care Societies (WFPICCS) in Porto Alegre, Brazil, 3-5 October 2004. One of the major points of discussion was the future aims and goals of WFPICCS. As all board members attended this meeting, all regions of the world were present and not surprisingly all regions have their own special needs to work and improve clinical practice in pediatric intensive care. The developed countries have mostly sufficient finance and a good organized health care system to fulfill the requirements for practice, education and research in pediatric intensive care. On top of this the developed countries have strong and active national or regional (pediatric) intensive care societies. This situation is different in the developing countries. It was argued that WFPICCS should concentrate on the developing regions in assisting to meet their needs.

Meanwhile a lot of good initiatives have been established and improved by our PICU colleagues. This journal (*Pediatric Intensive Care Nursing*), the list-server PICU-Nurse-International, and the International Pediatric Intensive Care Nursing Association help us to connect with our world colleagues. Also established is a group of PICU nurses from the world's regions to serve as a linking pin between those working in the regions and WFPICCS. Enough structure to communicate and identify our regional needs and consequently try to convert these needs into action. We can make a difference to pediatric intensive care nursing!

A major challenge will be our language. English is the first spoken language by around 400 million people and by many more millions as a second language. But, put this in perspective with other languages[4]:

Chinese: 1,2 billion people
Spanish: 417 million people
Hindi: 480 million people
Arab: 225 million people
Portuguese: 200 million people

Recently I experienced the language barrier at the 6th Latin-American Congress of Pediatric Intensive Care, Porto Alegre, Brazil 5-8 October 2004. Of the 1400 participants, 200 were PICU nurses from Latin America with a majority coming from Brazil. A colleague, Liane

Einloft, translated my slides into Portuguese. After 10 minutes speaking slowly in English, I asked the participants if they understood me. 'No' was the answer from most of the attendees. Luckily, Mavilda Pedreira and Marta Avena helped me with simultaneous translation. Eventually I had lively discussions with many nurses throughout the congress.

Together we can make it happen. Having many colleagues across the world who are bilingual or multi-lingual is a valuable thing. Going back to my experience in Brazil, at the congress we discussed the PICU-Nurse-International list-server, this journal and the Association. We have ended up with a list of over 120 email addresses of PICU nurses from Latin America who are eager to communicate with fellow nurses from around the world. Mavilda Pedreira offered to be the linking pin between the Portuguese speaking nurses and the rest of the world. By translating the emails I hope to see all these nurses come across the list-server with questions or their needs.

By this means we can built up and maintain a dialogue across the world!

References

World Bank Group. (September 2004) *Reduce Child Mortality.* Retrieved November 23, 2004 from http://www.developmentgoals.org/Child_Mortality.htm

Gordon B, Mackay R, Rehfuess E. (2004) *Inheriting the World: the atlas of children's health and the environment.* The Hanway Press, London: World Health Organization.

UNICEF. (2 July 2004) *Frontline Diary. 2 July 2004: Stories of horror – in a child's picture*. Retrieved November 23, 2004 from http://www.unicef.org/emerg/darfur/index_22106.html

Wikipedia. (20 November 2004) *List of languages by total speakers.* Retrieved November 23, 2004 from http://en.wikipedia.org/wiki/List_of_languages_by_total_speakers

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The Mountable Unit Stretcher Extension Rack (MOUNSTER©) of the AZ-VUB, Brussels, Belgium

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Abstract

Pediatric intensive care units (PICU) are generally centralized in tertiary hospitals, requiring a transportation system to transfer patients from initial management areas towards the PICU. This transport system should be safe according to the highest standards and include initiation of full PICU therapeutic measures from the moment patient care is entrusted to the transport team. The therapeutic measures should be qualitatively identical to those that will be continued in the PICU and maintained prior to, during and after transport.

Therefore, all PICU equipment has been integrated on a reconfigured ambulance trolley, leading to the design of an out-of-hospital bed with precisely the same options as for a standard PICU bed; the transport team is thus not challenged by different or additional equipment during transportation.

A standard available Stryker M-1 rugged trolley has been equipped with a second patient level. Most of the equipment has been integrated in the level between carrier and patient bed, creating full and 360° access round and above the patient. All original 10G fixation points were kept unaffected. Binary gas supply and a manifold controlled distribution system provide a Siemens 300 servo respirator with compressed air and oxygen, either from the trolley gas cylinders or the ambulance supply. The same technique was used for oxygen and aerosol administration. Two independent batteries generate 1200 W resulting in 2 hours of autonomy in case of ambulance inverter failure. The trolley is standard equipped with 4 IV syringe pumps but 3 IV poles offer additional expansion. Full monitoring (including EtCO2 and invasive blood pressure measurement), AED and communication system are incorporated. The trolley is also equipped with a suction unit and an active heating and humidification device for inspired gasses. Standard PICU medication and disposables, resuscitation charts and precalculated medication charts are available in the transport backpacks. The notion of a mobile PICU is not new, but the feature of our mobile unit represents an important step in the optimisation of the transport of critically ill children.

Introduction

Critically ill or severely injured patients who are admitted to smaller hospitals generally require transfer to larger referral centers. This is a trend and in some countries it is even regulated by state law – particularly if small children are involved. The mode of transport in the best possible manner for the patient and staff is a concern for healthcare providers. The issue is the multifactor mandating of attention to the maintenance of equipment. This must occur with a maximum of safety, a minimum of secondary effects caused by 'transport' and a certain degree of speed. This suggests that standardization – globalization – of transport is already a fact or at least within reach.

Questionnaire

We are far from a uniform transport mode. This has nothing to do with the equipment on its own. Why should we not be able to equip stretchers the same way all over the world? A questionnaire was sent to all the main pediatric intensive care units (PICU's) in Europe. Most input came indeed from the United Kingdom and countries where English is more or less common, like the Netherlands, Austria or the Dutch speaking part of Belgium. We received no more than one answer from Poland, Germany, Scandinavia, Israel or Italy. Some volunteer Spanish, Portuguese and French translators helped us out that we could obtain useful data from these European regions. The results of this inquiry were accepted for oral presentations at an international transport conference in Florida, resulting in additional information from the United States (US). Via a PICU Internet listserve, we also gathered data from some Australian colleagues. Based on these data, we were able to get a certain impression of the transportation models used on these 3 continents. This impression suggested that the Europeans had no clear model at all.

Job description

Transport behavior is primarily influenced by the job description of the transporters. Educational background and professional profile determine the structure and the organization of the transfer. If educational backgrounds require that the transport team leader is a medical doctor, the organization of transport will differ from teams where nurses are operating autonomously. Also the way medical doctors are 'generated' (referential center versus transport doctor from an extramural site) influences transport organization. The involvement of professionals other than nurses also affects the course of transport management.

Our original opinion was that in most cases the transfer (installing a patient on a stretcher and move him or her via an ambulance, plane or helicopter) happened more or less the same way. Our study however revealed that in reality many modes of transportation existed. All these modes happened to exist in a mixed pattern even in the same country. Sometimes patients are brought by the small hospital; in other cases the patients are retrieved by the referral center. A further variation is added if the transport is delegated (voluntarily or involuntarily) to external transport teams. These can be organized following state law or simply by private and commercial institutions. Different arrangements, education and training will likely result in non-uniform transport practices.

In the USA and Canada 3 different professions are directly involved during patient transport. There may be more if you include physicians, pilots, technical staff, etc. The US approach is rarely organized from an *integrated nursing* model but rather from a *task* oriented model. In the latter, specific tasks are performed by specific professionals: the transport nurse (TRN), the respiratory or inhalation-therapist (RRT) and the paramedic (EMT).

The EMT or the paramedic drives the ambulance (or flies the F- or H-wing vector). Paramedics have a high level of training and are able to intubate – they have a very defined curriculum for this. It sounds odd to us European nurses (who are actually schooled for a longer period than paramedics) that the insertion of central lines, the treatment of tension pneumothorax, among others; are performed routinely and 'officially' by non-physicians, such as paramedics, but not by nurses.

The main area of expertise of the RRT focuses on mechanical ventilation, including the procedures and the equipment used for that purpose. They are also capable of intubating. US nurses who meet certain competency requirements can be transport nurses. They do the skills necessary for a safe transport, including intubation, chest tube insertion, line insertion, among others. In the US, and especially in the bigger hospitals, extra-corporeal membrane oxygenation (ECMO) can be accomplished during transport, while transport ECMO remains something extremely

difficult to do in Europe. In the case of ECMO, the transport team is joined by a perfusionist or dedicated ECMO-nurse. We should mention that the average US ambulances (Kenworth, Peterbilt, or White) are quite larger than the European types. Furthermore American ambulances are trucks that carry containers, while the European are more a kind of remodeled short lorries. American containers are much larger, 'facilitating' transport ECMO with the necessary space and room. Also the US helicopters (often army or coast-guard types) or planes are in general a larger type than what is used in Europe.

All these professionals can be either (a) part of a 'base' and be operational for different hospitals dedicated to cover a certain area, or (b) employed on a specific unit in a hospital. This results in a swing among equipment – which could be the same from the hospital or based on cost/benefit analyses or depending on grants, sponsoring or budgets. Also philosophy, population or geography will influence the type of equipment and materials (lightweight, compact, endurance, autonomy, multiple patient transport…) used for transport.

The transporter's profile

When we started examining our transport program and the types of stretchers we use, we were under the impression that there was order, similarity and uniformity. However, we realized that this was not the case. Nevertheless, US and Canadian transport models seemed fairly well organized. In Europe, there are not as wide a variety of disciplines involved in transport. In addition, as far as nursing is concerned, there does not exist a European standard at this time. In Scandinavia for instance, it is common that the 'anesthesiology' nurse brings the critically ill child to the referral hospital. This nurse operates on her own because she has completed the necessary university requirements. The Paris SAMU does a similar thing with 'anesthesiology' nurses as well. They work alone like most of their Scandinavian colleagues but are undergraduate. Dutch ambulance nurses go and pick-up physicians to fetch children; or the transport team might be generated by the unit itself. By 'unit' we mean the PICU or the Emergency Room or a mix of both. This is the most common formula in Europe. The concern with this approach to transport is that it involves many people with a great fluctuation in skills (ranging from 'inexperienced' to 'dedicated' for both the nurse and the physician).

This seems to be so for the UK, Holland, Germany, Austria, Switzerland, France, Belgium, Spain, Luxemburg and Italy. Some Portuguese teams seem to start with a handicap since they need to work with the materials provided not by them but by the hospital that made the call. Holland on the contrary is probably the only European country – right now – that is working on a nationwide consensus on identical PICU-stretchers for all of their 8 PICUs. No country however that incorporates H- and F-wing transport vectors like Luxemburg. In some of the European countries the nurses are asked to obtain a helicopter navigator's license, in some individual cases, to save on costly co-pilots.

Where to start?

Input from the questionnaire revealed quite a lot of useful data. The major finding is that there is no such thing as a uniform transport model, not even in one small country. In fact every hospital does what seems to be the most rational in its own region. In most cases this is probably the best thing to do.

To build a stretcher based on the gathered data seemed impossible. The following question was raised: *'What is it that I really want?'* It is the transport team's profile that will determine how the system looks. On the other hand and for years now we were also convinced that transport had to be limited to the unavoidable laws of physics while all equipment and therapy should be equal to what was going to follow for days or weeks at the ICU.

Our own transport team is randomly generated from the medical and nursing team of a 6-bed PICU. This is a quite common size for Belgian university hospitals (10 million inhabitants). The team is called upon to get out and to fetch the child in a smaller hospital. During evenings or nightshifts, a junior nurse and a young pediatrician (senior but not resident) leave the hospital as a team. This means that 24/7 both a very experienced or on the contrary a very young and stressed team could leave the unit. Our stretcher is not built for the expert team situation (because they will always find a solution) but from the novice-junior-inexperienced point of view.

We learned from our own history that a wrong choice would be the introduction of transport equipment especially designed for the purpose of transport alone. This implicates that the equipment will only be used in these particular situations. In a 6-bed unit like ours, one out of two to three admissions requires a transport: 150 transfers for 16 nurses per year are not that much. Many weeks or even months can go by before the same nurse performs a 'technically challenging' transport again. Realizing that junior nurses and young doctors have to deal with tons of input during such transports, we figured that stress reduction through the use of very familiar equipment might be helpful. Luckily for us this also meant equipment identical to the PICU and thus deleting the intermediate 'transport-equipment' (ITE) phase. However, we still need to think about the following: *'if I take all of this with me, where I am going to put my patient?'*

The MOUNSTER

The amount of equipment required mandates this question. The necessary equipment includes 2 gas cylinders of 6 liters each (compressed air and oxygen), 1 modular monitor (full-option type including ETCO2 and invasive pressures), 1 portable computer, 1 suction unit, 2 uninterrupted-power-supply batteries, active humidification and warming of inspired gasses, aerosol, individual oxygen regulator, a head immobilization splint, a minimum of 4 syringe-pumps with easy/fast upgrade to 10, IV-poles, ET-tube telescopic pole, 1 defibrillator-pacemaker and most of all: 1 Siemens Elema 300 servo respirator. This adds up to about 100 kg.
Stretchers that are adapted for this purpose are not for sale: one has to 'make' – convert – it from a standard commercially available model.

The first apsect is to choose a trolley. A trolley especially designed to load obese patients without its components failing is a good choice. The American (but also available in Europe) Stryker M-1, alias 'rugged' seemed to best fit the job we had in mind. A stretcher capable of carrying 500 lbs with accessories like high side ramps, IV-poles, table, et cetera, met our needs. More important were the emphasized safety features, like multi-safety belts and the high limits set for collision and equipment stress (10 G). Compared to other heavy-duty stretchers (e.g., Stollenwerk) there were no safety warnings to find about component failures. The fact also that the patient level could be turned 180° independently from the trolley was very meaningful to us. In Belgium, transports from one hospital to another (no matter how severe the condition of the patient) are classified as 'secondary' or 'primo-secondary'. This implicates that transports are performed with private company ambulances and according to a *'first called, first served'* policy. The patient cabins differ a lot. Therefore a patient could lie in the middle (rarely!), on the left or on the right. A 'fixed' direction stretcher can therefore unhappily result in 2 limiting options: a transport company monopoly or patients installed with their feet first. In the first situation we are limited in available ambulance resources or - patient access if left with an odd direction of the stretcher. This feature of 'disconnectable' patient level that consequently can be turned and fixed again on the trolley ultimately generated the tool's name. MOUNSTER© is the stand-alone acronym or byword to be put before or after the word 'trolley' or type of trolley. In our particular situation we were going to build a Stryker-MOUNSTER©. MOUNSTER© stands for MOuntable UNit STretcher Extension Rack. In other words: a segment containing technical parts that can be removed or inserted as an extension rack for standard trolleys.

The wheels of the M-1 however appeared too soft and were replaced with a heavy-duty aluminum-titanium lightweight-type of wheels. Secondly this wheel also had a large floor-contact profile (complete tire width), which added to trolley stability and solidity. The early regression of the original M-1 wheel to a kind of 'egg' form can be observed in every original Stryker – loaded or unloaded.

36O° access

There is only one bed design that allows full access to the patient. It is the design where nothing is mounted above or around the patient level. In the ICU this accessibility is gained by installing all equipment far from the bed, creating the opportunity for the professional to stand between patient and machinery. The same can be done in a large ambulance, but there is still the difficult trajectory on hospital floors, pavements, grass and tarmac connecting hospital to the transport vector. To create a 360° bird's eye perspective at all times, all the equipment needs to be installed underneath the patient. Designs hanging over the head, legs or lateral sides limit access from the side that has been extended. Therefore all equipment needs to be incorporated in a level between patient and carrier except for the monitor screen. This concept is not new, however, there are problems. Only the tall can see what happens on the patient level. The patient is piled up on a towering height and the whole concept looks very unstable because of the high gravitational center. So we built a 'tub' instead of a 'plate,' winning a few inches that way. In the tub we cut holes and what we cut out was welded back on a lower level.

The equipment that we cut the holes for sunk into the tub to an even lower support level. So again, we gained a few inches. This had two major advantages, one of which is already mentioned: the gain of inches makes the stretcher not too high and keeps the gravitational center as close to the ground as possible. Second, all heavy equipment was sunk into the tub and sandwiched by the patient level above it. It did not need to be fixed (by bolts or metal straps) because there is no way it could move out of the 6mm aluminum plated traps.

Crew safety is considered in this design. Sandwiching (trapping) most of the equipment was undeniably a good idea. Also we did not choose very thin stainless steel metal plates (as observed quite often in transport designs). Instead we took an aluminum plate of 6mm thickness, which is about 2-2,5 times thicker than the ambulance's wall. In case of a violent collision, spin or roll this kind of plate will not fragment and will break legs instead of amputating them. Also the corners of the tub were welded in a round form to add to safety.

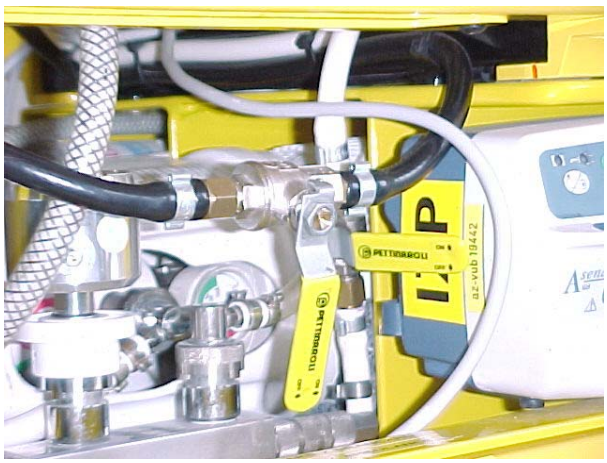
The heaviest components (gas cylinders, Servo and UPS) were housed inside the rectangle formed by the 4 legs of the stretcher. The cylinders could not be sunk into the tub, but they each got a solid metal housing instead linearly welded on the bottom of the tub. Solid DIN-rails were attached on the lateral sides of this compartment that then would carry 4 IV-pumps. An additional requirement was that cylinder manifolds and the internal circuit of the servo stayed accessible at all time. We now had a stretcher with a lateral nurse's side and on the proximal end a doctor's (or RT) side. A side for the nurse with all the IV-pumps, oxygen and compressed air distribution system, manifolds and gauges as well - and a doctor's side with the control panel of the ventilator and the humidification/heating device. To further expand the 'coincidence' concept, we added plastic tubes containing suction catheters and a suction unit in the transit zone between nurse and doctor (RT). Above it all stands the monitor, with its screen facing both of them.

The construction became heavy by now. We considered both tub and cylinders from composite construction, but this would make the MOUNSTER from both the financial and versatility (back-up from other hospital in case of gas failure) point of view less attractive. Instead we started sawing holes (with a clock saw) in the tub, considerably reducing the weight while not altering the global solidity of the metal frame. All original and patented Stryker© fixation points remained unchanged.

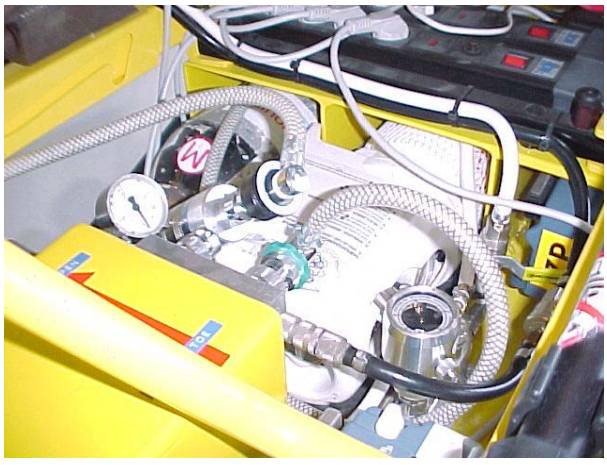
3-way stopcocks

Until this stage we managed to ensure that this is not new to the nurse nor is there an ITE (intermediate transport equipment) phase for the patient. When the stretcher is not moving there is no single difference between a PICU-bed in our unit and the MOUNSTER. It is nothing else but the 7th PICU-bed.

It has a clear and understandable division between 'a nursing' and 'a doctor' side. It has a 'paramedic' side as well. All the buttons or levers beneath the tub are not for the nurse or the doctor. Only the paramedic is allowed to operate the green, red and blue buttons or levers.



Only one 'foreign object' has been introduced into the tub. It is the gas distribution manifold ramp. It is the system that directs and controls the gas flow. The gases can either be provided by the MOUNSTER itself or by another source outside the MOUNSTER. This could be the ambulance resources, medical pipelines via wall outlets or stand-alone gas cylinders. We designed two sets of metal 3-way stopcocks, but a bit larger than the disposable version nurses are very familiarized with (to administer drugs or fluids to the patients). Well, it is already clear by now: this gas design is not that unfamiliar after all. The distribution system acts exactly the same way as the infusion therapy line. The stopcocks are manifolds and the whole is a little bigger. So the only 'new' item on the MOUNSTER is something nurses work with on a daily basis.



Independence day

One of the requirements of the MOUNTSTER was a unit that could function independently. All equipment is provided with batteries, but it is not always clear what stage of the end-of-life cycle the battery is at. Ambulances are provided with sufficiently powerful inverters, but these can fail. So we determined what a regular hospital does to deal with electricity power failures. First of all, almost every machine is equipped with an internal battery. Secondly, the hospital has a power generator: this could be an additional battery system or inverter in the ambulance. This is however quite

uncommon in most European ambulances, based more on local initiative. Thirdly, hospitals have so-called no-break installations provided by a number of sudden power surge protecting batteries, called UPS. So we put UPS batteries in the tub to create our own no-break system, providing us with 2,5 H of full electrical autonomy in case of inverter failure. 2,5 H means that you have crossed Belgium via its longest axis and are now half way back. Another team operating in a larger country could similarly put 4 or 6 or 10 UPS on a rack in the transport vector and have electrical autonomy for days instead of hours. We decided to incorporate them into the MOUNSTER.

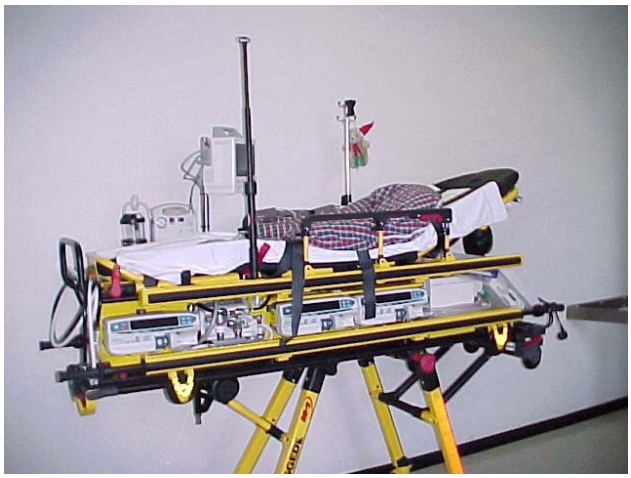
Communication

The monitor (Phillips Medical Systems) is a transport version of the bedside monitor with the same screen display and panel configuration. There is nothing unfamiliar about it. All data is stored from the moment the patient is dedicated to the team and branched to the monitor. In the PICU, the patient module is changed to the bedside monitor, which is followed by an immediate download in the patient server. During the transfer, the team communicates with the home base via GSM or via (less likely) radio. GPRS technology is now offering us an additional feature: digital information (which is otherwise transmitted orally via GSM and written down in a chart) is now written down in a handheld computer and transmitted on-line via the Internet. The on-screen chart is the same as the paper version.

The next step is the capture of the telemetry signal by an industrial modem and the transmission of analogue data to the home base. This is now performed via the LP20 defibrillator-pacemaker.

To infinity and beyond

Docket to its power sources to load its batteries, the MOUNSTER is now waiting and ready. With the MOUNSTER there is no ITE-phase and consequently the syringe pumps together with the syringes are exchanged as a whole together with the patient. Compared to what happens if transport teams disconnect their syringes from the pumps, here there are no drops or thrusts in the mean IV-medication pressure. There is no such thing as a 'respirator clash', a swing from conventional to open lung concept ventilation, simply because the machine is the same. The humidification and warming of inspired gasses is approximately the same via a HME booster system. Long transportation times (e.g., Spain, US, or Canada) would benefit from the development of a dedicated Fisher & Paykel heating component for heated wire tubing.



Equipment like the MOUNSTER can foster stress reduction for less experienced transporters. Ultimately the transporter's craftsmanship will stay decisive, but it is clear that the right tools help.

Abstracts concerning the MOUNSTER concept have been accepted both nationally and internationally, such as the American Academy of Pediatrics congress (San Francisco, October 2004) and the 10th International Pediatric Nursing Research congress (Montreal, November 2004). Similarly, papers have been accepted for publication (e.g., *Agenda Pediatrie*, *Percentile*).

It appears that the *'redesigned trolley for interhospital critical care transport of children'* of the VUB has sparked international interest.

Can the need for Intensive Care be avoided in Children?

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Abstract

This paper discusses current child health trends. In particular, factors are highlighted that have diminshed certain types of critical illness in children as well as those that have contributed to a rise of other types of life-threatening illnesses.

Introduction

I started work in paediatric intensive care some time ago, in the late seventies. A great number of the patients on our unit were firstly children with various kinds of trauma and secondly children with infections such as epiglottitis or meningitis.

I remember that it was like an unwritten law that with the first sunny days in spring we had to be prepared to admit patients after casualties (e.g., bicycle accidents) because children had started to go to school by bike, or just because they played outdoors more.

Nowadays we see these patients, too, but only occasionally. We could hardly run a paediatric intensive care unit (PICU) with them. There must have been some developments in medicine and in society as well to reduce or avoid the need for intensive care for children.

The aim of this paper is to discuss the influence of the following factors for the PICU setting:

- Prevention programs
- New techniques in medicine
- Developments in Society

Prevention Programs

Most paediatric intensive care units are interdisciplinary as the patient populations are not sufficiently large to allow specialization – with a few exceptions such as neonatology, paediatric cardiology and cardiac surgery.

Thus, you will find the whole spectrum of paediatric diseases and emergencies in a PICU. As mentioned above, head injuries or multiple trauma following traffic accidents were very common 20 years ago.

Based on official cause of death certificates, child injury mortality rates in Germany are compared with those of Austria, the Netherlands, Sweden, and Switzerland. In all five countries, the most common cause of mortality among children aged 1–4 years is drowning and home and leisure accidents.

Transport accidents are the main cause of death in the 5–14 age groups. Mortality in both age groups has fallen significantly since 1980, most markedly in Sweden and the Netherlands. (1)

When we look at the health statistics for Germany we see that the number of injured children under 14 years of age is continuously decreasing. In 2000 we see a decrease from almost 10% in comparison to 1999 and this is the lowest number since 1953 when statistical recording started. (2)

So what happened in this time span?

The majority of childhood injuries requiring PICU admission are due to traffic related injury, falls or burns. Many of these injuries are preventable!

It was in the early 1980s when safety campaigns and special educational programs, (e.g., the SAFE KIDS program in the USA) were established. There are similar programs in most western countries. They were based on the results of a systematic look at the patterns of injury in children and contain strategies for prevention and the establishment of safety standards.

Examples of effective interventions include

- Vehicular restraint systems for small and young passengers,
- The wearing of bicycle helmets,
- Using safety belts,
- Securing fire arms in the home,
- The controlling of hot water heater temperatures levels,
- Area-wide traffic calming means,
- Child resistant containers to avoid poisoning and
- Window bars to prevent falls.

Also, interventions for changing behaviour, which include pedestrian education and parent education on home hazard reduction, were very effective.

Education, legislation and environmental modification were the key for the improvement of child safety. Thus, the need for intensive care in children in this specific field cannot really be avoided but it can be reduced in paediatrics.

Another very effective means to avoid pediatric critical illness is vaccination. For example, streptococcus pneumoniae is the most common cause of bacteria-induced infections worldwide. More than 1, 2 million people worldwide die every year due to pneumonia. Forty percent are children less than 5 years of age.

Streptococcus pneumoniae in children is the main cause for life threathening diseases like meningitis and sepsis.

A pneumococcus infection in children is characterized by

- A rapid development of symptoms
- A high rate of complications
- Severe consequental damages and
- A high number of deaths

Each year in Germany (with 82 million inhabitants) there are approximately 220 – 300 children less than 10 years of age, who develop meningitis. Approximately 20 of them die and another 50 will develop neurological deficits. [3]

Recently the pneumococcal vaccine, which is currently recommended for people that are immunocompromized or over the age of 65 was also approved for use in children under two years of age. The introduction of this vaccine in the United States (US) showed a very impressive reduction of invasive pneumococcal infections.

We expect that in the coming years the incidence of menigitis and sepsis in childhood will also be rapidly diminished in Europe.

In the past we have seen this effect with the introduction of the haemophilus influenzae type b vaccines. For example, the rate of invasive infections due to haemophilus influenzae meningitis rapidly decreased in Germany and remains continously low.

Laryngitis with airway stenosis, a common and life threathening infection in toddlers years ago, disappeared from the list of paediatric diseases that require intensive care. The same trend is seen with pertussis in neonates and young infants, often accompanied with apnea and pneumonia. So vaccination is a very effective method for preventing paediatric critical illness in children.

New Techniques

New techniques in medicine already have and will also have a remarkable influence on the PICU patient population. Let us consider reproductive medicine.

The objective of infertility treatment should be the birth of a single healthy child but unfortunately many of the options presented to infertile couples are associated with the high risk of multiple gestations. Multiple births are much more common today than they were in the past. According to the U.S. Department of Health and Human Services, the twin birth rate has increased more than 50% since 1980, and triplet, quadruplet, and higher order multiple births have increased at an even higher rate.

Advances in medical treatments have improved the outcomes of multiple births, but they are still associated with significant risks and complications for mother and children.

First of all there is the risk of a preterm birth, which occurs in over 50% of twin pregnancies, 90% in triplet pregnancies and in all quadruplet pregnacies. Prematurity is associated with an increased risk of respiratory distress syndrome (RDS), intra-cranial hemorrhage, cerebral palsy, blindness, low birth weight and neonatal morbidity and mortality.

Furthermore women with multiple pregnancies are more likely to develop gestational diabetes during pregnancy. Babies of a diabetic mother are more likely to experience respiratory distress and other newborn complications. Intrauterine growth restriction and congenital anomalies are all more common.

Lifelong disability risk is over 25% for babies weighing less than 1000 grams.

For all these conditions we need intensive care not only for the neonatal period but for lifelong care as well, as these patients often need neurosurgical interventions.

Congenital malformation and genetic diseases are some of the main causes of mortality and morbidity in industrialised countries.

Although there has been progress in the medical understanding of these disorders and their causes, there are still diseases for which medical treatment is not presently available. Ultrasonic fetal imagery has led to new diagnostic possibilities to detect a large number of anomalies in an early stage of pregnancy. Many affected pregnancies are terminated due to the fetal screening diagnosis. This has an effect on the prevalence and types of diseases which were seen at term and finally on the need for intensive care in children.

Minimally invasive surgery will have an impact on the need for paediatric intensive care, as well. For example, at present nearly 1 % of all newborns are affected by congenital heart disease. More than half of the children who need surgical intervention with cardiopulmonary bypass in North America are younger than 1 year. New techniques such as minimally invasive cardiac surgery may reduce the need for sternotomy and cardiopulmonary bypass. Tissue damage, infection and discomfort for the patient and therefore the need for intensive care is reduced.

Interventional heart catheterisation can have the same effect. At present 40% of all singular heart defects are managed by interventional catheter techniques. Stents hold vessels open, coils can close them. If an atrium or ventricular septum defect can be closed with an umbrella, open heart surgery in these children and as a consequence paediatric intensive care is no longer necessary for these patients.

Developments in Society

When I indicated earlier that 20 years ago, with the first sunny days in spring, that the season was open for children to start playing outside the house - this belongs more and more to the past. As there is a tendency toward more inactivity among children, childhood obesity creates a serious problem.

Television and computers for entertainment have contributed to a decline in the physical activity of many children. Also a decreased participation in physical educational programs in schools has been noted. Over the past 20 years the number of children who are overweight has increased by more than 50 percent and the number of extremely overweight children has nearly doubled.

About 25 – 30 % of all school age children in the United States are overweight or obese. Similar trends are being observed worldwide. An increased prevalence of overweight and obesity has been documented for Southern Europe, Northern America and South America. [(4)]

The trend toward childhood obesity is alarming, as obesity is clearly linked to heart disease. The more that teenagers weigh, the more heart disease risk factors they have. And this may lead to the development of cardiovascular disease at an earlier age than expected. The set of multiple risk factors this implies includes hypertension, hyperinsulinaemia and insulin resistance. The incidence of Type 2 Diabetes in childhood has risen to an epidemic level, caused by poor eating habits and sedentary lifestyles.

So a new patient category for paediatric intensive care is continously developing.

Conclusion

Although the composition of the patient population in a PICU has changed over the years since the beginning of paediatric intensive care in the early sixties, there is an obvious need for intensive care in children in Europe. Safety programs for the prevention of injuries, and vaccination for the prevention of infections may protect children from the need for intensive care. Also new medical techniques like minimally invasive surgery have the potential for further reducing the need for paediatric intensive care.

But on the other hand new medical treatments and sociological factors will have a negative impact. Therefore, my answer to the question: 'Can the need for intensive care be avoided in children' is yes and no.

References

(1) Elssäßer, G. International Comparison of Child Injuries and Prevention Programs: Recommendations for Germany; Brandenburg Regional Public Health Office, Germany

(2) Statistisches Bundesamt, Unfallstatistik 2000

(3) Epidemiologisches Bulletin Nr. 28, Impfempfehlungen der ständigen Impfkommission (STIKO) am Robert Koch-Institut, Juli 2001 and Graf v. d. Schulenburg J. M., Prof. Dr., Claes C., Dipl. Ök., North German Centre of Health Economics and Health Systems Research (HSR), Pharmakoökonomische Evaluation, data on file

(4) Guttersen, C. Metabolic Syndrome of Obesity in Teens predicts Risk as an Adult; www.calolive.org/nutrionist/top

Spotlight on PICU

This regular column will provide readers with an opportunity to learn about fellow PICUs in various parts of the world.

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KK Women's and Children's Hospital of Singapore – The Paediatric Intensive Care Unit

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Introduction

KK Women's and Children's Hospital (KKH) is the largest medical facility in Singapore that provides specialised care in the areas of obstetrics and gynaecology, neonatalogy and paediatrics. The 888-bed hospital consists of two eight-storey blocks built on a four-storey podium with two basement levels**.** The 443-bed Women's Hospital and 445-bed Children's Hospital are located in two separate towers. Every year, KKH registers over 400,000 visits by women and children who come as inpatients or outpatients. The Women's hospital is a tertiary referral centre for high-risk obstetrics and has 24 neonatal intensive care cots. The hospital has a staff strength of 2,500 employees, of which, over 150 are specialist doctors, more than 1,000 are nurses and over 300 are paramedical staff.

KK Women's and Children's Hospital

The Children's Hospital

Paediatric services from three national hospitals in Singapore were centralized in the Children's Hospital in March 1997. Since then, Singapore's first and only purpose-built Children's Hospital offers a complete range of healthcare services for children from birth through age 16.

With 15 clinical services and nine surgical disciplines, the Children Hospital records of approximately 25,500 inpatient admission each year, and its Specialist Clinic care for over 118,500 outpatient visits annually. The hospital's Children's Emergency Department sees over 99,000 patients yearly. The hospital is a tertiary referral centre for paediatric bone marrow transplants and open-heart surgeries in the country.

Children's Intensive Care Unit

The Children's Intensive Care Unit (CICU) is a 16-bedded, multi-disciplinary unit with over 700 admissions a year. The CICU cares for medical, surgical and post-operative patients, with the majority of the post-operative workload being open-heart surgeries. The CICU has a dedicated team of nursing and medical staff, along with a complete range of medical technologies. Treatments available include invasive and non-invasive ventilation, high frequency ventilation, inhaled nitric oxide, continuous renal replacement therapy, ribavirin aerosol, isoflurane inhalation and ECMO. As a tertiary paediatric referral centre with a full range of paediatric subspecialty services, CICU pioneered the development of the Children's Hospital Emergency Transport Service (CHETS), Paediatric Homecare services, Code team, Parental Cardio-pulmonary Resuscitation course, Advanced Children's Life Support course and Paediatric Intensive Care Nursing course.

Nursing a post cardiac surgical patient

The CICU has liberal visiting policies for parents of children admitted to the unit. To portray a child friendly environment, the walls are decorated walls with paintings by children and murals painted by the CICU doctors and nurses. The symphony of technological equipment and high noise level of caregivers are often replaced by the sounds of video games, video shows, in-house children programs, music and songs that are made available for patients at their bedsides in CICU.

The Nurses

The CICU is staffed by registered nurses, with more than 65% of the nurses are trained either in critical care nursing, paediatric and neonatal intensive care nursing or paediatric nursing. The unit is managed by a senior nurse manager, 2 nurse managers and a senior nurse clinician with 45 other full time registered nurses. The nurse-patient ratio in CICU is 30% 1:1 and a 70% 1:2; however the nurse-patient ratio allocated is greatly dependent on patient acuity and level of technological support each patient requires. In a critically ill patient requiring CVVH, ECMO and other ventilatory support, two nurses may be assigned to a patient on each shift. In KKH more than 60% of the nurses work on a 12-hour shift system. The 12-hour shift was initiated by the

CICU when the Children's Hospital first opened in 1997. Given the comprehensive and complex nature of nursing work, CICU only deployed nurses from within when in need of staff during critical period and nurses are given the option to claim payment or replaced with "time off".

Nursing Education

In Singapore, all registered nurses undergo a 3-year diploma course in Health Sciences in a polytechnic education institution. After this, they are given a choice of embarking on 1 year of post basic specialization after two years of clinical attachment in a relevant area. The Paediatric Intensive Care nursing course is not offered in the Singapore Health Sciences faculty due to the lack in demand by Singapore hospitals. In the previous years, a few nurses were sent to the Royal Children's Hospital in Melbourne for Paediatric Intensive Care Nursing training. This year, with the establishment of comprehensive services and care deliveries, CICU started its 6-month structured Paediatric Intensive Care Nursing course for nurses in Singapore. Besides, formal structured training necessary for the core trade of our nurses in paediatric intensive care nursing, each year one or two nurses in CICU are sent to overseas' children's medical centers for a 3-month Hospital Management Development Program (HMDP) attachment in a specified field such as transport and retrieval, cardio-thoracic nursing, renal nursing, respiratory care, among others. The Bachelor of Science in Nursing is offered mostly by a tertiary institute of external sources, about 20% of CICU nurses are BSN holders and more than 5% are masters prepared.

It is mandatory for nurses in Singapore to continuously upgrade their skills and knowledge to maintain their level of competency in care delivery; hence all nurses must attain the number of Continuous Nursing Education (CNE) points stipulated by the Singapore Nursing Board. In KKH, nurses are given 40 hours of protected time for training each year. Periodically, CICU also conducts in-house education programs and workshops such as non-invasive or invasive ventilation, tracheostomy care, CVVH, care of patient with Intra-aortic balloon pump (IABP), central venous line access and many others that are important for skills development.

Hands-on training on the use of the CVVH machine

Nursing competency is important to the patient and every new nurse posted to CICU undergoes a 3-month induction program. The new nurses are closely precepted by a nurse clinician, nurse managers and senior staff nurses. They are continuously assessed and tested on nursing skills that are critical to the care of the patient before they are placed to nurse patients independently. The CICU is also a clinical attachment ground for post basic nurses and overseas' nurses.

Quality Improvement Projects

Improving quality and performance has become a commitment for healthcare settings in Singapore. The CICU has a process improvement project team to work on cost-effective methods in the care delivery and review work systems. The team meets periodically to review work processes, brainstorm for better and innovative solutions to help in their care and work processes. There is also a Nursing Policy and Procedures committee within the CICU, working and reviewing CICU nursing policy and procedures.

The CICU also has its own quality improvement initiatives and audits. Sentinel events such as medication errors, extravasations, accidental self-extubations and events that deviate from the standards of practice are monitored. Routine surveillance of nosocomial infection on ventilator-associated pneumonia, urinary catheter-associated urinary tract infection, central line-associated bloodstream infection and surgical wound infection are done and computed to calculate the incidence of the events.

Special Services

Children's Hospital Emergency Transport Service (CHETS)

Into its fifth year of establishment, the CHETS team carries an extensive range of mobile intensive care unit (ICU) equipment and has performed critical care transfers by road, air and sea. The team, made up of neonatologists and paediatricians with critical care training along with trained neonatal and children's intensive care nurses, carry out local, international and third party transfers.

CHETS: arrival of patient to CICU

Code Team

Taking into consideration the nature of work related experience; nurses working in the ICU are usually more skillful in dealing with resuscitation. Together with the code physicians, in each shift, a code nurse is assigned to run children's hospital code blue and trauma code in Children's Emergency. Most nurses in the CICU are trained in Advanced Children's Life Support (ACLS) program and a handful of the senior nurses are qualified ACLS and BCLS instructors.

Children's Hospital Homecare Service

The homecare program provides care to children with chronic illnesses who require continued medical care at home. The homecare program was set up to facilitate a smooth transition of technologically dependent patients from the hospital back to their home. These children have many underlying conditions, which require them to rely on medical equipment and

devices such as tracheotomies, oxygen devices, home ventilation, artificial enteral feeding and long-term central lines. The homecare nurse has a structured program in place for every patient needing such service. The aim of this program is to have chronically ill children cared for in the familiar and comforting environments of their homes, with their families as their source of support.

Homecare nurse on home visit

Parental CPR

As caregivers are capable of helping the child in a life-threatening situation, if given the opportunity to learn CPR, the parental CPR program was developed to prepare parents and caregivers to acquire such skills. This program is conducted by both the physicians and nurses of CICU once every two months on a voluntary basis and is open to the public.

What are your comments?

The Editorial Board would appreciate your comments on this publication. This can include any thoughts that you have regarding the structure as well as the content of the Newsletter.
We would particularly appreciate your suggestions on topics or issues that you would like to read about in future editions.

Forward your ideas to Franco Carnevale (Editor) :
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Contents of Previous Issue

Pediatric Intensive Care Nursing

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If you have missed this past issue, as well as any other issue, you can access them at our website: http://groups.yahoo.com/group/PICU-Nurse-International (just click on 'Files' after you have signed in on Yahoo – top of page – and then gone to 'My Groups' and selected PICU-Nurse-International).

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Come visit many interesting website links to various international nursing societies as well other important resources:

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CONNECT

Official Journal of the World Federation of Critical Care Nurses

The main purpose of CONNECT is to provide a forum for critical care nurses around the world to share good practice. It aims to be the voice of critical care nurses world-wide. One of its founding principles is that of support of the Critical Care Nursing speciality. CONNECT aims to create a nurturing environment that enables all critical care nurses to have a voice. As such, the editors believe that all nurses have something valuable to contribute to CONNECT, that others may learn from. For this reason, no articles are rejected on the basis of language, and the editors undertake to provide help to authors, especially those writing in a second language. The main focus of CONNECT is clinical practice, and we (the editors) are particularly keen to receive articles that describe or evaluate developments in nursing. The journal contains a mixture of articles, including descriptions of practice innovation, literature reviews, letters, conference reports, clinical skills guidelines, news items, research and, of course, all the latest information about developments in WFCCN. Its aim is to be a friendly journal - one that nurses read because they are interested - and we make no apologies for its informal style!

CONNECT is produced in association with the European federation of Critical Care Nursing associations :
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Current Issue

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Upcoming Conferences

2nd Congress of the European federation of Critical Care Nursing Associations

Delivering critical care across the lifespan: meeting the challenge

November 10-12, 2005
Amsterdam, The Netherlands

Deadline abstract submission: 15th of March 2005

Dear friends and colleagues,

On behalf of the European federation of Critical Care Nursing associations (EfCCNa) we have great pleasure of inviting you to attend its second congress on advances and developments in the field of critical care nursing. The congress will be held in the Meervaart congress centre, Amsterdam, The Netherlands, from 10th - 12th of November 2005.

The congress theme, ***delivering critical care across the lifespan: meeting the challenges*** aims to address the key issues for critical care nurses engaged in caring for patients across the continuum of life, starting with birth through to the elderly. Additionally, the content is sure to stimulate and provoke debate between nurses about how to best respond to the challenges of delivering individualised, high-quality, evidence based care to a broad range of age groups. The quality of the scientific programme coupled with distinctive ambience, culture and vibrancy of the remarkable city of Amsterdam are all the necessary ingredients for a truly memorable experience.

We are looking forward to welcoming you in Amsterdam.

Jos M. Latour
Chairman, International Organising Committee

John W. Albarran
Chairman, International Scientific Committee

For detailed information visit: www.efccna.org/congress2005

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9th Congress of the World Federation of Societies of Intensive and Critical Care Medicine

International Meeting of the World Federation of Pediatric and Intensive and Critical Care Societies
International Meeting of the World Federation of Critical and Care Nurses

August 27-31, 2005 Buenos Aires, Argentina

Abstrat submission deadline: February 1st, 2005

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