ICU MANAGEMENT

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EDUCATION

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Amid the challenges of managing the ICU, the elements of the system are forever altering, creating yet more complexity. Changes in an ICU, whether tried and tested or from innovative research that indicates beneficial results, are prone to error if doctors, nurses and other staff are not educated sufficiently. This may involve not just training on modern technology and new procedures, but also stimulating a positive change culture. The initial training of physicians is also altering, with extended areas of instruction and renewed methods for assessment arising, with an aim of improving not just knowledge and skills, but also attitudes and behaviours. With an increasing flow of medical practitioners across borders, societies and institutions are also promoting more harmonised curriculums.

In this issue of ICU Management, Profs. Julian Bion and Hans-Ulrich Rothen describe the steps taken to develop the ambitious Competency-Based Training in Intensive Care in Europe (CoBaTrICE) programme, which was conceptualised to be compatible with very diverse national training programmes, but to also provide a harmonised, quality-assured product. This concept has come to inspire other programme developers, as Dr Jannicke Mellin-Olsen of the European Board of Anaesthesiology (EBA) explains, while enlightening us on the board's new syllabus. Next, Prof. Hans Flaatten passionately highlights ESICM's new educational activities, which deliver training courses as cheaply as possible, so that as many participants as possible, particularly those in less developed areas of Europe and the world, are able to enrol.

The Cover Story then moves on to simulation via virtual worlds, with Prof. Ross Brown and his colleagues emphasising the findings of their research, including a prototype ICU handover training environment. They suggest this potentially matches well with encouragement of reflective learning and student engagement. Prof. Dominique Vandijck and his team subsequently provide us with an insight into how quality improvement measures, integrated with cultural changes and continuous education, can improve the quality of patient care provided, and potentially dramatically reduce the occurence of preventable errors.

Next, we move into our nutrition section, in which Dr. Victor Manuel Nava Sánchez and Lic. Veronica de la Peña Gil offer a simplified protocol framework that helps in determining the best route of enteral nutrition in critically ill patients. Prof. Jan Wernerman then takes us on a more individualised path, suggesting that many ambiguities are present in current patient nutrition formulae. An important confounder, he says, is that timing in critical illness is not sufficiently considered when making nutritional decisions.

Our focus on education is subsequently brought into the realm of endotracheal intubations in our Matrix section, where Drs. Jestin Carlson and Lillian Emlet highlight new teaching modalities regarding airway management in acute or emergent settings, that have been brought about by video laryngoscopes. We then move into the field of ultrasonography, in which Drs. Lorenzo Ball, Francesco Corradi and Prof. Paolo Pelosi introduce the WAMS-D approach algorithm, with a purpose of disentangling complex questions that crowd a physician's mind. They suggest that efforts should be made to develop a quantitative approach to ultrasonography and that attention should be paid on continous training.

Rounding off our features section, Dr. Manu Malbrain and his colleagues provide a sequel to their article in the previous issue of ICU Management, taking us deeper into the issues involved in fluid management via results from a meta analysis and apractical approach.

Research is the focus of our management segment, with Prof. Marcelo Gama de Abreu presenting a personal, engagingly anecdotal advisory piece on how to get a research grant, from what topic to choose and how this could be best presented to referees, to maintaining a realistic schedule and a healthy relationship with a granting institution.

Prof. Benoit Vallet follows, delving into currently evolving methods for research and evaluation and the impact this could have on quality of care provision. Furthermore, in this broadly encompassing interview, Prof. Vallet emphasises that data management and clinical decision support are among the most important topics in perioperative medicine, along with a rising continuum of care, all helping to improve standards. In addition to telling us about his most significant research findings, he provides an informative overview of his current data-mining project, with the aim of establishing anaesthesia quality rules.

Finally, we take a look at the challenges and changes that have evolved in Russia's healthcare arena, with Dr. German Salamov taking us through the persisting problems, and what moves could be made to improve the situation.

Continuous education in various areas, from new technology to safety, is being considered of increasing importance in the ICU, which takes countless lives into its hands. Gradually a culture of harmonious learning is being integrated into ICU daily practice, with a transfer of skills and knowledge becoming increasingly facilitated.

Please send your responses to me at **editorial@icu-management.org.**

Jean-Louis Vincent

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RESEARCH NEWS

Urine Dipstick Helps Predict Acute Kidney Injury

A commonly used, inexpensive diagnostic tool, the dipstick proteinuria (DP) urine test, may provide an easier, more effective way to predict Acute Kidney Injury (AKI) in patients with sepsis or severe blood poisoning infections.

Led by Dr. Javier Neyra at the Henry Ford Hospital in Detroit, Michigan, researchers have found a new prognostic application for the readily available urine test. Intensivists and emergency room physicians have been using it as part of routine testing on admission.

This study, which examined 328 septic patients with no recent history of protein in the urine, found that the detection of this protein via a dipstick on patient admission accurately predicted AKI in 55 percent of septic patients. AKI occurs, in almost 30 percent of patients with severe sepsis and the presence of albuminuria, or elevated protein in the urine, occurs in nearly 87 percent of septic patients. Using the DP test resulted in fewer false positives, and accurate detection of more severe AKI.

"Production of creatinine from the muscle is reduced in septic patients, so relying on changes in serum creatinine to diagnose AKI in such settings could delay its diagnosis. As such, it is highly important to identify biomarkers that are sensitive, specific, and which enable early diagnosis before substantial kidney damage has been done. Additionally, septic patients receive aggressive IV fluid administration which can further dilute serum creatinine, making it harder to detect AKI in this population," expressed Dr. Neyra.

This research was presented at the National Kidney Foundation's Spring Clinical Meetings, held from 10-13 May, 2012.

"Ultimately, using this tool to indicate who is most susceptible to AKI may allow providers to intervene early and prevent it from developing. Given the increased risk of developing chronic kidney disease later in life after an episode of AKI, this is especially significant," said Dr. Lynda Szczech, National Kidney Foundation

www.kidney.org

FDA to Review CV Risk with Azithromycin

The US Food and Drug Administration (FDA) will review a new study in which it is indicated that patients taking azithromycin are at a slightly increased risk of sudden cardiac death than patients treated with amoxicillin, ciprofloxacin, or no antibiotic at all.

The observational study entitled "Azithromycin and the Risk of Cardiovascular Death", which was published on May 17, 2012, in the New England Journal of Medicine (NEJM), looked at Medicaid patients on a five day course of azithromycin. The FDA made the announcement to look into the study that same day.

The agency recapped that QT interval prolongation, which can trigger an abnormal and sometimes fatal heart arrhythmia called torsades de pointes (TdP), has been linked not only with azithromycin but also with other antibiotic drugs in the macrolides class. Drugs in this group include clarithromycin and erythromycin, neither of which figured into the NEJM study.

Concern on the risk for cardiovascular death for patients taking the macrolides class of antibiotics has been on the FDA's radar since 2011, when it evaluated the labels for these drugs.

In March, the FDA revised the warnings and precautions section of an extended-release, oral suspension version of azithromycin. It added mention of reports of QT interval prolongation and TdP and advised clinicians to avoid prescribing the antibiotic for patients with known QT interval prolongation, patients with low potassium, or those taking drugs that prolong the QT interval. The labels for clarithromycin and erythromycin also warn of reports regarding QT interval prolongation. Labels of other macrolides will also be reviewed by the agency.

Officials at the FDA said that the agency would update the public regarding azithromycin and the potential risk for QT interval prolongation after it has reviewed the NEJM study. Patients taking azithromycin are advised by the FDA not to stop taking it without first consulting a clinician.

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COMPETENCY-BASED TRAINING IN INTENSIVE CARE MEDICINE:

Creating the New Intensive Care Specialist

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The Competency-Based Training in Intensive Care Medicine in Europe (CoBaTrICE) collaboration was established in 2003 with a grant from the European Union's Leonardo Programme, and endorsement from the European Society of Intensive Care Medicine and the national training organisations (NTO) of 42 countries, including all those of the EU. The aim was ambitious: to develop an international competency-based training programme in intensive care medicine, which was compatible with very diverse national training programmes, but which resulted in a harmonised, quality-assured product—the intensive care specialist. The founding principle was to define a specialist in intensive care medicine (ICM) in terms of the knowledge, skills, behaviours and attitudes required to become an expert in the highly complex task of caring for critically ill patients and their families. The following article provides an overview of the steps taken by the authors to create what is today a successful and inspirational educational programme.

The first step in developing this ambitious programme was to convince individual practitioners and their NTOs that a harmonised international training programme was both desirable and necessary. We did this by surveying the current state of ICM training worldwide (Barrett and Bion 2005), and found very large, and probably undesirable, differences in the structures, content, processes and outcomes of training, to the extent that it was difficult to believe that these programmes could produce intensive care specialists of a common and high standard. Armed with this information, it became easier to convince colleagues of the need for change.

The Leonardo Programme grant allowed us to build a worldwide collaboration, based first on the European Region, with 28 national coordinators and deputies representing the diverse national training programmes. Countries from other world regions—North and South America, the Middle East, Asia and the Far East—also joined this enterprise, via representatives who were either supported by their NTOs or who were self-funding. We held biannual meetings that were linked to the major European intensive care congresses, and managed most of the work through electronic means of communication, and a website (www.cobatrice.org).

> *"We also want to develop the CoBaTrICE collaboration as a platform for pedagogic research and quality improvement that links clinical research, best practice, and implementation science."*

Stakeholder Involvement

We started the core part of our work by accessing the expertise of front-line clinicians and other relevant stakeholders, inviting them to submit up to 10 competencies that they considered a specialist in intensive care medicine should have acquired by the end of training. We did this using a modified web-based Delphi process (The CoBaTrICE collaboration 2006). The first round secured 5,241 suggestions from 536 respondents in 57 countries. Importantly and uniquely, the competencies identified by our respondents referred to attitudes and behaviours as much as to practical task-related skills and procedures, demonstrating the importance that intensive care specialists attach to communication, teamworking, professionalism and leadership. The majority of respondents were intensive care physicians (76 percent specialists, 10 percent trainees), but 8.5 percent were from other disciplines, and three percent were nurses.

We also undertook a parallel survey of patients and families from 70 ICUs in eight European countries (working in collaboration

with the Picker Institute), and this generated 1,398 responses (The CoBaTrICE collaboration 2007). We brought these two sets of informed opinion together and, using a structured editing process, reduced the proposals and suggestions to 164 items. We then submitted these items to a nominal (expert) group (NG) with multidisciplinary representation, and over a two day period this group refined and ranked the content, having first defined the level of expertise at which each competence should be demonstrated (among four levels of expertise from "knowledge of", to "independent practice"). The output from the NG was then presented again to the wider group as the second phase of the Delphi process. This resulted in a final set of 102 competencies in 12 domains, covering all aspects of practice in ICM.

The next step was to link the competencies to underlying factual knowledge—the syllabus. We did this by aggregating the ICM curricula of eight countries, removing redundant material, and then allocating the knowledge elements within each competence and domain. This then brought together the outcomes of training—the competencies—with the underlying knowledge.

Finally, we described the methods of assessment of competence, to provide guidance to colleagues on how to conduct assessments in the workplace, since many national training programmes did not have a tradition of formal assessment. Within this, we included a template for multi-source feedback: a 360 degree appraisal based on those competencies which best reflected attitudes, behaviours and aspects of professionalism.

Development, Harmonisation and Assessment

The second phase of CoBaTrICE was called CoBa-IT; this was the IT component referring to innovation transfer. The aim of phase two was to develop practical tools for implementing training in ICM, focusing on those areas which trainers and training programmes found most challenging. These were the need for internationally harmonised methods for workplace-based assessment of competence, and systems for documentation. With this in mind, we undertook a second survey, this time of structures and processes of training in ICM, which again revealed wide variation in practice and resources (The CoBaTrICE collaboration 2009). We used this to develop a set of standards for training programmes in ICM, using consensus techniques as the method for development. This resulted in 29 internationally agreed programme standards, and a further nine potential standards for future development (The CoBaTrICE collaboration 2011). Finally, we developed an e-portfolio for documentation of acquisition of competence, which also permits electronic communication between trainer and trainee, and linkage of competencies to supporting evidence. The e-portfolio is fully functional and freely available to NTOs, but is still in an early stage of development and requires additional work to adapt it to national needs.

The combined work has resulted in the CoBaTrICE programme, a virtual tool that is freely accessed by any national training programme in ICM, endorsed by 42 NTOs and already adopted by 10 European countries, including France and the UK. The programme has twice been identified as an example of best practice by the European Commission, and the process has been emulated by the USA. In the UK, the competencies have been integrated in the training of advanced critical care practitioners (Department of Health 2008) (nurses and technical grade staff working in intensive care) and in all healthcare staff with responsibilities for acutely ill patients (Department of Health 2009). Links are being developed with undergraduate training as well (Perkins et al. 2005). This is a model of integrated multidisciplinary work in practice.

Nevertheless, this is merely the beginning. The development of competencies is no more than a product specification. We now need to develop quality assurance processes across very different training structures and cultures. We also want to develop the CoBaTrICE collaboration as a platform for pedagogic research and quality improvement that links clinical research, best practice, and implementation science. Achieving this requires a new phase, in which we try to answer the question: "Does better training result in better specialists delivering better care to patients?" This challenging question demands a new model of research, involving human factors and sociology expertise, investigating different models of training, in different locations, over long periods of time. The challenge lies not just in developing new research methodologies but also in engaging research funders, who all too often regard education as a mere add-on to clinical work and who are impatient, expecting results from research funding within a few months. The EU has the opportunity to use international variation in education and training experience to answer important questions relating to patient care, but to do this requires long-term commitment to pedagogic research as a valid and important area of scientific enquiry.

The CoBaTrICE collaboration has been a model of collaborative practice which, through training and education, provides healthcare systems with an opportunity to determine the best approaches for quality assurance and long-term improvements in the care of critically ill patients and their families. Enhancement and harmonisation looks set to continue both via this developing programme and also others that are influenced by it. ■

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OUTCOME-BASED EDUCATION IS THE FUTURE: New European Guidelines for Postgraduate Training in Anaesthesiology, Pain and Intensive Care

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On 20 July, 1958, delegates of the professional organisations representing medical specialists of the six member countries of the very new European Community (EEC) convened in Brussels and created the European Union of Medical Specialists (UEMS), which later came to define the basic principles involved in training the community's medical experts. Over the years, amid developments and the expanding EU, requirements and ideology have evolved to reach an ever more appropriate guideline for education.

The objectives of the European Union of Medical Specialists (UEMS) are, among others:

- The study, promotion and harmonisation of the highest level of training in healthcare, medical practice and medical specialities within the EU; and
- The study and promotion of free movement of specialist doctors within the EU.

To achieve these objectives, the UEMS has set up sections and boards for each medical specialty (UEMS Statutes). Multidisciplinary boards, such as the Multidisciplinary Joint Committee of Intensive Care Medicine (MDJCICM), cover special competence areas that are not covered by a basic specialty.

If you are on the specialist registry in any European country, then you are automatically entitled to be registered as a specialist in the other EU countries. But that does not mean that you are equally fit to practice in every country. If we want to continue having a common market for doctors in Europe, then we must aim for a common setup of postgraduate training, even though each individual country is responsible for its own training and certification.

Some years ago, the duration of specialist training in anaesthesiology varied from three to seven years throughout Europe (Egger-Halbeis et al. 2007). The EU Directive 2005/36/EC on the recognition of professional qualifications requires three years, but this rule was based on information from a time when the specialty was far less complex than today. Concerning intensive care medicine, anaesthesiologists led development in the field from the first stages; yet, the required duration of training in intensive care medicine in anaesthesiology varies between three months and two years throughout the EU.

Since the first postgraduate training guidelines were published by the European Board of Anaesthesiology (EBA) in 2001, the EBA has worked to harmonise training in anaesthesiology, reanimation and intensive care medicine. This guideline described the basic knowledge, skills and methods that a modern practicing specialist in anaesthesiology must possess. It consisted of a list of aims, basic science content, physiology, pharmacology, physics and measurements, and anatomy. There was a core syllabus for anaesthesia, pain management, pre-hospital, emergency and intensive care medicine. The latter was divided into diagnostic and therapeutic problems of the respiratory system, the cardiovascular system, head injury, affection of the central nervous system, multiple organ system failure and communication skills.

A European Hospital Visitation Programme was introduced to ensure the quality of training, while logbooks were recommended as a tool to record the number of procedures undergone.

The minimum duration of training was set to five years, of which a minimum of six months should be spent in intensive care and three months in both pain and emergency medicine.

A Change of Course

In 2005 and 2007, the EU expanded. With several new countries with varying training programmes entering the community, the 2001 guidelines needed revision (Carlsson et al, 2008). The EBA acknowledged that simply listing the duration of time spent in various fields, and doing any procedure a certain number of times, would not ensure a candidate's competency in taking care of patients. Hence, the objectives have now been changed from process-oriented specialisation to outcome-based training. This work led to the announcement of a completely revised set of guidelines and curriculum in 2011: "Anaesthesiology, Pain and Intensive Care Medicine UEMS/EBA Guidelines" (http://www.eba-uems.eu/resources/PDFS/ANAESTHESIOLOGY-PGT-guidelines.pdf), which were detailed in an editorial this year (Van Gessel et al 2012).

The competencies as endpoints of training and the focus of evaluation were described:

- To demonstrate clinical skills in pre-, peri- and postoperative clinical management;

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- To improve familiarity with chronic pain management both in acute and postoperative situations;
- To ensure specialists are able to safely handle critical situations, including resuscitation;
- To ensure provision of general intensive care for adult medical and surgical patients and general paediatric patients;
- To ensure functionality in pre-hospital and emergency medicine;
- To show activity in the development and science of the specialty;
- To demonstrate satisfactory behavioural and professional attitude towards patients and hospital employees at large; and
- To ensure specialists are able to function as role models and teachers for younger colleagues.

The protocol includes an emphasis on progression from easier to more difficult situations, on the use of mentors and simulators, and on evaluation of each trainee at regular intervals.

Following the outline of broad competencies in these guidelines, the EBA decided to develop much more specific tools to facilitate the setting up of training programmes in each individual nation.

There are several similar models available in the world, but the EBA decided on the CanMEDS framework, from the Royal College of Physicians and Surgeons of Canada, for doctors' roles when it developed a programme, for all aspects of anaesthesiology (Figure 1). The CanMEDS framework describes six roles of a doctor - professional, communicator, collaborator, manager, health advocate and scholar - coming together to form the seventh: the medical expert. Each of the roles was descried in more detail, with special attention placed on the anaesthesiologist.

Another important inspiration was the Competency-Based Training in Intensive Care Medicine in Europe (CoBaTrICE) collaboration. This was the first example, and an excellent one, of competencies being defined in an effort to harmonise training throughout Europe. Pursuing a similar note, the EBA training programme aims to educate a primary specialist in anaesthesiology, who can then undergo further training in an area requiring particular qualifications, one of which is intensive care medicine. The EBA defined the programme's domains of general core competencies, in addition to more specific core competencies.

Figure 1: The CanMEDS Physician Competency Framework

The 10 domains of general core competencies identified are:

1.1 Disease management, patient assessment and preparation;
1.2 Intraoperative patient care and anaesthetic techniques;
1.3 Postoperative patient care and acute pain management;
1.4 Emergency medicine: management of critical conditions, including trauma, and initial burn management;
1.5 Medical and perioperative care of critically ill patients / multidisciplinary intensive care medicine;
1.6 Practical anaesthetic procedures, invasive and imaging techniques, as well as regional blocks;
1.7 Quality, safety, management and health economics;
1.8 Anaesthesia: non-technical skills;
1.9 Professionalism and ethics; and
1.10 Education, self-directed learning and research.

The 7 domains of specific core competencies identified are:

2.1 Obstetric anaesthesiology;
2.2 Airway management and surgery;
2.3 Thoracic and cardiovascular anaesthesiology;
2.4 Neuroanaesthesiology;
2.5 Paediatric anaesthesiology;
2.6 Anaesthesiology in remote locations / ambulatory anaesthesiology; and
2.7 Multidisciplinary pain management.

Both general and specific core competencies in each domain were expressed in a list of competence statements. These were compiled using Miller's pyramid of competence (Miller, 2001) as a model, starting from A at the bottom of the prism (those who have knowledge and describe) to D at the top (those who teach or supervise others).

For each domain of expertise, EBA developed a detailed list of learning objectives, which have been listed in the syllabus (http://www.eba-uems.eu/resources/PDFS/Anaesthesiology-syllabus.pdf). The learning objectives were broken down into knowledge, skills and attitudes that are necessary to achieve the competences. Hence, this approach still requires that the learner knows his/her basic sciences, as this knowledge is a prerequisite to obtaining the competences.

The shift of mind-set with the new guideline also extends to the stage of evaluation of progress and outcomes from training (Van Gessel et al. 2010). EBA recommends repeated assessment throughout the training period, with methods including:

- Formative in-training evaluations, including case-based discussions, peer assessment and direct observation –intended to give feedback and monitor progress;
- Self-assessment tools, including portfolios and logbooks;
- A credit point system–with points following courses, e-learning and other training approaches; and
- Summative evaluations and examinations – eg. the European Diploma of Anaesthesiology (which includes intensive care medicine).

In the opinion of the EBA, these guidelines should apply to any curriculum:

1. Clinical competencies should be clearly stated in the curriculum (learning objectives and outcomes);
2. Clinical competencies should be realistic and measurable, and thus be assessed;
3. Multiple evaluation tools should be considered to assess different aspects of competence and performance;
4. Evaluation tools should be used frequently;

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NEW ESICM EDUCATIONAL ACTIVITIES - MADE IN CHINA

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European Society of Intensive Care Medicine (ESICM) has for decades engaged in education and training as one of its core activities. Through the Division of Professional development (DPD) it now runs the European Diploma of Intensive Care (EDIC) exam; the distant e-learning tool, PACT; and the Competence Based Training in Intensive Care in Europe (CoBaTrICE) programme. Intensive care training courses are the latest addition to this portfolio. For some years now it has been a wish from individual members, as well as from national societies, for ESICM to run educational courses. This is a short overview of ESICM's latest educational activities, which aim to instruct budding intensivists from across the social and geographical spectrum.

Introduction Course: BASIC

In providing a course for inexperienced ICU trainees (very early on in their career), we have chosen not to re-invent the wheel. An introduction course—Basic Assessment and Support in Intensive Care (BASIC)—has already been developed in Hong Kong, and has rapidly spread across Asia as well as to Australia, New Zealand and the UK. The course was developed in 2004, and since being refined it has become labelled a robust introduction programme. Attendance on the course is free of charge to its developers, as it was a wish that the course be available as cheaply as possible. Following collaboration between ESICM and the Chinese University of Hong Kong, this course is now offered to national intensive care societies across Europe. ESICM is currently active in educating course instructors, with trainers so far having been educated in the UK, Ireland, Iceland, Norway, Switzerland, Romania, Greece, Portugal and Serbia, with more planned to follow this and next year.

The course is held over two days, typically including 25-30 participants and four to five instructors. Prior to beginning lessons, participants have to read a specifically written course manual and answer a pre-course multiple choice question (MCQ) test. There is also additional electronic educational material on the web, on the Modular Object-Oriented Dynamic Learning Environment (Moodle) platform. The course alternates between short plenary lectures in core topics (also available as chapters in the book that is provided) and group work, with group work being either case based discussion or hands-on training. The course ends with a post-course MCQ test, which has to be completed in order for a certificate to be awarded.

So far, the course has received very good feedback from participants as well as from instructor candidates in Europe. In developing the programme, ESICM hopes that each country will find a use for BASIC in educating intensivists. In Norway, where intensive care is based on anaesthesiology, it has been decided to introduce this course as an obligatory element early on in anaesthesiology training.

Advanced Training Courses in Intensive Care (ATCIC)

ESICM also aims to offer a series of more advanced training courses in intensive care. The target group for this are ICU trainees who are working towards finalisation of the national training programme, but it will also probably be a refresher course for other intensivists. The course concept is the same as that of BASIC. It will be a very standardised course based on a well written, well illustrated textbook of approximately 100-150 pages. Fixed power-point slide sets in core topics that coincide with the book will be delivered either on site during the course or via e-learning, with recorded lectures. Trainees will be given a pre-course online MCQ test as well as a post-course closed MCQ test and, as in the BASIC course, a lot of time is offered on group based case discussions and relevant hands-on training. At present, courses are delivered through the BASIC group in Hong Kong and through ESICM, which collaborate for their development. So far, five courses have been created, and all have been tested at least once:

- Mechanical Ventilation, beyond BASIC (developed in Hong Kong);
- Critical Care Nephrology (joint venture of ESICM and BASIC group);
- ICU Management (ESICM);

> *"ESICM's intention continues to be to deliver advanced training courses as cheaply as possible, so that as many participants as possible, particularly those in less developed areas of Europe and the world, are able to take part."*

- Haemodynamic Monitoring and Management (ESICM);
- Bronchoscopy (ESICM).

All courses, with the exception of the Bronchoscopy course, have been developed along with a comprehensive course manual, slide sets, skill stations and MCQs. This year, advanced training courses have been held in Hungary (Mechanical Ventilation), in Portugal (Bronchoscopy) and in Bern (ICU Management, and Haemodynamic Monitoring and Management). In the next phase, it is important that enough instructors are educated so that the request for courses can be met.

There are plans for several new courses, and with one expected to be ready by the end of 2012. Ultimately, ESICM's aim is to have eight to 10 different advanced training courses. All of these will be developed using the abovementioned framework, which will hopefully ease their dissemination across Europe. Of course, larger countries with well developed training programmes in intensive care may not see a pressing need for these courses, but certainly a lot of smaller nations and countries with poorly developed curriculums for intensivists could profit highly from such courses. Ultimately they will increase the quality of care provided to the critically ill patient.

Valuable hands-on training and discussion workshops provided to students on one of the new courses delivered by ESICM

Trainees gather at a skill station to gain practical experience in the ICU as part of an ESICM-delivered course.

ESICM's intention continues to be to deliver advanced training courses as cheaply as possible, so that as many participants as possible, particularly those in less developed areas of Europe and the world, are able to take part. Both the course fee and the cost of teaching material will be kept low, just covering necessary direct costs.

ESICM aims to update its web-pages to provide more information about education courses throughout Europe, and to make it easier to plan attendance for those who want to enrol on a course. National societies in Europe that are interested in getting involved should contact ESICM headquarters or DPD. ■

For more details on courses, and for contact details, please visit **www.esicm.org**.

ASSISTING ICU TRAINING MANAGEMENT WITH VIRTUAL WORLDS

Resource Difficulties in ICU Education

Conventional training methods for nurses involve many physical factors that place limits on potential class size (Sorce, Simone, and Madden 2010). Alternate training methods with lower physical requirements may support larger class sizes but, given the tactile quality of nurse training, are most appropriately applied to supplement conventional methods. Where the importance of physical factors is periphery, such alternate training methods can provide an important way of increasing class-size limits and therefore the rate of trained nurses entering the important field of critical care.

A major issue regarding ICU training is that the trainee can be released into a real-life intensive care scenario with sub-optimal preparation, ensuing anxiety, and some risk for management level nurses and for patient safety. This lack of preparation places a strain on the allocation of human and non-human resources to training, as students require greater levels of supervision. Such issues are a concern to ICU management, as they relate to nursing skill development and patient health outcomes. Nursing training is potentially dangerous for patients who are placed in the care of inexperienced staff (Morrison et al. 2001).

> *"Technology is now mature enough to provide cost-effective solutions."*

Virtual Worlds as a Training Resource Solution

Nurse training in computer-simulated virtual worlds has been considered a cost-effective complement to conventional nurse training, given that computing and network resources may be the only limiting factor to class sizes in such environments (Brown et al. 2012). What remains to be seen is whether these virtual world tools are as successful as physical-based simulations that are presently used in nurse training. While this question has not been answered definitively, early results are positive with regard to the training effects of virtual worlds on healthcare (Jarvis and Freitas 2009).

Interactive computer simulations can be used to augment resource intensive education and training that is expensive, repetitive in context and potentially dangerous when an insufficiently prepared student is deployed in a real-life environment. Critical care training also involves education on social situations, such as the development of specialised communication skills, which is not intrinsically dependent on actual physical resources. Training in these cases may have more cost-effective solutions in virtual worlds, assuming tactile simulation is not critical to that specific training scenario. Furthermore, such simulation technology frees up physical teaching resources (such as training manikins) by offering flexible, remote networked training solutions to critical care trainers and students alike.

The Case for Efficacy of Virtual World Training

Five virtual world educational capabilities have been identified that guide future research and development in the educational use of virtual worlds (Dalgarno 2010). These identified capabilities include:

- Facilitation of tasks that lead to enhanced spatial knowledge representation;
- Provision of greater opportunities for experiential learning;
- Increasing student motivation and engagement;
- Improving contextualisation of learning; and
- Provision of richer, more effective collaborative training.

These features align strongly with pedagogical requirements in critical care training, including making meaningful associations between patient and staff interactions to improve standards, safety and work flow in the busy and complex environment that is the ICU. Key requirements in ICU education, such as student engagement and encouragement of reflective learning, potentially match well with the capabilities of virtual worlds (Boulos, Hetherington and Wheeler 2007). Initial quantitative results show the superior capabilities of such virtual worlds in knowledge transfer in health training scenarios (Jarvis and Freitas 2009), or at least that they are equal to present physical methods (Dev et al. 2007). These results also cover teamwork collaboration scenarios, with positive results recorded for the training effect and subjective sense

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of teamwork and collaboration (Le Roy et al. 2008), which are key to critical care training and daily work.

Prototype ICU Handover Training Environment

The authors of this paper form part of a team that have developed a prototype ICU handover training environment in a socially interactive virtual world. Nurses in training can connect to this environment remotely via the Internet and engage in collaborative handover training classes. Communication logs, real-time monitoring and interactivity through the environment provide educators with scope to virtually assess and mentor their students.

In this prototype study, the nursing handover is an activity requiring nurses for the shift to attend a meeting room and listen to a brief overview of the ICU and all the patients admitted. Key areas covered for each patient are diagnosis, current treatments used and any social or family issue of importance. This is followed by the allocation of an individual nurse to each patient, recognising different levels of acuity required with the patients and different levels of knowledge, experience and skills possessed by each nurse. Providing a match of the most appropriate nurse to care for each patient in specific shifts is an important factor in ICU management. Nurses then leave this room and walk to the bedside or patient area allocated to them to gain a more comprehensive handover of the patient, which includes a series of cross checks with life support equipment in use, drug administration schedules, note taking, ongoing treatments and care requirements. This prototype provides a simple but compelling scenario for students to practice with other students, in their own time, before they have to function in the real world. The research project is progressing through an evaluation stage at Austin Health, Melbourne, Australia, with promising initial results.

Figure 1: Example image from the prototype showing two trainees performing a handover simulation at an ICU bay.

Conclusions, ICU Management Implications and Future Directions

Evidence from the literature indicates that virtual worlds should meet a number of key requirements in order to be appropriate for modern forms of education in intensive care nursing. Implications for training management in ICUs are many; technology is now mature enough to provide cost effective solutions. This study uses free Open Source software, and the only costs for development were for labour by digital content creators. The simulator can be hosted on the Internet as a "Cloud" solution, freeing up scheduling constraints, and releasing physical training room resources for other more advanced teaching classes. The solution is also very scalable, as multiple copies of the simulator can be cheaply created online, and may be offered as an online service to major healthcare providers.

Many new directions can also be investigated for such simulation technology. In particular, implementations on mobile devices can facilitate ad hoc social collaboration, to form even more flexible and immersive learning options, which are contemporary for the mindsets and behaviours of current and future students. ■

> *"Key requirements in ICU education, such as student engagement and encouragement of reflective learning, potentially match well with the capabilities of virtual worlds" (Boulos, Hetherington and Wheeler 2007)*

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CULTURE, STRUCTURE AND EDUCATION TO IMPROVE PATIENT SAFETY IN CRITICAL CARE

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Despite the ever-increasing evidence base suggesting that interventions enhance the quality and safety of healthcare, a large gap remains between the existing evidence and the actual implementation of these interventions in day-to-day critical care practice. This gap undoubtedly impacts on patient safety and quality of care. This article provides the most elementary basics for enhancing successful implementation of quality improvement interventions.

Background

The nature of patient safety and quality problems within hospitals is very broad (Pronovost et al. 2009). In particular, the critical care department is one of the most complex environments in a hospital. This is related to the continuous challenge of balancing the maintenance of a high-tech setting and supply of competent staff to operate the advanced equipment, with the continual provision of high-quality care to patients. Meeting the needs of all staff members working in a very stressful environment is also a key component of the balancing act. While other hospital units may need to manage one or two challenges at a time, critical care departments have to manage them all simultaneously while remaining focused on the delivery of safe patient care (Vandijck and Annemans 2010). Regarding patient safety, relevant issues range from improving interdisciplinary communication and teamwork to increasing highly technical skills. However, when thinking about quality and safety, one of the most important issues is to ensure that patients receive the recommended care based on the highest available evidence. The top requirements for high-quality and safe care are appropriate education and implementation of evidence-based measures for ensuring and/or improving quality and safety in the healthcare organisation.

> *"The top requirements for high-quality and safe care are appropriate education and implementation of evidence-based measures for ensuring and/or improving quality and safety in the healthcare organisation."*

Several important factors play a role in fostering patient safety in critical care. They are briefly discussed in this paper. Strategies to improve or maintain patient safety in critical care are:

1. Creating a culture that supports and promotes safety measures;
2. Operating a critical care structure in which the care of severely ill patients is directed and managed by professionals who are specialised in critical care;
3. Ensuring that the work environment can support professionals in interacting productively, making vital decisions, performing medical interventions safely; and
4. Ensuring staff competency in operating medical equipment safely.

Patient Harm in Critical Care

How does critical care perform with respect to quality and safety issues? Critical care patients are at increased risk for complications given the severity of their underlying medical conditions, the complex and invasive nature of treatments and procedures, and the use of drugs and highly expensive technology that carry risks as well as benefits. Adverse events (AEs) on critical care units are unfortunately common, multifactorial, serious and often preventable (Forster et al.

2008). One of the most striking, and at the same time instructive, studies ever performed is the Critical Care Safety Study (Rothschild et al. 2005). This study found that 20 percent of patients in critical care suffered an AE, of which half were considered preventable. But critical care units are also confronted with patients who have undergone preventable AEs in other hospitals units (Vlayen et al 2012).

How to Start from Zero

Any critical care patient safety improvement process must start by engaging hospital leadership. This means that risk managers, patient safety officers, and critical care nurses/physicians should work together to make a "business case" for patient safety investments, to be communicated to the hospital executives (Vandijck et al. 2009). In developing such a case, there is an important role for clinical leadership in building a stimulating patient safety culture (Hellings et al. 2010). Once leadership support is obtained, the implementation of critical care safety becomes a team effort, supported at all levels. There must be a clearly articulated plan for improvement, developed with input and involvement from frontline professionals, that is understood by all managers, physicians, and staff members. Identifying a specific group of individuals responsible for initiating, coordinating, monitoring, and communicating safety measures is a key and primary step in the process. Whether the group is an existing patient safety committee, a newly formed task force, or some other combination of individuals depends on the hospitals structure, knowledge base, and resources. The group can expect to be involved in education and training, translating evidence to bedside practice, communication, and baseline data gathering, which should include a safety assessment of the critical care departments.

In order to change practice and improve utilisation of evidence-based care, it is key to identify which interventions have the largest potential in terms of patient outcome. At the same time, it is important to be aware of the unique barriers to implementation in your own setting (Needham

> *"Identifying a specific group of individuals responsible for initiating, coordinating, monitoring, and communicating safety measures is a key and primary step in the process."*

EXAMPLE OF A QUALITY IMPROVEMENT MEASURE IN CRITICAL CARE:
Prevention of Line-Associated Sepsis

A study by Berenholtz and colleagues exemplifies safety, quality, and knowledge translation issues in critical care. It is an outstanding example of the successful implementation of a quality improvement measure (Berenholtz et al. 2004). Researchers focused on the prevention of line-associated sepsis, being one of the most important but preventable critical care acquired infections. The study aimed to determine whether a multifaceted intervention would eliminate line-associated sepsis in the ICU at Johns Hopkins Hospital, and to evaluate guideline adherence. A quality improvement team implemented five interventions respectively over a two year period. Firstly, staff were educated to review the guidelines to be followed at the time of catheter insertion and for catheter care, and to focus on this particular problem in their unit. Secondly, a dedicated "catheter cart" containing all equipment necessary for catheter insertion was assembled, with the hypothesis that adherence would improve by avoiding unnecessary searching for material. Thirdly, for every catheter in each patient, critical care nurses had to check daily with the physician whether the catheter was still needed for medical management, in order to stimulate prompt removal of obsolete catheters. Two additional interventions consisted of introducing a checklist to be completed by the bedside nurse during placement, and staff empowerment. The investigators found a significant increase in guideline adherence after implementation of the measures, and line-associated sepsis rates were almost eliminated in the unit (respectively from 11.3 to 0.0/1,000 catheter days, P <0.01). Moreover, this benefit could be sustained in the period following the intervention.

2010). There are many barriers that may undermine the implementation of evidence-based recommendations, such as lack of awareness and familiarity with guidelines, staff attitudes, lack of agreement with the guideline and self-efficacy. Therefore, when aiming to enhance the likelihood of successful guideline implementation, there are several key issues to consider (Vandijck et al. 2009; Cabana et al 1999; Labeau et al. 2008).

Firstly, when introducing a new quality measure, keep in mind that people are conservative in work management and habits; therefore, it is crucial to adequately inform all staff who will have to deal with the new protocol/procedure, in particular about the expected consequences regarding organisation and patient care. If necessary, educational sessions should be conducted repeatedly (Labeau et al. 2008). In other words, staff need to be informed about and understand the reasons for change, but must also be stimulated to play an active role in it. The favourable impact of a quality improvement measure will increase if the underlying principles are better understood, although knowledge alone does not ensure adherence. Embedding the new requirements will be supported by a stimulating patient safety culture (Huang et al. 2010).

Secondly, when developing a new initiative to improve delivery of safe patient care, simple, low cost and less complex interventions should be preferred to highly complicated and expensive measures. It should be avoided to impact thoroughly on someone's autonomy. Staff should be allowed, and even be prompted, to use their professional judgment and expertise in a model of participative decision-making. Accordingly, colleagues (even of different disciplines) should be authorised, and even empowered, to interrupt care procedures in cases where violation against the recommendations is noticed. This empowerment is not intended to undermine colleagues' (eg. physicians) authority, but, on the contrary, to stimulate collaboration and discussion between disciplines and, most importantly, to improve quality of care and thus patient safety. Similarly, implementation of a quality measure will require a multidisciplinary approach, and an atmosphere in which open communication in the team is encouraged. Despite this, the valuable time of staff should not be wasted. If action has a solid basis with clear motivation, staff time spent will not be perceived as futile or irrelevant, and hence the initiative will not be easily abandoned. Another way to increase the likelihood of successful implementation is to keep it simple, as every step in a process induces an incremental risk.

Thirdly, summarising the evidence in a care bundle, if possible, is a next step. The main aim of a bundle approach is to group a limited number of measures with a solid evidence base, in order to further improve patient care and safety. Care bundles comprise the best practice measures that when implemented together will yield better outcomes than when implemented separately. It is important, however, to remember that adherence will also depend on the user-friendliness of the bundle, or of the quality measure.

Finally, understanding measures of performance, by means of well-considered quality indicators, is important for appropriately following up the initiative. Last but not least, hard work, enthusiasm, continuous assessment, and above all, a never ending willingness to closely work together and to never stop learning new skills are key contributing factors to success.

> *"There are many barriers that may undermine the implementation of evidence-based recommendations."*

Conclusion

Getting evidence-based quality improving measures implemented into daily practice is not as simple as often considered, and this clearly affects patient safety and quality of care in all healthcare services, especially within the field of critical care. Having a better insight into some easy and straightforward basics for tackling this hurdle is a first. Then, firm steps towards providing and maintaining a high level of care are crucial, and are an elementary right of each patient. ■

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VACANCIES IN THE MIDDLE EAST

Physicians

Qualifications/Requirements for Consultant Posts:
Board certified in the hospital field with three years' post board hospital experience. Fluent in English.

- Consultant Anaesthesiology
- Consultant Adult Emergency Medicine
- Consultant Cardiology
- Consultant Cardiology Interventional
- Consultant Cardiac Anaesthesia and Critical Care
- Consultant Intensivist
- Consultant Neurology
- Consultant Paediatric Neurology
- Consultant Paediatric Pulmonology
- Consultant Paediatric Cardiology
- Consultant Paediatric Cardiology Interventional
- Consultant Paediatric ER
- Consultant Paediatric Cardiac Surgery
- Consultant Pulmonary
- Consultant Radiology
- Consultant Thoracic Surgeon

Benefits

- Salary paid tax free
- Salaries from 9,000 to 20,000 euros (dependent on CV) with a lot of opportunities for very well paid extra shifts and overtime
- Severance pay
- Free furnished accommodation with free recreation, sports and cultural facilities
- Free transportation service
- Up to 7,5 weeks paid annual leave per contract year
- Up to two return airline tickets per contract year (including agreed dependents)
- Free medical care & emergency dental care (including agreed dependents)
- Educational allowance per child (Maximum of three children, four -18 years old)
- Study leave of 10 working days per contract year and CPD courses

Nurses

UNIT MANAGER IN NURSING

Qualifications/Requirements:
Minimum of four years' practice in a nursing managerial position or a Charge Nurse in a hospital with a bed capacity of more than 100. Minimum of eight years nursing experience. Fluent in English.

NURSING SERVICE MANAGER

Qualifications/Requirements:
Minimum of two years' practice in a managerial nursing position or or as a Charge Nurse in a hospital with a bed capacity of more than 100. Minimum of five years' nursing experience.

HEAD NURSE

Qualifications/Requirements:
Minimum of three years' practice as Head Nurse in one of the areas mentioned below, in a hospital with a bed capacity of over 100. Fluent in English.

- Head Nurse OR/RR
- Head Nurse Surgical Ward
- Head Nurse Medical Ward
- Head Nurse ICU
- Head Nurse NICU
- Head Nurse ER
- Head Nurse Infection Control
- Head Nurse Nursing Education
- Head Nurse Cardiac Ward
- Head Nurse CCU Benefits

Benefits

- Salary paid tax free
- Salaries from 4,000 to 6,000 euros (depends on the CV) with a lot of opportunities for very well paid extra shifts and overtimes
- Severance pay
- Free furnished accommodation with free recreation, sports and cultural facilities
- Free transportation service
- Up to 7,5 weeks paid annual leave per contract year
- Up to two return airline tickets per contract year (including agreed dependents)
- Free medical care & emergency dental care (including agreed dependents)
- Educational Allowance per child (Maximum of three children, four -18 years old)
- Study Leave of 10 working days per contract year and CPD courses

CHARGE NURSE

Qualifications/Requirements:
Minimum of three years' practice as Head Nurse in the areas below, in a hospital with a bed capacity of more than 100. Fluent in English.

- Charge Nurse Emergency
- Charge Nurse Surgical ward
- Charge Nurse Cardiac Ward
- Charge Nurse Medical Ward
- Charge Nurse Paediatric Ward
- Charge Nurse ICU
- Charge Nurse NICU
- Charge Nurse CCU
- Charge Nurse OR
- Charge Nurse Cardiology
- Charge Nurse Internal Medicine

STAFF NURSE

Qualifications/Requirements:
Minimum of two years' practice as a registered nurse in a hospital with a bed capacity of more than 100. Fluent in English.

ALL AREAS OF NURSING

Benefits

- Salary paid tax free
- Salaries from 3,000 to 4,500 euros (dependent on CV), with a lot of opportunities for very well paid extra shifts and overtime
- Free furnished accommodation with free recreation, sports and cultural facilities
- Free transportation service
- Up to six weeks paid annual leave per contract year
- Up to two return airline tickets per contract year
- Free medical care & emergency dental care
- Study leave of 10 working days per contract year and CPD courses

Paramedical professionals

Qualifications/Requirements:
Minimum of two years' practice as a registered paramedic in one of the following areas, in a hospital with a bed capacity of more than 200, or in an out-patient clinic:

- Catheterisation Laboratory Technician
- Catheterisation Laboratory Radiographer
- Cardiovascular Technologist
- Clinical Engineer
- Computed Tomography Technologist
- Clinical Pharmacy Specialist
- Clinical Pharmacist
- Coordinator Infection Control
- Emergency Medical Services Educator
- Infection Control Practitioner
- Laboratory Technologist
- Medical Technologist
- Paramedic Team Leader
- Physiotherapist
- Radiology Technologist
- Respiratory Therapist
- Special Procedure Technologist
- Transplant Coordinator
- Tumor Registry Technician
- Ultrasound Technologist

Benefits

- Salary paid tax free
- Salaries from 3,000 to 4,500 euros (dependent on CV) with a lot of opportunities for very well paid extra shifts and overtime
- Free furnished accommodation with free recreation, sports and cultural facilities
- Free transportation service
- Up to six weeks paid annual leave per contract year
- Up to one return airline ticket per contract year
- Free medical care & emergency dental care
- Study leave of ten working days per contract year and CPD courses

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Qualifications/Requirements:

Minimum of two years' practice as Head Nurse in one of the following areas, in a hospital with a bed capacity of more than 100.

- Head Nurse OR/RR
- Head Nurse Surgical Ward
- Head Nurse Medical Ward
- Head Nurse ICU
- Head Nurse NICU
- Head Nurse ER
- Head Nurse Infection Control
- Head Nurse Nursing Education
- Head Nurse Cardiac Ward
- Head Nurse CCU

Benefits

- Salaries from 3.200 (depends on the CV* and the position).
- Up to four weeks paid annual leave per contract year
- Educational leave
- Medical insurance (including agreed dependents)

CHARGE NURSE

Qualifications/Requirements:

Minimum of two years' practice as Head Nurse in one of the following areas, in a hospital with a bed capacity of more than 100. German language (B2 - Mittelstufe).

- Charge Nurse Emergency
- Charge Nurse Surgical ward
- Charge Nurse Cardiac Ward
- Charge Nurse Medical Ward
- Charge Nurse Pediatric Ward
- Charge Nurse ICU
- Charge Nurse NICU
- Charge Nurse CCU
- Charge Nurse OR
- Charge Nurse Cardiology
- Charge Nurse Internal Medicine

STAFF NURSE

Qualifications/Requirements:

Minimum of two years' practice as a registered nurse in a hospital with a bed capacity of more than 100.

- All areas of nursing

Benefits

- Salaries from 2.300 euros (depends on the CV* and the position).
- Up to four weeks paid annual leave per contract year
- Educational leave
- Medical insurance

* depending on degrees, certifications and years of experience

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ADMINISTERING ENTERAL NUTRITION IN THE CRITICALLY ILL

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Metabolic nutritional support is a cornerstone in the management of seriously ill patients. Election of the route of nutritional administration – parenteral nutrition (PN), enteral nutrition (EN) or mixed – depends on the condition and integrity of the digestive tract as well as the diagnosis and condition of the patient.

If the gastrointestinal tract is functional and the haemodynamic status of the patient is adequate, EN must be the first choice in the nutritional therapy of seriously ill patients. Many benefits have been proposed to justify the administration of enteral nutrients as quickly as possible (Table 1), although based on international practice guidelines, there are considerations to be taken for the implementation of early EN (in the first 24 - 48 hours).

Table 1:

Advantages of Enteral Nutrition
1 Improves and maintains the immune function
2 Improves nitrogen balance
3 Improves wound healing
4 Improves protein synthesis
5 Increases intracellular antioxidant system
6 Decreases the hypermetabolic response to tissue injury
7 Preserves the integrity of the intestinal mucosa
8 Preserves the integrity of the intestinal barrier
9 Prevents bacterial translocation
10 Decreases infections, hospital stay and mortality

The critically ill patient is in a constant hypermetabolic state, resulting in an impending loss of protein and quickly occurring protein malnutrition, which is why the administration of exogenous nutrients in the early hours is critical to preventing the loss of visceral structure, protein reserves and circulating proteins.

With the rate of malnutrition in these patients based on protein, we must consider alterations in metabolism that are caused by other macronutrients – lipid and carbohydrate – so that we can carefully calculate their required administration. In this way, we can avoid side effects and minimise the risk of metabolic complications that are most common with this type of support.

Early EN is Not Always the Best Choice

Despite numerous proposed benefits of early EN, contraindications to enterally administered nutrients exist, which are divided into absolute and relative. Absolute contraindications are usually mechanistic. Within these are persistent ileus, intestinal obstruction, peritonitis, massive gastrointestinal haemorrhage, splanchnic hypoperfusion and high-output fistulae. Among the relative contraindications are intolerance of enteral route intestinal resection, moderate-output fistulae, pancreatitis, and inflammatory bowel disease. A recent anastomosis is not considered as a contraindication to initiation of the enteral route.

Table 2:

Indications for Early Enteral Nutrition Administration
Severe head trauma (Glasgow ‹ 8)
Major chest trauma
Major abdominal trauma (abdominal trauma index › 18)
Major gastrointestinal surgery in which oral initial plan is no more than five days.
Burn of second or third grade › 20 percent
Chronically malnourished patients with anticipated absence of oral intake › five days
Patients ‹ 80 percent ideal weight
Cryonics history of poor intake
Pulmonary disease (COPD with bronchodilators)
Liver disease (bilirubin › 2.5 dl, history of cirrhosis or encephalopathy)
Renal Disease (chronic dialysis or renal transplantation)
Cancer chemotherapy
AIDS

Enteral Nutrition Protocol

A protocol should be followed to consider the best possible nutritional route for a patient, taking numerous factors into consideration. Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient (Society of Critical Care

Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN) 2009) provides suggestions for a broad range of scenarios, with recommendations graded from A to E, depending on the level of evidence available. The flow diagram in Figure 1 presents a simplified version of the guidelines, which aims to further facilitate the decision-making process. The protocol provides an effective strategy for maximising the benefits and minimising the risks of enteral nutrition in critically ill patients, and automating its provision, with recommendations; although it should be considered that studies are continually being completed and recommendations are evolving. ■

Table 3:

Barriers to Enteral Nutrition
1 Haemodynamic instability
2 Gut dysfunction
3 Gastric Retention
4 Ileus
5 Surgery
6 Tube feeding location
7 Procedures and diagnostic tests in ICU
8 Radiology and laboratory exams
9 Pharmacology gastroparesis
10 The necessity to stop enteral infusion for patient mobilisation

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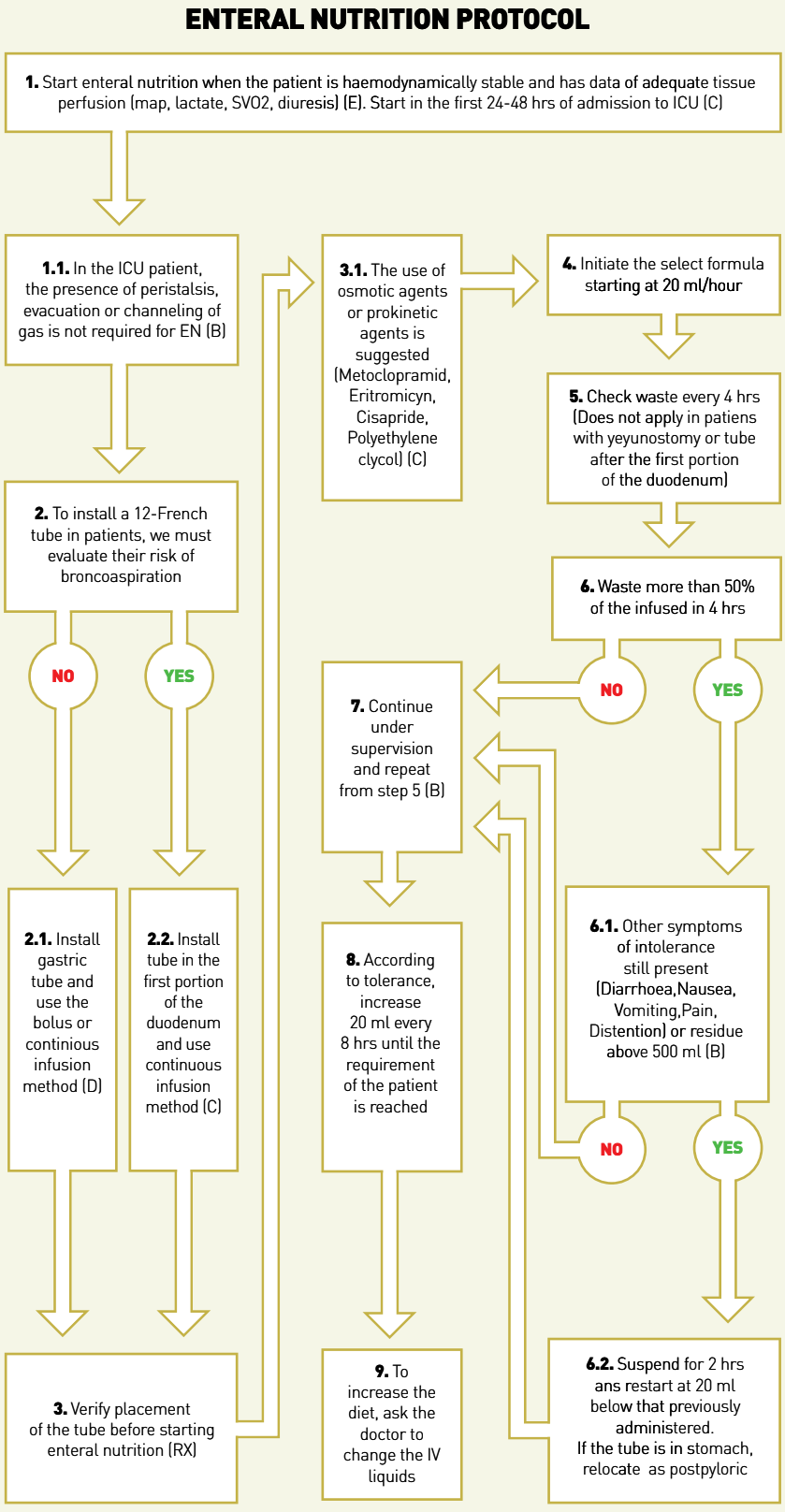
Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN) (2009). Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. JPEN J Enteral Nutr Parente, 33, 277, DOI: 10.1177/0148607109335234

Full clinical nutrition critical care guidelines and further information from ASPEN can be viewed at **www.nutritioncare.org**

For full references, please send a request to **editorial@icu-management.org**

Figure 1:



Information taken from Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN), 2009

IS INDIVIDUALISED NUTRITION THE FUTURE?

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Introduction

Does the caloric intake of critically ill patients make a difference? Ever since initial measurements with indirect calorimetry were made, it has been obvious that predictions from body size end up with some + 30 percent uncertainty with regard to the actual energy expenditure of a patient. Following this realisation, a long line of modified equations has been suggested where, in addition to age, chronic and acute morbidity are considered. Still though, nothing much better than the original Harris-Benedict formula is at hand. An important confounder, and something which is not always sufficiently recognised, is timing in critical illness. In the acute phase, hypermetabolism, if defined as energy expenditure above basal metabolic rate, according to Harris and Benedict, is very rare, whilst it is common in a later more stable phase of critical illness, turning into a recovery phase. There is still more space for exploration of the variables associated with sufficient nutrition.

The Importance of Nutrition

The first step taken by Harris and Benedict in creating their formula was to recognise that massive overfeeding is not a good thing. Still, the study had a poor design where full parenteral nutrition was given in addition to adequate enteral nutrition (Veterans Affairs Total Parenteral Nutrition Cooperative Study Group 1991). Not to be forgotten, however, is that besides recognising the adverse effects of massive overfeeding, the study defined undernourished patients as a subgroup where adequate nutrition most probably made a difference. This finding was more recently reproduced in an observational study, where possible undernutrition was defined as a BMI < 20 (Alberta et al. 2009). However, the timeline of critical illness was not very well defined in this study.

In the acute phase of critical illness there are today a number of studies that indicate that caloric intake does not make a difference, or may even be dangerous. In well nourished patients this is well demonstrated in the recent EDEN study (Rice et al. 2012). Lacking though is a more controversial study that looks at patients who are possibly at nutritional risk. The EPaNIC study has also been critiqued since the majority of patients were not at nutritional risk (Casaer et al. 2011). In this large prospective study with a high inclusion rate, it was quite obviously indicated that in the acute phase of critical illness, full nutrition given as a combination of enteral and parenteral nutrition according to existing caloric recommendations related to body weight give a morbidity disadvantage. Also, in the subgroup where no enteral nutrition was possible to give, those patients randomised to no parenteral nutrition during the initial ICU week had more favorable outcomes. Although the EPaNIC study is criticised for not identifying patients who were at nutritional risk and for overfeeding patients who were not at risk, investigators pointed out that the choice of caloric intake and risk scoring were in accord with the current guidelines (Singer et al. 2009; McClave et al. 2009).

So, is nutritional nihilism the track to follow? Are the risks involved with nutrition outbalancing the possible advantageous effects? It is obvious that this issue has become very emotional and that we really need to settle what evidences there are.

Facts and Confounders

A primary ambiguity is that early enteral nutrition is advocated in critical illness as well as following major surgery (Doig et al. 2009), though most of the documentation behind this recommendation, which is present in all major guidelines, does not consider the nutritional status of the patients. A possible confounder of course, as demonstrated in the EDEN study, is that nutritional intake is not a critical factor in the outcome of the well fed majority of the patients studied. Another possible confounder is the fact that successful enteral nutrition is a favourable prognostic sign. It may be that studies which look at successful early enteral nutrition discriminate patients with good outcomes, rather than that the nutritional support in itself brings a better outcome. All statistical correlations are not causative!

Secondly, the level of caloric intake in itself does not logically cause excess morbidity. In all patients successfully enterally fed, a high caloric intake is associated with a favorable outcome, while the not so

good outcomes seem to be confined to patients given parenteral nutrition in the early phase of critical illness. In the EPaNIC study there was a clear signal: waiting until day eight of ICU stay for supplementary parenteral nutrition was a better option when patients were randomised. The study dichotomised patients to parenteral supplementation on day two or on day eight. But what about day five? We still do not know whether providing parenteral supplementation on an alternative day may be a better choice.

"In summary, adequate nutrition is lifesaving in the ICU as in any other segment of hospital care."

A possible mechanistic explanation of why early parenteral supplementation may be a disadvantage is the hypothesis of an early autophagic phase in critical illness, in which mitochondrial stimulation by feeding may be harmful (Vanhorebeek et al. 2012). This hypothesis is founded on electron microscopy findings, where intracellular vacuoles and swollen mitochondria show up.

Application of Nutritional Support

The old concept that the caloric content of nutrition be dosed according to body weight may need to be reconsidered. The tight calorie control study (TICACOS) investigators indicated in a pilot study that there might even be a survival advantage when caloric intake is given in close accordance with daily measurements of energy expenditure estimated by indirect calorimetry (Singer et al. 2011). In the preliminary results of the SPN study, it was reported that in the 60 percent of patients for whom the caloric intake was derived from measurements with indirect calorimetry, there was a 300 kcal/24 hours (15 percent) difference compared with patients to whom caloric intake was given according to body weight (Heidegger et al. 2011). If considering the EPaNIC study together with these data, one may conclude that overfeeding even marginally (10 - 20 percent) in relation to energy expenditure may be harmful. If so, the use of indirect calorimetry in the ICU should be encouraged.

Historically there have been technical difficulties associated with indirect calorimetry. Although modern instruments are easy to handle and to calibrate, there have been discrepancies in patients on stable mechanical ventilation (Sundstrom et al. 2011). In tertiary ICUs with a relatively high proportion of long-stay patients, and in centres with a high proportion of patients with a high BMI, it must be considered as controversial to abstain from indirect calorimetry to measure energy expenditure. Full indirect calorimetry is recommended since the sole measurement of CO_2 production is associated with placing a need of particularly high competence on evaluating readings in respiratorily unstable patients, in particular as the accuracy of the estimation of energy expenditure may be of greater importance than earlier anticipated.

In summary, adequate nutrition is lifesaving in the ICU as in any other segment of hospital care. Nutrition must be dosed properly, as both underfeeding and overfeeding may be dangerous for patients. Proper dosing is today not possible to define, but it is obvious that it varies between individuals and that it changes over the course of sickness in the individual patient. The best estimation is done by indirect calorimetry, and obtained readings should be interpreted as the maximum dosage. All sources of caloric intake must be considered in the intake calculation when caloric balance is established. During the early phase of acute illness, particular caution not to overfeed the patient should be applied. During this period, supplementary parenteral nutrition should not be practiced. ■

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HEALTH ECONOMIC BENEFITS OF ENTERAL NUTRITION

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Introduction

Enteral nutrition (EN) by tube feeding has been demonstrated to be the prefered feeding method as compared to parenteral nutrition (PN) in patients eligible for EN (Marik and Zaloga, 2004; Simpson and Doig, 2005). In critically ill patients requiring nutrition therapy, the European, Canadian and American guidelines recommend the enteral feeding route (Kreymann et al. 2006, Heyland et al. 2003 and McClave et al. 2009, respectively). Currently, the debate has shift from the best feeding route to the best feeding timing. Although the costs of the PN therapy are well known to exceed those of the EN therapy, no study has emphasized the health economic benefits of enteral nutrition in ICU patients. This article presents a recent publication on the cost-effectiveness analysis of EN in hospitalized patients, and identifies the premises of the health economic benefits of early EN in critically patients.

Enteral nutrition in hospitalized patients: a cost-effective nutritional strategy

In hospitalized patients, a recent meta-analysis (Cangelosi et al., 2011) has analysed the cost-effectiveness of EN as compared with PN. The study included 31 randomized clinical trials (RCT) of patients admitted to hospital either in ICU (trauma, burns, pancreatitis, and head injury) or for planned surgery (gastrointestinal surgery). Compared to PN, EN was demonstrated to have a significant protective effect on major infections (relative risk of 0.58 with 95% Confidence Interval=[0.44, 0.77]), and on major non-infectious complications (RR=0.73; 95%CI=[0.59, 0.91]). The major infections included, among others, pneumonia and sepsis, whereas the major non-infectious complications included fistula, GI anastomostic leak, wound dehiscence. In terms of impact on healthcare resource use, compared to PN, EN decreased significantly the total length of hospital stay by 1.66 days per patient (95%CI=[0.95, 2.37]).

Both the decrease in complications and length of stay will likely produce savings for the hospitals. Cangelosi and co-authors demonstrated that the reduction in major infections led to savings of $1,074 per patient (95%CI=[$199 to $2,587]), furthermore the reduction in major non-infectious complications allowed hospital to save $261 per patient (95%CI=[$34 to $518]). While the cost of PN formula can reach $200 per litre and the EN formula $24 per litre, when considering total hospital cost for patients using either PN or EN, the difference in daily hospital cost was of 10% only. Therefore, the authors used a daily hospitalization cost of $1,490 per day for both groups regardless of the nutrition therapy. Based on this value, and on the decrease in total hospital length of stay of 1.66 days due to EN, hospital can save $2,473 per patient (95%CI=[$1416, $3531]) by switching patients from PN to EN, when medically appropriate. The authors concluded that in 2008, if 10% of the 231,000 American patients hospitalized on PN could have used EN instead, $57 million (95%CI=[$33 to $82 million]) would have been saved annually by American hospitals.

Hence use of EN instead of PN, when medically appropriate, can improve health outcomes of patients as well as reduce the cost to hospitals. The health economic benefits of EN compared to PN go beyond the cost reduction of artificial nutrition.

Estimation of health economic benefits of early enteral nutrition in ICU patients

In intensive care units, enteral nutrition is the recommended feeding method for patients able to tolerate it (European, Canadian and American guidelines). The hazards of PN have been demonstrated to be worse than those of EN, especially on organ failure, infections and complications, mechanical ventilators duration and length of ICU stay (Minard and Kudsk, 1998; Simpson and Doig, 2005). Interestingly in Simpson's 2005 publication, the benefit of EN over PN seemed to be correlated with the timing of enteral feeding. Since then, the debate on artificial nutrition in ICU patients has moved from the best feeding route to the best feeding timing with EN. Recent studies have been shown to improve clinical outcomes with early feeding (Marik et al., 2001; Doig et al, 2009 and 2011). In recent meta-analysis by Doig and co-authors (2009 and 2011) EEN was defined as EN within 24 h of ICU admission or injury. A meta-analysis of 6 RCTs (234 patients) done by Doig and co-authors (2009) demonstrated that EEN significantly reduced the risk of mortality compared to late EN (odds ratio OR=0.34 with 95%CI=[0.14–0.85]) as well as the risk of pneumonia (OR=0.31 with 95%CI=[0.12–0.78]). Despite the few number of ICU studies with EEN defined as within 24h after ICU admission, the reduction in risk of pneumonia can likely lead to economic benefits of EEN for hospitals. In the US, the hospital costs of treating pneumonia were estimated to be $91,292 for hospital-acquired pneumonia (HAP) and $150,841 for ventilator-acquired pneumonia (VAP) (2003 $) by Kollef et al. (2005). Therefore, based on these hospital costs updated in 2012 $ value[1] and the relative risk of pneumonia[2] of 0.51 adapted from Doig et al. (2009), savings for hospital due to the use of EEN might range from $10,693 to $58,343 per patient. Hence, based on these crude estimations, EEN might be cost-saving in addition of being more clinically effective than late EN.

Premise of health economics benefits of enteral nutrition in PICU patients

In paediatric intensive care units (PICU), although EEN has been demonstrated to be well tolerated by paediatric patients (Sillkman and Wischmeyer, 2008), feeding them accurately is more challenging. Incidence of malnutrition in the PICU patients is still high ranging from 25% to 70% (Prieto et al., 2011). Mehta and co-authors (2012) estimated from an international prospective cohort study of 31 PICU (500 patients under mechanical ventilation for more than 48 hours) that 30% of these patients had severe malnutrition on admission. However, only 38% of the prescribed energy and 43% of the prescribed protein were administrated to PICU patients. Chronic underfeeding in PICU patients is mainly due to many EN interruptions which undermined achievement of caloric goal. However most of these EN interruptions are estimated to be avoidable. Mehta and co-authors (2010) found that 30% of PICU patients experienced EN interruptions with 58% of those interruptions deemed as avoidable. The

three leading causes of avoidable EN interruptions were: intubation and extubation of patients (61%), feeding tube issues (75%), and perceived EN intolerance by attending physicians (48%). All of these interruptions increased length of PICU stay with a risk of more PN use, failure to achieve caloric goal or prolonged duration to achieve it. The use of PN was found to be 4-fold higher in patients experiencing EN interruption compared to those not experiencing (Mehta et al., 2010). Consequently if EN feeding in PICU patients could be administrated early whenever possible and avoidable interruption carefully monitored, then healthcare cost might be better controlled and patients' health outcome improved, leading to potential cost-effectiveness.

1. Translation based on an average of the Consumer Price Index for Medical Care (CPIMEDSL) over the first 4 months of 2009 and 2012 of respectively 393 and 410 (Federal Reserve Board, 21.05.2012, http://research.stlouisfed.org/fred2/series/CPIMEDSL/downloaddata?cid=32419). 2. Computation based on the following formulas: RR=R0/R1; R0=1/(a/(a+b)); with RR=relative risk, OR=risk ratio and R0=absolute risk in the control group; R0 computed as a pooled R0=0.561 from Doig et al (2009) data.

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VIDEO LARYNGOSCOPY: NO LONGER JUST FOR DIFFICULT INTUBATIONS

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Introduction

In the US alone, up to 1,000,000 emergent intubations are performed annually in the acute care setting, both in and out of hospital (Weingart et al. 2012; Wang et al. 2011; National Emergency Number Association 2011). Meanwhile, multiple studies have demonstrated varying rates of successful endotracheal intubation (ETI). While anesthesiologists and emergency physicians exhibit ETI success rates in excess of 95 percent in acutely ill and injured patients, paramedics demonstrate ETI success rates as low as 45 percent, highlighting the disparity of skills between care providers. Success rates with emergent ETI do improve with clinical experience, research has shown (Wang et al. 2011; Hubble et al. 2010; Wang et al. 2005; Bushra et al. 2004). It is estimated that 20 clinical ETI attempts may be required to attain a 90 percent success rate; however, clinical opportunities for novice providers to practice procedures in acute medicine are limited (Warner et al. 2010; Tarasi et al. 2011). Since there are a finite number of clinical opportunities for airway management available, we must improve our current educational practices to provide enhanced feedback to the learner and accelerate the ETI learning curve.

Current limitations in training and clinical experience may hinder a novice provider's acquisition of ETI skills and maintenance. ETI is commonly conceptualised as the combination of:

- Movement of the provider's body and patient's head and neck; to
- Achievement of the best possible visualisation of the airway structures for passage of the endotracheal tube.

However, no data describes how gross and fine motions of the airway operator translate to optimal airway visualisation, whether using direct laryngoscopy (DL), video laryngoscopy (VL), or flexible fibreoptics. The inability to visualise the vocal cords during ETI is the most common reason for failed attempts. Current training techniques are often unstructured and have few specific objectives for altering provider kinematics. An improved understanding of the motions involved in ETI and their connection with airway exposure and visualisation could impact airway education practices, thus shedding light on the yet unrecognised actions needed to accomplish ETI and improve patient outcomes. VL is one tool that may help to improve airway education.

Video Laryngoscopy: Where Does it Fit in?

VL is a relatively new technology whereby a micro-video camera is attached to the laryngoscope blade adjacent to the light source, thereby magnifying and improving the angle of view of the glottis. A wide variety of VL devices have entered the market, each with differing angulation, light quality, screen size, magnification power, and ease of recording capability. Depending on the device, the laryngoscope can be used as either a direct laryngoscope where the structures of the airway are directly visualised by the provider, or more commonly as an indirect laryngoscope where the provider visualises the anatomic structures of the airway captured by the camera on a screen, similar to bronchoscopes and endoscopes.

Multiple reviews suggest that VL improves glottic view when compared to direct laryngoscopy (Griesdale 2012). It remains unclear whether improved view is correlated with improved first pass success in a wide variety of arenas where airways are managed (prehospital, emergency departments, operating theatres, inpatient wards, intensive care units), and by novices and expert airway providers in

> *"An improved understanding of the motions involved in ETI and their connection with airway exposure and visualisation could impact airway education practices"*

DL and other airway devices. However, evidence that VL achieves a higher first attempt success rate than DL is accumulating through a wide variety of comparisons (Aziz 2012, Aziz 2011, Sakles 2012). Caution should be exercised in lumping together studies of different devices categorised as video laryngoscopes, as the majority of past studies had different comparator control arms, subjects, airway operators, patient populations, convenience sampling, endpoints, and focused on different areas in acute medicine, which is beyond the scope of this article.

It is evident that video laryngoscopes open the door to

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new teaching modalities regarding airway management in acute or emergent settings. As many of these devices have large external screens, the provider can more easily visualise the airway structures in real-time. These devices also provide the instructor with a matching, or near identical, view of the airway as that seen by the trainee. They, therefore, have the potential to eliminate the "What do you see?" question from the instructor and help to reduce anxiety during the already stressful situation of acute airway management. Video laryngoscopes have different indirect views of the glottis, so a few seconds of setup time is required to turn on the device or recording system. Many of these devices also have the ability to record the ETI attempt for off-line review. These recordings can be used in the classroom setting to offer trainees actual views of airways which present various challenges (blood, vomit, laryngeal mass, and so on). Trainees can then be more prepaired for these cases when they meet them in the clinical realm.

A Teaching Tool with Objective Analysis

Over 100 ETI's performed by flight crews on a single helicopter emergency medical service, using a VL (C-MAC, Karl Storz Corp.), were reviewed. Several variables known to be associated with ETI success (Cormack-Lehane view, Percentage of Glotic Opening (POGO) score) were extracted from videos. VL also allows for assessment of other variables, which were previously unavailable using traditional DL, including the number of forward movements made with the endotracheal tube and various time intervals. Time intervals in this study started when the laryngoscope blade first crossed the lips (time zero), continuing until the vocal cords were first visualised (entry to cord time), the best view of the glottic opening was obtained (entry to POGO time), the endotracheal tube first appeared in view (entry to tube time), and ended at completion of the ETI attempt (attempt time), whether successful (passed through the cords) or unsuccessful, where the blade was withdrawn past the lips.

The Cormack-Lehane view and POGO score predicted ETI success, whilst the number of forward movements of the endotracheal tube did not; neither did the attempt time. Successful and unsuccessful attempt times were similar: 28.4 seconds versus 35.8 seconds (P=0.181); however entry to POGO time (16.6 seconds versus 32.1 seconds) and entry to tube time (17.6 seconds versus 27.4 seconds) were shorter during successful ETI attempts (P=0.113 and P=0.04 respectively).

Table 1. Time Intervals in Successful Video Laryngoscopy

The vocal cords were visualised
The best view of the vocal cords was obtained
The endotracheal tube came into view
The endotracheal tube was passed through the cords

It was also noted that successful attempts followed a characteristic pattern during ETI, which was reflected in the time intervals (Table 1). Further analysis on how to teach and improve upon each of these component steps in VL may shed light on how to improve the overall performance of VL. As with any new motor skill, repetition and deliberate practice of specific steps is necessary, combined with timely feedback, similar to coaching competitive athletes or performers.

Preventing Skill Decrement and Improving Learner Success

Moving into a new era of laryngoscopy, uncertainty exists on whether DL will remain a viable technical skill to maintain. Maintenance of proficiency in airway management encompasses both technical and non-technical (decision-making) skills, which is usually only attained with continuous practice and commitment to improving performance (Baker 2011). Using simulation and VL as teaching tools allow consistency in measurement and assessment of airway manipulation. Teaching DL, on the other hand, remains an important skill to maintain for situations when the technology for VL fails (blood completely obscuring video, fibreoptic malfunction, battery outages).

Video laryngoscopes that allow for teaching and assessment of both DL and VL technical skills will be important, as airway education encompasses teaching for rare events. With the high success rate and increasing adoption of indirect VL, airway educators will need to pay even greater attention to the situations where VL fails. At a time when an increasing number of airway manipulations are performed in very disparate locations by a heterogenous provider mix, routine review of video recordings may provide quality assurance and improvement.

Conclusion

Recorded direct video laryngoscopes provide valuable information to the instructor, not only during the intubation attempt, but also in educating future providers by identifying deficiencies or skills that resulted in unsuccessful or successful attempts. This technology finally allows for objective analysis of a procedural skill and can allow us as educators to provide more effective feedback to our trainees. ■

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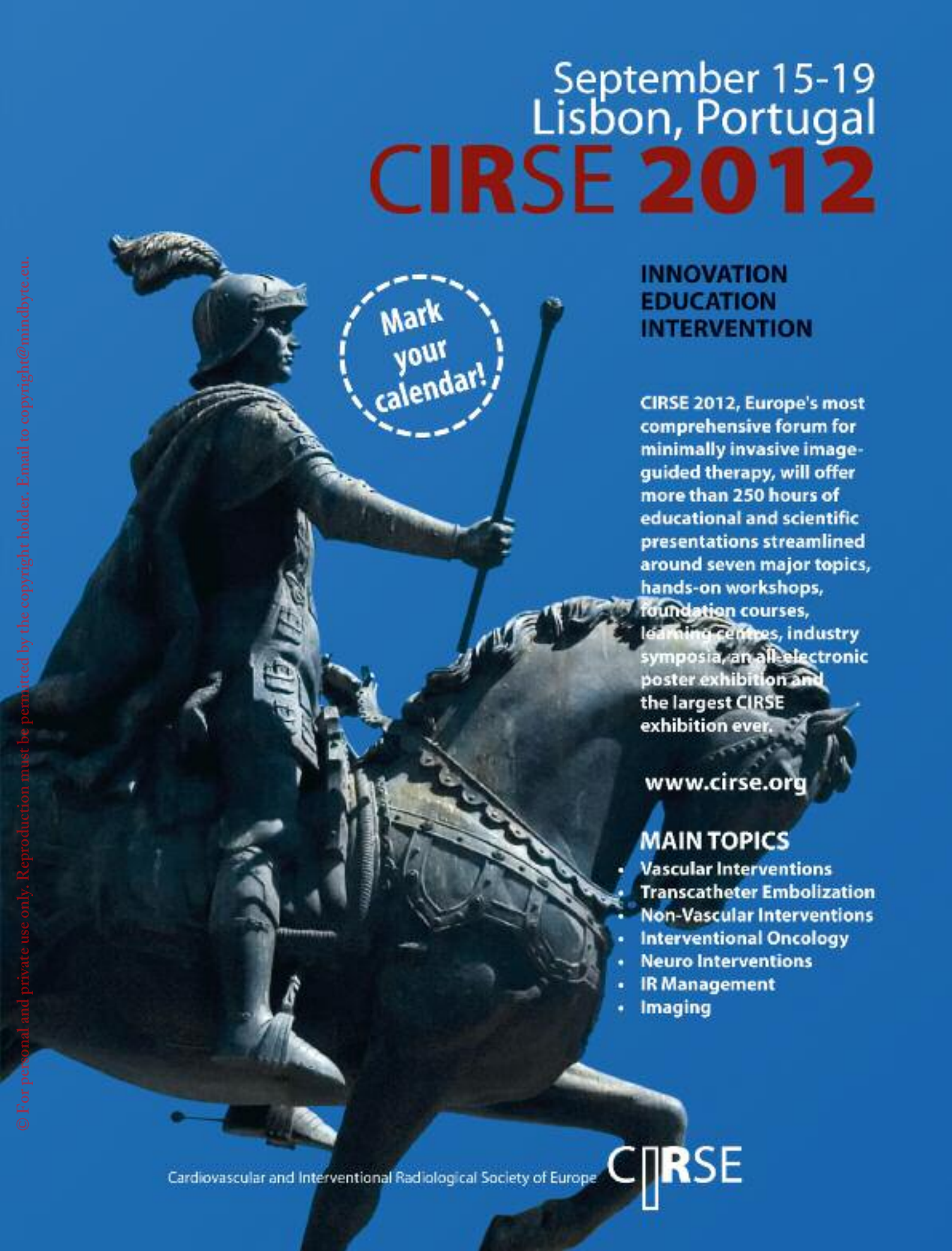

ULTRASONOGRAPHY IN CRITICAL CARE MEDICINE: THE WAMS APPROACH

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Ultrasonography with a head-to-toe approach has become a comprehensive tool in evaluating critically ill patients from the bedside. In this article, authors propose an innovative approach to critical care ultrasonography, which is simple, fast and transferrable to different anatomical sites.

Introduction

In the past decade many authors have emphasised the role of ultrasonography in daily patient assessment (Beaulieu and Marik, 2005a;b), even proposing to replace, rather than accompany, the traditional stethoscope. A particular role for ultrasonography is emerging in the management of emergency room (Gunst et al. 2008) and ICU patients (Kendall et al. 2004), where its advantages are well known, including, but not limited to, the absence of radiation exposure, and cost-effectiveness (Kendall et al. 2007). For the critical care patient, instead of concentrating on a specific anatomical district, ultrasonography seems to evolve in the direction of a total-body approach (Karabinis et al. 2010).

Critical Care Ultrasonography (CCU) is emerging as a multidisciplinary technique, where morpho-functional information, obtained with imaging in different anatomical districts, is integrated with clinical data in real-time by the intensivist (Bouhemad et al. 2007). Beyond already mentioned advantages, CCU permits 24-hour bedside availability and repeatability (Harding et al. 2011), rapid information accumulation on all anatomical districts, possibility to provide assistance to invasive manoeuvres (Hind et al. 2003; Sustic et al. 2000) and titration of mechanical ventilation (Luecke et al. 2012).

Why is CCU Different?

In the ICU or emergency department, where CCU is performed, the irregularity of the setting clearly discloses major differences in both patient approach and physician observation compared with those in traditional ultrasonography, performed by the radiologist.

The physical approach to the patient is somewhat unstructured: the physician may prefer not to follow an anatomical order, giving priority to ruling out potentially life-threatening conditions (Nagdev and Stone, 2011), assessing the function of vital organs (Jambrik et al. 2004), or looking for early signs of organ failure (Corradi et al. 2011). This subversion from the classical head-to-toe physical exam recalls that of Advanced Life Support, where priority is given to the identification of clinical situations that might precipitate a patient's conditions.

CCU is held at a clinical moment where a functional evaluation, rather than anatomical, is needed, since it consists of a problem-focused analysis that gives a multidisciplinary visual. Given the emerging relevance of CCU, the intensivist must focus his/her attention on using such tool appropriately; simple questions must be posed and simple answers sought. The main intent of CCU is to allow early goal-directed therapy.

The approach we are trying to propose is conceptual rather than practical, and the aim is to give the physician a short list of questions to pose each time the probe touches a specific part of the body. The simplicity of the approach we focus on does not want to be reductive and we share the invite of other authors (Vignon et al. 2007) for others to be involved in promoting continuous formation in ultrasonography for intensivists.

The WAMS-D Approach

Authors of this paper want to propose a generic approach that can adapt to different situations, involving disparate anatomical sites. Without pretending to give a universal approach, we suggest a conceptual flow that can help in disentangling complex questions that crowd the physician's mind once a probe is placed on the patient's skin.

To promote this fluidity, questions and answers have only one mandatory characteristic: simplicity. Yes/no questions are the most valuable, especially if answers are given in a reasonable timespan. The algorithm that follows focuses on the observation that ultrasonography can rapidly identify water and liquids (black), air (barrier effect), see moving parts and measure distances. This is all related to water, air, movement, size and Doppler.

Figure 1
The WAMS-D Approach Algorithm

In the WAMS-D approach, we must begin by asking: Is there liquid (water, blood, urine or other) in our image and, if so, is the position and quantity of such liquid abnormal? Then: Is an air collection hampering ultrasound transmission? Are movements of anatomical parts absent or altered? Are anatomical dimensions altered?

Critical care WAMS ultrasonography can give quick answers in most cases. Doppler gives extra functional information in particular circumstances.

WAMS-D in a Topographic Approach

The following tables, without claiming to be exhaustive, illustrate some of the possible WAMS-D approach applications grouped per anatomical district, as proposed by various authors.

Head

In the head region, precious information can be derived through direct visualisation of the optic nerve and its vascularisation (Rajajee et al. 2011b). Transcranial Doppler, born as a high-specialisation exam, is now increasingly being performed at the bedside by adequately trained intensivists (Munoz-Sanchez et al. 2012).

Thorax

Concerning the thoracic region, many critical cardiac conditions can be rapidly identified by the intensivist, preceding or, in some cases, substituting the conventional echocardiography performed by the cardiologist (Vignon 2005).

For decades air in the inflated lungs has been considered an impassable obstacle to direct parenchymal visualisation. Despite this, indirect signs have been widely investigated to identify many pulmonary conditions (Stefanidis et al. 2011).

Table 1: WAMS-D Ultrasonography of the Head

	W	A	M	S	D
Optic nerve				Increased diameter in raised intracranial pressure (Rajajee et al. 2011b)	Monitoring of cerebral haemodynamics (Nenekidis et al. 2011)
Cerebral arteries					Evaluation of cerebrovascular spasm in haemorrhage (Aaslid et al. 1984)
Brain death					Diagnosis of cerebral circulatory arrest (Ducrocq et al. 1998)

Table 2: WAMS-D Ultrasonography of the Chest

	W	A	M	S	D
Pleura	Precise evaluation of pleural effusion or empyema (Maslove et al. 2011)	Indirect signs of pneumothorax (Stefanidis et al. 2011) Post-procedural pneumothorax (Vezzani et al. 2010)	Seashore sign in healthy lung (Stefanidis et al. 2011)		
Lung and airways	B-Lines as sign of EVLW (Jambrik et al. 2010)	Assessment of PEEP-induced lung recruitment (Bouhemad et al. 2011) Differential diagnosis of non-pulmonary oedema (Copetti et al. 2008)		Assessment of tracheal trauma (Moriwaki et al. 2006)	
Vessels				Vena cava, vascular filling (De Vecchis et al. 2012)	
Heart and pericardium	Prompt detection of tamponade (Nagdev and Stone 2011)	Early detection of pneumopericardium (Howlett and Chua 2011) and pneumoperitoneum (Russo and Giangregorio 2012)	Right ventricular strain in pulmonary embolism (Stergiopoulos et al. 2011)	Monitoring volumes (Subramaniam and Talmor 2007) Estimate work of breathing (Vivier et al. 2012)	Focus-oriented echocardiography (Vignon et al. 2007)
Diaphragm			Study of diaphragmatic dysfunction (Lerolle et al. 2009)		

Table 3: WAMS-D Ultrasonography of the Abdomen

	W	A	M	S	D
Abdomen	Free liquid in peritoneum (Tayal et al. 2004)	Perforation (Chen et al. 2002)		Study of biliary tree (Horrow 2010)	Aortic aneurysms, mesenteric infraction (Danse et al. 2009)
Kidney	Hydronephrosis (Barozzi et al. 2007)			Cortical thickness (Barozzi et al. 2007)	Resistance index as shock predictor (Corradi et al. 2011)

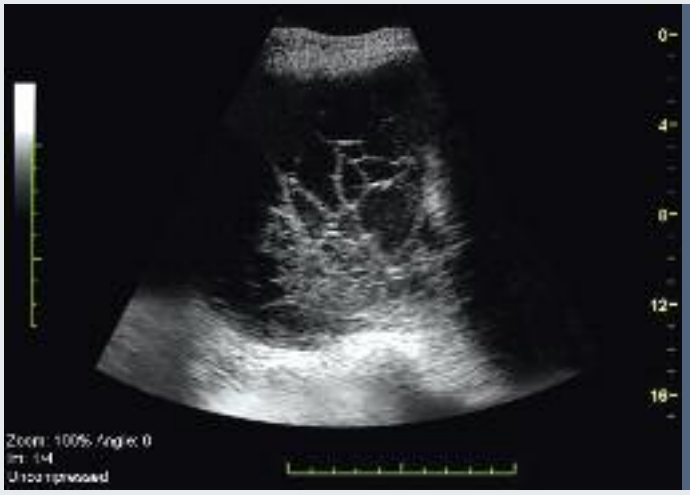

Figure 2: Pleural Empyema with Fibrous Septa

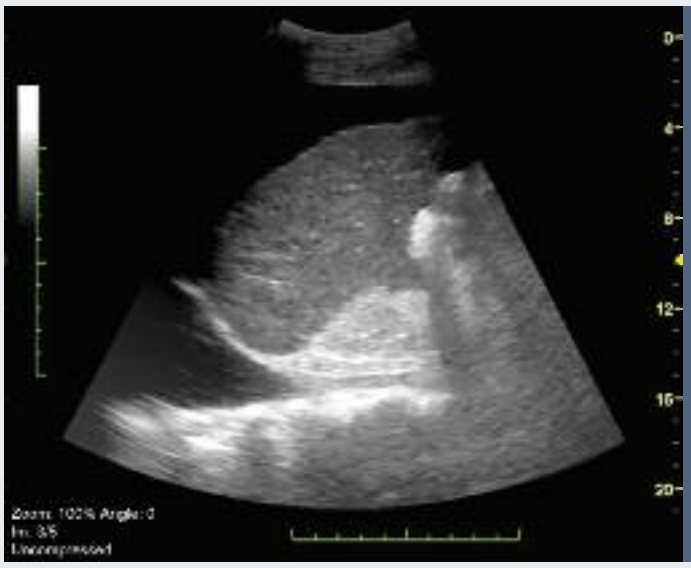

Figure 3: Subcapsular Spleen Rupture

Abdomen

Abdominal CCU has various applications in the study of the hepatobiliary system, pancreas, spleen and genito-urinary system (Wang and Chen 2007). Important data can be obtained from investigation of abdominal vessels: evaluation of volume (Carr et al. 2007) and cases of thrombosis, stenosis or rupture of aneurysms. Protocols have been proposed, reviewed, criticised and refined for rapid assessment in polytrauma patients.

Limbs

In addition to guiding vascular access, CCU of the limbs can rapidly recognise clots in patients with suspected deep vein thrombosis, and identify gas presence in cases of anaerobic soft tissue infections (Jaovisidha et al. 2012).

CCU in Invasive Manoeuvres

In addition to the aforementioned diagnostic possibilities, CCU is consolidating its role in assisting the intensivist in the execution of invasive manoeuvres. Some such techniques are widely implemented, like ultrasound-guidance for placement of central venous catheters (Brusasco et al. 2009), execution of pericardiocentesis

Table 4: WAMS-D Ultrasonography of the Limbs

	W	A	M	S	D
Lower limb		Soft tissue infection (Jaovisidha et al. 2012)			Deep vein thrombosis (Kory et al. 2011)

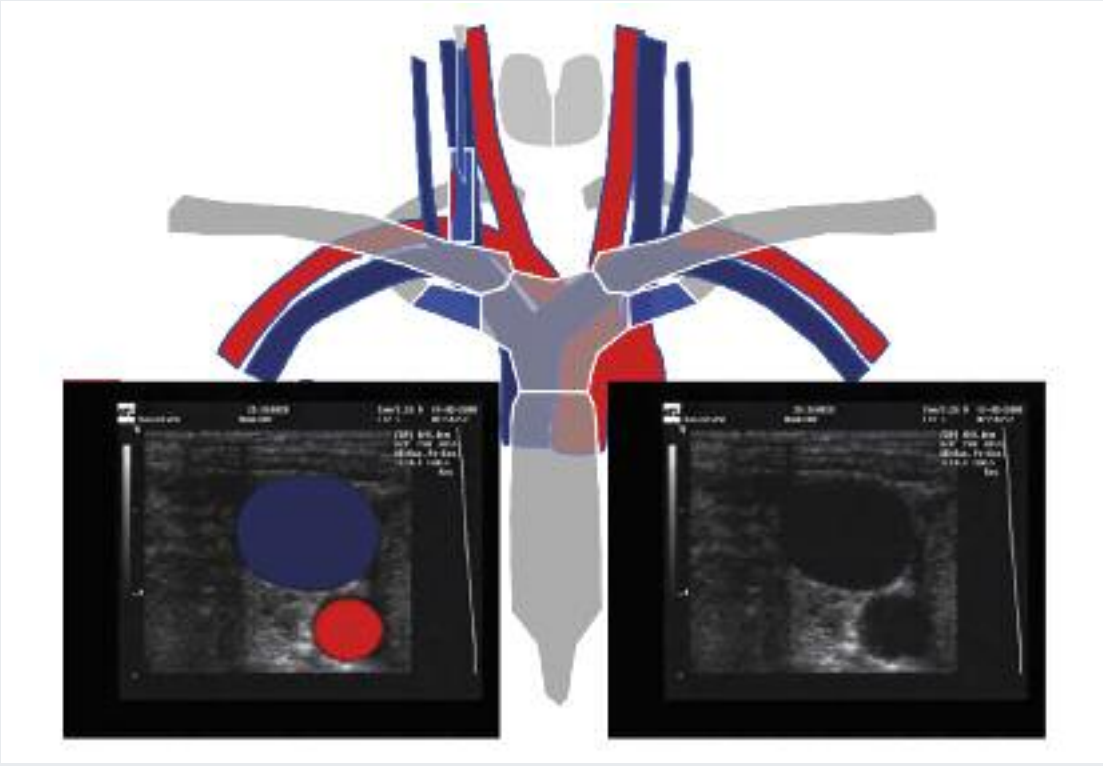

Figure 4: Doppler-Guided Central Venous Catheterisation

(Matthew Fields et al. 2012), thoracentesis (Patel et al. 2012) and paracentesis (Nicolaou et al., 2007). Less common applications of CCU include the confirmation of correct endotracheal tube placement (Hsieh et al. 2004), postpyloric feeding tube placement (Hernandez-Socorro et al. 1996) and ultrasound-guided percutaneous dilatational tracheostomy (Rajajee et al. 2011a).

Concluding Remarks

Ultrasonography has countless applications in the intensive care unit. The fact that basic concepts are simple does not mean that the technique is necessarily easy. Primarily, we think attention should be paid on continuous training: the ultrasound machine should be taken out of the closet and each intensivist, from the student to the director, should have the opportunity to train on a daily basis.

It is the authors' opinion that excessive subjectivity in image interpretation is a major limitation at the moment; therefore, we believe that maximum efforts should be made to develop and validate a quantitative approach to ultrasonography, to reduce effects from operator inexperience, to increase resolution and to obtain a reproducible datum. ■

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FLUID OVERLOAD IS NOT ONLY OF COSMETIC CONCERN

(Part II): Results from a Meta-Analysis and Practical Approach

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Introduction

In a previous issue of ICU Management (volume 12, issue 1), we suggested a three hit model of shock and emphasised that both early and late fluid management affect outcome in acute lung injury (ALI), sepsis and trauma (Rivers 2006; Bagshaw et al. 2008; Murphy et al. 2009; Prowle et al. 2010; Schrier 2010; Malbrain and Van Regenmortel 2012). After the initial adequate-filling phase to reverse distributive shock (Rivers et al. 2001), emphasis shifts to limitation and elimination of interstitial oedema in vital organs. Indeed, positive fluid balance resulting from third spacing is independently associated with impaired organ function and worse outcome, (Sakr et al. 2005; Malbrain et al. 2006; Vincent et al. 2006; Payen et al. 2008; Rosenberg et al. 2009). This was recently shown in a sophisticated retrospective study by Murphy and coworkers (Murphy et al. 2009). Conversely, achievement of negative fluid balance suggests survival and improved lung function (Alsous et al. 2000; Wiedemann et al. 2006). These have been referred to as the ebb and flow phases of shock.

The ebb phase was characterised by Cuthbertson in 1932, by the presence of "ashen faces, a thready pulse and cold clammy extremities", while during the flow phase, "the patient warms up, cardiac output increases and the surgical team relaxes" (Malbrain et al. 2012). Recent data tell us, however, that many patients do not enter the flow phase spontaneously. In order to avoid a positive cumulative fluid balance with peripheral oedema and organ oedema, resulting in end-organ dysfunction and failure, these patients may need a little help in the transition from ebb to flow (Cordemans et al. 2012). This article will check the evidence with regard to the impact of a positive fluid balance on patient outcome and how to deal with it at the bedside.

Background and Results of Meta-Analysis

The below PICO method was used in performing a meta-analysis of the available literature in order to find an answer to the following question: Does a management strategy attempting to obtain a daily fluid balance (FB) close to zero, or even negative (conservative fluid strategy), after day three result in a lower intra-abdominal pressure (IAP) and improved patient outcome compared with management approach that accept a liberal fluid strategy, and will the latter result in higher IAPs in critically ill adults in intensive care units?

We applied the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) system to guide the assessment of evidence when addressing the clinical management questions. Opinions were graded from high to very low to help determine the strength of recommendations. Proposals at the top of the scale (Grade 1A) suggested that the overall desirable effects of intervention clearly outweighed potential undesirable effects, while weaker recommendations (Grade 2D) indicated that the balance of risks and benefits for any intervention was rather unclear. Lowest ranking opinions suggested that clear uncertainty existed on any benefits from intervention, meaning that no final recommendation could be made.

By performing a Medline and Pubmed search, 40 articles were identified and included in this analysis: there was one meta-analysis (albeit only published in abstract form), while there were 10 randomised controlled clinical trials (four of which were blinded), seven interventional studies, 28 observational studies, and four case series. In total, 23,625 critically ill patients were studied in the 40 articles; in 23 studies the IAP was also measured. Through analysing the data collected, we developed four subquestions:

Table 1. PICO Method

Patients: Critically ill / injured adults in critical care units.
Intervention: Any strategy or protocol attempting to obtain negative fluid balance or equilibrium after the third day of intensive care.
Comparator: A comparable strategy or protocol not attempting to obtain negative fluid balance or equilibrium after the third day of intensive care.
Outcomes: With regard to mortality, cost, ICU utilisation, incidences of IAP and intra-abdominal hypertension (IAH).

1. Do non-survivors have a more positive FB? Data on 3,246 patients from 13 studies showed, indeed, that non-survivors (n= 1,643, mortality being 50.6 percent) have a more positive cumulative FB by day seven of their ICU stay. The cumulative FB was on average 4,628 ml more positive in non-survivors compared to survivors. The summary of findings of these studies is given in Table 1.
2. Does intervention to limit fluid intake or lower FB improve outcome? Data on 12,871 patients from 23 studies showed that

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outcome significantly improves with a conservative fluid regimen (odds ratio 0.34). In patients treated with a restrictive fluid regimen, mortality decreased from 29.1 percent (1,859 deaths in 6,384 patients) to 22.2 percent (1,443 deaths in 6,488 patients) ($p < 0.0001$). Actual data on cumulative FB was available in 6,555 patients from 13 studies. Data suggests that conservative treatment results in a less positive FB. Cumulative FB was on average 5,470 ml less positive after one week of ICU stay. The summary of findings of these studies is given in Table 2.

3. Do patients with IAH have a more positive FB? Data on 1,517 patients from eight studies showed that the 597 patients with IAH (incidence being 39.4 percent) had a more positive FB. The cumulative FB after one week of ICU stay was on average 3,389 ml more positive.
4. Does IAP improve with interventions acting on lowering FB? Only 10 studies looked at the effects of fluid removal (by using furosemide or renal replacement therapy with net ultrafiltration) on IAP. These were case studies or small series. A total fluid removal of 6,810 ml resulted in a drop in IAP from 21.5 mmHg to 12 mmHg. A dose related effect was observed: the more negative the FB, the greater the decrease in IAP.

Suggestions for Management and a Practical Approach

In light of this evidence, we recommend the use of a protocol to try to avoid a positive cumulative FB occurring in the critically ill,

Table 1. Summary of studies looking at cumulative fluid balance after one week of ICU stay in survivors versus nonsurvivors

	Cum FB Survivors	FB SD	n	FB Non-survivors	FB SD	n	Delta FB
Alsous 2000	50	400	16	2400	1700	20	-2350
Cordemans 2012	3419	7842	70	6982	9875	44	-3563
Cordemans 2012	4971	7737	58	9503	6910	65	-4532
Goldstein 2005	457	403	60	805	858	56	-348
Kuzkov 2006	893	668	16	1782	750	15	-889
Malbrain 2005	1643	1500	192	6214	2143	73	-4571
Malbrain 2011	3862	6904	314	5994	7546	413	-2132
Murphy 2009	9250	625	125	15875	1125	87	-6625
Rosenberg 2009	5154	769	159	10308	1923	635	-5154
Schuller 1991	250	1600	43	2000	2800	26	-1750
Shum 2011	880	2320	505	5410	5050	134	-4530
Simmons 1986	7500	4090	11	17220	2045	26	-9720
Vidal 2008	2100	3900	34	16100	6400	49	-14000
Mean Fluid Balance	3109,9	2981,4	1603,0	7737,9	3778,8	1643,0	-4628,0
Standard Deviation	2928,5	2848,3		5716,0	3011,1		3777,0

Table 2. Summary of studies looking at cumulative fluid balance after one week of ICU stay, in patients with and without intervention to limit fluid intake and/or to increase fluid loss.

	Cum FB Intervention	SD	n	Cum FB control	SD	n	Delta FB
Cordemans 2012	126	8180	57	9902	5863	57	-9776
Balogh 2003	6857	1000	71	12286	2143	85	-5429
Brandstrup 2003	3240	2000	69	6888	4000	72	-3648
Martin 2002	-3300	1000	19	500	1000	18	-3800
Martin 2005	-5480	4384	20	-1490	5480	20	-3990
Mc Ardle 2009	2570	977	9	8242	714	11	-5672
Mitchell 1992	142	3632	52	2239	3695	49	-2097
O'Mara 2005	12300	9300	16	22100	12800	15	-9800
Oda 2006	14474	4202	14	23369	5393	22	-8895
Rivers 2001	8625	5162	130	10602	6216	133	-1977
Stewart 2009	-4115	825	122	4651	917	122	-8766
The SAFE Study 2004	422	1633	2190	553	1732	2182	-131
Wiedemann 2006	-136	491	503	6992	502	497	-7128
Mean Fluid Balance	2748,1	3291,2	3272,0	8218,0	3881,2	3283,0	-5469,9
Standard Deviation	6186,1	2884,5		7700,9	3415,6		3202,3

especially in those with, or at risk of, IAH, and after acute resuscitation has been completed and the inciting issues and source control have been addressed (Grade 1B). We suggest obtaining a zero to negative FB by day three and keeping the cumulative FB on day seven as low as possible (Grade 1B). A vicious cycle leading to more fluid loading and further IAP increase is illustrated in Figure 1, and this must be avoided.

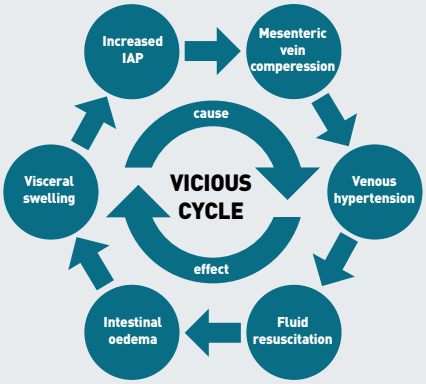


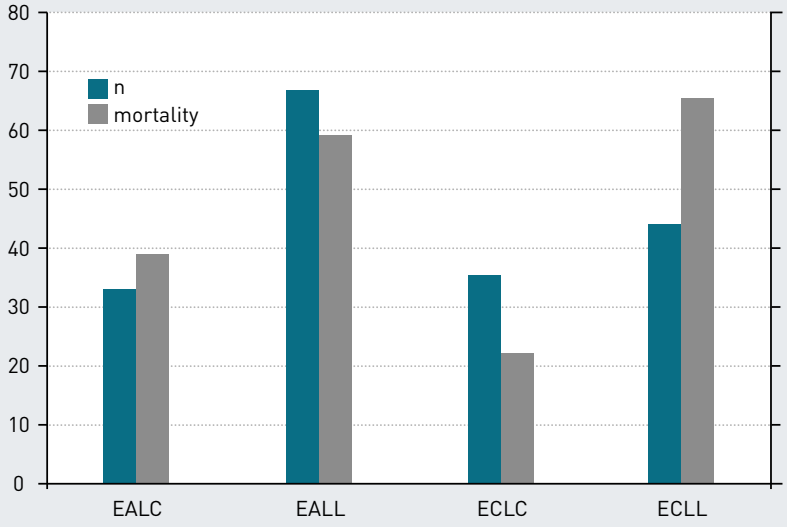
Figure 1. Vicious cycle of futile fluid loading leading to increased IAP and ongoing fluid administration

After reviewing the scarce evidence, we can only make a weak suggestion regarding the use of diuretics or renal replacement therapy (in combination with albumin) versus nothing to mobilise fluids in haemodynamically stable patients with IAH and a positive cumulative FB following acute resuscitation and source control measures (Grade 2C). The lack of consensus for this intervention underscores the uncertainity regarding it's role in managing FB and subsequently IAH, and signifies the need for further study.

In addition to measuring extravascular lung water index (EVLWI), transcardiopulmonary thermodilution allows the extent of capillary leak and fluid overload to be estimated. Accordingly, EVLWI correlates well with organ function and survival (Sakka et al. 2002; Martin et al. 2005; Kuzkov et al. 2006; Phillips et al. 2008). Moreover, fluid management aimed at EVLWI reduction results in a more negative FB and improved outcomes (Mitchell et al. 1992). In order to achieve a negative FB, previous prospective trials excluded patients with hypotension and renal failure (Mitchell et al. 1992; Martin et al. 2005; Wiedemann et al. 2006).

Recently, the effects of a restrictive fluid regimen on patients with negative FB, who are using PAL-treatment, were examined in mechanically ventilated patients with ALI, who were presenting with severe hypoxemia, increased EVLWI and IAP (Cordemans et al. 2012). PAL-treatment combines high levels of positive end-expiratory pressure (PEEP), small volume resuscitation with hyperoncotic albumin, and fluid removal with diuretics or ultrafiltration during continuous renal replacement therapy (CRRT). First, a 30 minute application of PEEP is titrated to counterbalance the effects of increased IAP (best PEEP in cmH^2O = IAP in mmHg). Next, hyperoncotic albumin (20 percent) solution is administered with 200 ml boluses, over a 60 minute period, twice on the first day; it is subsequently titrated towards a serum albumin level of 30 g/dl. Finally, after 30 minutes, a furosemide drip is initiated with an intravenous loading dose of 60 mg, followed by a continuous infusion at 60 mg per hour for the first 4 hours and 5-10 mg per hour thereafter, according to haemodynamic tolerance. In anuric patients, CRRT is initiated with an ultrafiltration rate resulting in neutral to negative daily fluid balances.

In a recent study of 57 patients, compared with 57 matched controls, we found significant beneficial effects of PAL-treatment on EVLWI, IAP, organ function and vasopressor therapy during one week. This resulted in a shorter duration of mechanical ventilation and an improved 28-day mortality. Through combining the results of two recent studies (with number of patients totalling 180), we found that the group of patients treated with conservative initial and late fluid management had the best outcome, followed by those who received initial adequate and late conservative fluid management (Cordemans et al. 2012; Cordemans et al. 2012). Mortality was significantly increased in those patients who received late liberal fluid management (Figure 2). This is in line with previous results by Murphy and co-workers (Murphy et al. 2009).



EA: early adequate fluid management, defined as fluid intake > 50ml/kg/first 12-24 hours of ICU stay
EC: early conservative fluid management, defined as fluid intake < 50ml/kg/first 12-24 hours of ICU stay
LC: late conservative fluid management, defined as two negative daily FB within first week of ICU stay
LL: late liberal fluid management, defined as the absence of two negative daily FB within first week of ICU stay

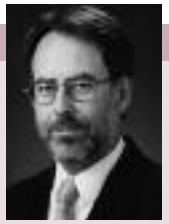
Figure 2. Bar graph showing patient distribution and outcome in different fluid management categories.

Key Messages

Late conservative fluid management may, in the long run, be even more important than initial resuscitation efforts during the ebb phase in patients with shock. EVLWI can be used at the bedside as a guide to initiating a

Continues on page 41

HOW TO GET A RESEARCH GRANT: TIPS FROM AN INSIDER



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A successful research grant application may represent an important step in the career of professionals working in the intensive care medicine field, especially in academic institutions. Grants are needed for launching and keeping research projects, as well as for buying equipment for the laboratory or initiating a clinical trial. Ideally, grant applications should not be driven by ambitions of getting a chief position in an academic institution, but rather by the real need and motivation to perform highly innovative research. Successful grant applications will certainly push one's career, but they should primarily be seen as a chance to put a project into practice.

This short overview is intended for intensive care professionals who are still novices, and have minor experience with the grant application process. The recommendations herein represent the very personal experience of the author as an applicant (both successful and unsuccessful) as well as a referee of grant applications in Germany and Europe.

What Topic is Worth Investigating?

As soon as you start writing a research grant application, the object of research must be exactly defined and must have been comprehensively discussed with your group. Ideally, you and your team already know the topics to be addressed and the questions to be answered long before the application. If you have more than one question, make sure that the most important one is evident in the application, so that referees easily recognise the focus of your proposal. A straightforward, well-focused proposal is worth granting support.

What are the Mechanisms?

Research applications often aim to describe the effects of therapies or interventions on organ systems or clinical outcomes. Descriptive works are certainly necessary and extremely important for the intensive care community, since they provide us with information about treatments. However, as far as possible, you should consider shedding light on the mechanisms behind the effects. Referees usually prefer, and are prone to recommend acceptance of, research proposals that try to elucidate why and how a given effect occurs, ie. research projects with a mechanistic approach. This is especially true when the project shall be conducted in a laboratory. Referees tend to classify research projects dealing with genes, cells and tissue as mechanistic, even if this is not always the case. Accordingly, I have observed that research in whole organisms, e.g. animals and patients, is usually classified as "not mechanistic enough". Of course, such procedure is not correct, but many fellow referees are highly biased and do not correctly identify the mechanistic potential of "whole organism research". In fact, the micro-behaviour of genes, cells and tissues may not be enough to describe the macro-behaviour of complex systems, but most referees seem to ignore this completely. Thus, I highly recommend including mechanistic aspects in a research proposal whenever possible. Such recommendation does not imply that descriptive research will not be granted financial support, however. The degree of innovation and the importance of certain descriptive works are so high that they will certainly be recommended by reviewers.

> *"In my experience, collaborations can be very fruitful and push your own and the collaborator's research to another level of quality."*

Experimental or Clinical Research?

Medical evidence is based on clinical not experimental research; therefore, the chance of clinical projects being granted financial support should be proportionally high. Nonetheless, the quality of clinical research proposals is often not as high as their laboratory counterparts. Obviously, when referees have to evaluate applications with disparate quality levels, they will recommend the one with higher quality. Accordingly, clinical research may have a slight disadvantage compared with laboratory work in programmes that accept both experimental and clinical applications. I recommend that applicants make sure the institution responsible

AUTHOR GUIDELINES

ICU MANAGEMENT

Content

Articles may focus on any management or practice issue in intensive care related to economics, quality of care or patient outcome. We only accept scientific papers with a clear connection to management and practise issues. We also invite opinions for publication in our Viewpoints section, which can be personal opinions of the author and/or reactions to articles published in prior issues. These are published at the discretion of the editors. Submissions may not have been published previously or be currently submitted for publication elsewhere. Articles must be written by independent authorities and any sponsors for research must be named. If manufacturers are named in an article, the text must present an unbiased view, not in support of any particular company.

Submission Guidelines

Authors are responsible for all statements made in their work, including changes made by the editor and authorised by the submitting author. The text should be provided as a word document via email to editorial@icu-management.org. Please provide a contact email address for correspondence. Following review, a revised version, which includes the editors' comments and recommendations, is returned to the author (at the contact email address) for authorisation.

Length

- Articles: maximum 1400 words (less if figures or tables are included)
- Viewpoints: maximum 700 words
- News/research/product updates: maximum 200 words

Please note that contributions longer than the specified number of words may not be accepted.

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Article texts must contain:

- Title
- Names of authors with abbreviations for the highest academic degree
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- Summary of one or two sentences (no more than 30 words) describing the content
- Contact name for correspondence and an email address which may be published with the article
- Website, if appropriate
- Acknowledgements of any connections with a company or financial sponsor
- Introduction, main text and summary/conclusion, with subheadings as appropriate
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- References or sources, if appropriate, as specified below

Writing Style

Articles must be written in UK/British English (e.g. organisation, not organization), with short sentences, a clear structure (see above) and no bias. Full stops in numbers may only be used to indicate a decimal place; otherwise use commas as separators.

Images

Main authors are asked to supply a portrait photo for publication with their article. This and any other relevant images for publication with an article should be sent by email as separate files (only high resolution images with 300dpi) and their order of placement in the article must be clearly indicated. Only the electronic formats ".tif" or ".jpg" can be used for images, i.e. not Microsoft Word or PowerPoint. Images must be no smaller than 9cm x 9cm at 100% scale. Only images meeting these specifications can be published. If an image has been published before, permission to reproduce the material must be obtained by the author from the copyright holder and the original source acknowledged in the text, e.g. © 2010 Sherry Scharff.

Format for References

Any references that are deemed important to understanding of the article should be cited in concise form within the article. Please use the Harvard reference system. Citations within the text for a single author reference should include the author surname and year of publication; for a citation with two authors include both author surnames and year of publication; for more than two authors, include the first author surname followed by "et al." and the year of publication. Multiple citations should be separated by a semicolon, and listed in alphabetical order.

Example of within text citation: (Edwards 2004; Edwards and Miller 2002; Miller et al. 2003).

Reference lists should be alphabetised by lead author and included at the conclusion of the submission.

Example of standard journal reference: Sydow Campbell, K. (1999) "Collecting information; qualitative research methods for solving workplace problems", Technical communication, 46 (4) 532-544.

Authors are responsible for the accuracy of the references they cite.

Acceptance

It is always at the discretion of our editorial board to accept or refuse submissions. We will respond to submissions within 8 weeks of receipt. We reserve the right to revise the article or request the author to edit the contents, and to publish all texts in any MindByte Communications journal, on the Internet and to list them in online literature databases.

Thank you,
The ICU Management Editorial Team
editorial@icu-management.org

for the grant explicitly encourages such kind of application. However, even in such cases the evaluation may be biased towards laboratory research. Ideally, clinical research applications should be sent to institutions or programmes that specialise in clinical studies.

Am I Experienced Enough?

As a rule of thumb, the higher the budget of an application, the more experience that is required from the applicant. This is certainly disappointing for younger researchers whose publication track records are usually weaker than those of older researchers. One must understand that granting institutions consider it safer to approve the application from a researcher who has already shown he/she is able to conduct research projects successfully. In view of that, and provided the call for applications is not addressed to beginners, I recommend the following:
a) apply for a sum that is proportional to your experience;
b) consider sharing the project with a co-applicant who has a stronger publication track record and more experience than you; and
c) present data from pilot experiments to show that you have already addressed the issue and are able to perform the study. Put forward that all you need is a bit of money to conduct a promising project.

Getting Together: Networking

The importance of collaboration among researchers cannot be emphasised enough. Beginning at the local, intra-departmental level and going beyond national borders, collaborations can improve the quality of research enormously. Due to fear of concurrence, lacking self-confidence, shyness, or a combination of those, some applicants tend to reduce their work to a kind of "one-man-endeavor", instead of seeking help and advice. Even if a group leads its field of research, or a researcher is brilliant, both can still improve aspects of their research proposal when they invite other colleagues to collaborate with them. Institutions that support research are glad when they see that authors are seeking networking. I myself neglected networking for a long time but, fortunately, I came to appreciate the importance of collaboration a couple of years ago. In my experience, collaborations can be very fruitful and push your own and the collaborator's research to another level of quality. However, when applying for a grant, the role of partners must be well defined so as not to give the impression that the applicant just wanted to obtain political support. This can be accomplished by providing letters of intention from your collaborators.

> *"A straightforward text will help referees to retain the key issues of a proposal."*

How to Write Your Grant Proposal

Institutions that support research usually have their own rules regarding applications, and offer templates in which specific topics to be addressed are precisely defined. You must comply with such rules, and obviously also observe the deadlines for application, otherwise your proposal will not be considered.

Requirements for proposals may differ among institutions but referees will expect applicants to address the following issues:
1) Provide a highly qualitative revision of the topic you have chosen – A short review pointing out the most important advances and showing that the application is up to date can be a good start;
2) State clearly which issues have not yet been addressed and why you have chosen that particular issue;
3) Always state the hypotheses of the study and identify them clearly in the text – A precise formulation of remarkable hypotheses will help to show that your proposal is straightforward and focused, and that you can set priorities;
4) Be sure and show that you are using appropriate methods. In case of less modern technology, you should justify your choice;
5) Show sample size calculations – You must show that the number of experiments is enough to address the hypotheses, as a means to justify the amount of work and money applied for in the project. Also, you have to avoid more experiments than necessary, since this has ethical implications from the animal welfare perspective;
6) Define a feasible research schedule – You are expected to deliver the results of your project within the proposed schedule. A realistic time line is essential and you have to see the grant as a contract with the institution supporting your research. Obviously, if things develop differently than you expected, you will have to apply for an extension of the research period; and
7) Define a realistic budget – Referees will not expect the applicant to calculate the requested amount of money with precision of cents, but a serious proposal will list materials, devices, salaries, services etc. in a plausible way. While some institutions may require you to justify some costs and give you the chance to correct the calculations, others may simply reject your proposal due to an unrealistic (too low or too high) budget.

Another extremely important aspect is the formal one. Much attention has to be paid to grammar, spelling and the style of the text. You should ask a colleague to revise the application if you are not a native speaker or if you have difficulties in the language in which you are writing the proposal. In the case that the proposal has to be written in English, professional help for editing and revision of scientific texts is available on the web. I have used such a service in the past, with good results. Finally, it is important to stress that a straightforward text will help referees to retain the key issues of a proposal.

Increasing the Chances of Success: Preferred and Least-Preferred Referees

If you feel that some referees may be biased, for example due to competition in your field, you should identify them in a cover letter accompanying the application. Normally, granting institutions allow applicants to exclude referees based on concurrence criterion. Also, you can suggest possible referees for you application, but be sure that they will be impartial. By suggesting former collaborators, you will leave a bad impression and make the choice of new referees difficult for the granting institution.

Have You Applied for a Similar Grant Before?

If you have submitted the same proposal, or even just part of it, to a different institution, you have to declare this. Some institutions exchange information on applicants, and members of grant decision committees often serve more

than one institution. Referees may also be asked to evaluate proposals from different institutions. The increasing cross-communication among grant institutions, even across continents, amid failure to report multiple applications may lead to rejection of a proposal.

We are Happy to Inform that Your Application Has Been Accepted

After long arduous work, you have finally received the confirmation that your application was successful and it is time to celebrate. Sometimes this confirmation will arrive relatively late in respect to the planned work schedule; thus, you have to start immediately in order to achieve the results you agreed with the granting institution, within the time frame proposed. If you foresee that the work schedule is not feasible, you should contact the granting institution as soon as possible and apply for an extension. Normally, members of the grant decision committee will take the decision to extend the time frame as long as they are not associated with further costs for the granting institution. Occasionally, referees will be asked in that respect, but they are experienced with research and know that things may not work out as originally planned. In order to maintain eligibility for new financial support in the institution you were accepted at, you will have to submit a detailed final report. In case you obtain support from governmental research granting institutions, and subsequently fail to submit a thorough report, this may lead to a request of reimbursement of the sum received. But do not worry about that, as long as you have conducted serious research, you will not get into trouble.

We Regret to Inform that Your Application Has Not Been Selected

Unfortunately the decision regarding your grant application was not favourable, in spite of the work and time you have spent on compiling the proposal. Take your time and try to identify the reasons that led to the rejection of your application. Also, if you did not get specific feedback from referees together with the decision, request this formally. If the referees did a good job, the reasons for the rejection will certainly be useful towards rewriting the proposal and trying again at another funding institution.

Reasons for a rejection are not always clear. Accordingly, high quality applications can be rejected if the budget is tight or if concurrence is too high. The ranking of proposals and selection of those worth being supported is not always an easy task, so if yours was rejected, it does not necessarily mean it is of low quality. Furthermore, referees also make mistakes and may have had a wrong impression of your project. I have applied for several research grants and many of them have been rejected. A couple of years ago, I experienced a curious situation in which one of my applications was rejected and the referees classified the proposal as: 1) not original, 2) having low chance of success, and 3) having low probability of acceptance for publication in a renowned intensive care journal—in other words, a destructive evaluation, which would mean that the project had very low quality. After reflecting, I took the decision not to change the proposal and submitted it to another institution, where it was accepted. Three years thereafter our group received a patent on the main idea of the project, and published the results in a highly ranked journal of the field with an accompanying editorial. In summary, do not let a rejection discourage you from improving your application—and keep trying! ■

Continues from page 37

conservative late fluid strategy or late goal directed fluid removal in those patients that do not transgress spontaneously from the ebb to the flow phase of shock. However, we must remember that no single parameter can change outcome; this can only be achieved by a good protocol. PAL-treatment seems a good example of such a protocol, but further prospective studies are needed. ■

For more tables and graphs of findings, please visit **icu-management.org**

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NEW JUNCTURES IN RESEARCH, EVALUATION AND MANAGEMENT PAVE THE PATH OF IMPROVEMENT

AN INTERVIEW WITH PROFESSOR BENOIT VALLET

Professor Benoit Vallet, Chair for the Department of Anaesthesiology and Intensive Care Medicine at the University Hospital of Lille, France has played a great influence in his fields of professionalism over the years, with his current participating role in the steering committees for the Age of Blood Evaluation (ABLE) randomised controlled trial and European surgical outcomes (EuSOS) study just providing part of the grand picture. With the realms of critical care and anaesthesia continually evolving, whether via enhancements in education and standards, new research findings or technological developments, Managing Editor Marianna Keen asked Prof. Vallet to share his thoughts on the most influential recent achievements and potential areas of focus for future advancement.

You have suggested that quality improvement programmes could help to resolve uncertainty in perioperative haemodynamic therapy. How do you think this technique of evaluating new clinical strategies is better than other research methods?

Quality improvement research programmes have emerged over the past five years and allow the evaluation of new clinical strategies in real life conditions (Pronovost et al. 2006). When the quality improvement programmes are applied in routine, the control results reflect the real quality level in the hospital and not only the level of a test group. Indeed, when participating in a study, caregivers might ameliorate their behaviour and thus impede the extrapolation of randomised controlled trial (RCT) results. Moreover, a blind design is not applicable in the context of perioperative monitoring.

A very recent survey showed that the vast majority of anaesthetists do not follow perioperative haemodynamic protocols during high-risk surgery (Cannesson et al. 2011). This would illustrate very well that uncertainty regarding the value of perioperative hemodynamic therapy to improve outcome remains very high (McDonald and Pearse 2011). Available evidence from several RCTs should resolve this uncertainty, but they could be considered not large enough (McDonald and Pearse 2011). Furthermore, manpower would become an important limitation when implementing a new treatment protocol in daily practice in the real world, whereas it is rarely an issue when conducting a drug clinical trial.

We are not convinced, therefore, that large RCTs can solve our uncertainty (Michard, Cannesson and Vallet 2011).

> *"Non-invasiveness, data management and clinical decision support are the hottest topics in the world of perioperative medicine, along with that of the rising continuum of care between the OR and the ICU."*

In what ways have research and evaluation methods in the fields of critical care and anaesthesia changed in recent years?

In recent years, well conducted clinical research in intensive care has very often ended up with contradictory results, if not opposite results. Large positive RCTs were too frequently followed by negative ones, destroying hopes for patients as well as clinical guidelines for doctors. Clinical trials are often biased; their results do not pertain to real life practice. Research that is overly protocolised may include such a broad case mix of patients that they are not similar to those we have to treat on a routine basis. Sometimes the results from the studies are such that I cannot interpret them for my practice. Other times, clinical trials may not be biased, but recommendations derived from observed results were impossible for my medical staff to translate. For example, manpower may be far larger in the clinical trial than in my ICU or operating room.

One may wonder, therefore, whether monitoring technologies need be evaluated in terms of their effect on outcome of critically ill patients. That is a difficult question to answer. Most administrators will expect to have outcome data on any new and potentially expensive technology before purchasing it. However, this approach may well delay the implementation of useful technologies in the critical care environment, since it is more likely that initial studies, if well conducted, present the worst case scenario (no impact on outcome) (Council BoHCSNR 2002). As an example, the pulse oximeter has been indicated to have no impact on patient outcome (Moller et al. 1993). In the same vein, the aviation industry, which is based on pure science, has never waited for evidence-based data before implementing new technologies (monitors, auto pilot, simulation) to the field. Meanwhile, the medical community is still wondering whether pulse oximetry can improve outcome.

What do you believe to be the hottest topics in the world of critical care and anaesthesia at the moment?

Non-invasiveness, data management and clinical decision support are the hottest topics in the world of perioperative medicine, along with that of the rising continuum of care between the OR and the ICU. One may increasingly observe that

the technology used in both these settings is the same: this pertains to ventilators and ventilatory modes; general monitoring devices, including sedation and pain assist monitoring and delivering systems; and more specific haemodynamic monitoring technologies. From the early nineties, non-invasiveness has been considered a key factor for success in the development of monitoring in the OR; today this appears to be the case in the ICU as well. Patients are less sedated, more prone to be non-invasively ventilated, and as a consequence are more likely to be non-invasively monitored.

One may also observe that in hospital rooms, a lot of the computerised equipment used records data before, during and after surgery (drug delivery, vital signs, physician observations). This equipment produces billions of measurements each day. These data are stored in huge databases and may be integrated with other facts from the Hospital Information System (patient and hospital stay information). That is why data management is certainly one of the hottest topics in critical care and anaesthesia at present.

Which do you believe to be your most significant recent research developments?

Meta-analyses of these small RCTs provide evidence for supporting perioperative haemodynamic therapy. Recently, Marik et al. conducted a meta-analysis evaluating the ability of pulse pressure variation (PPV) to predict fluid responsiveness (Marik et al. 2009). Their study assessed the range of uncertainty of the estimated best cutoff value. It would be fair to emphasise that meta-analyses of diagnostic tools and cutoff values are not as powerful as they are for RCTs. There are four reasons for this — One: individual studies can considerably vary the threshold used, the population under study, and the measurement of the variable or reference standard; two: the choice of recruitment strategy can also affect the assessment; three: the statistical techniques used to aggregate the results of diagnostic tool studies differ from those of RCTs; and four: the meta-analysis of diagnostic studies requires consideration of two index measures—sensitivity and specificity—as opposed to a single index in the meta-analysis of an RCT.

In order to solve these difficulties, I was part of a team that conducted the first study to test the application of the grey zone (GZ) concept to PPV for the prediction of fluid responsiveness, and to do so in a large sample (Cannesson et al 2011).

The types of fluids to administer to specific cases is a matter that is highly debated, as is the measurement of fluid responsiveness. What impact are grey zones having on the decision process of administering fluids?

The GZ approach has been proposed to avoid the "black-or-white" decision of the receiver operating characteristic (ROC) curve approach. The ROC curve approach often does not fit the reality of clinical or screening practice. The GZ approach proposes two cutoffs that constitute the border of the GZs. One excludes the diagnosis (predicting no fluid responsiveness), and one includes the diagnosis (predicting fluid responsiveness). Intermediate values in the GZ mean a prediction is not precise enough for diagnostic decision. The GZ approach applied to PPV for predicting fluid responsiveness in mechanically ventilated patients during general anaesthesia identifies a range of PPV values for which fluid responsiveness cannot be reliably predicted. This occurred in our study between nine and 13 percent (Cannesson et al. 2011). Such PPV values may be seen in approximately 25 percent of patients.

The benefit-risk balance of fluid administration may vary between patients. Using the GZ approach instead of a single-threshold value for conducting goal-directed therapy may improve fluid management by ensuring minimisation of the explicit cost ratio (to avoid fluid restriction when fluid administration should be considered and to avoid fluid administration when restriction should be considered). Very interestingly, changes in the cost ratio of volume expansion moderately affected the GZ limits.

By administering cardiac output maximisation with small bolus infusion (100ml), or by considering absolute changes in PPV (dPPV) according to time, we should be able to define fluid response within the limits of the GZ. This would combine cardiac output maximisation and dynamic indicator minimisation.

What research projects do you currently have underway?

We are currently working on a data mining project, with the aim of establishing anaesthesia quality rules.

The University Hospital of Lille deals with about 50,000 anaesthesia procedures per year. The information related to these procedures—from pre-anaesthetic consultation to the recovery room—are collected and consolidated into the Anaesthesia Data Management System and stored in a shared database for all the anaesthesia units. We are building a data warehouse, with anaesthesia data coming from two different sources: the Anaesthesia Data Management System and the Hospital Information System. Thanks to this data warehouse and statistical analysis, we should be able to make a connection with respect to anaesthesia quality rules and patient outcomes. After validation of these rules, we will consider the development and implementation of a computerised decision support system.

This project should also allow us to reach other targets. For example, the development of dashboards will give us a better view of anaesthetic activity in the hospital (drugs consumption, anaesthesia quality, OR occupancy, and so on). Moreover, the relationship between the Anaesthesia Data Management System and the Hospital Information System will help us to implement identity-vigilance controls. This information consolidation and interpretation will allow us to develop our own quality improvement research programme. ■

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HEALTHCARE IN RUSSIA: CHALLENGES AND CHANGES IN CARE PROVISION FOR THE HIV INFECTED POPULATION

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The break up of the USSR brought about negative changes in healthcare among other industries, with nepotism in research and corruption from authorities remaining the weak spots of the health system. Although the occupation of a physician has not lost its appeal, more than 50 percent of graduates of Russian medical schools seek jobs elsewhere, and along with other negative influences, this is having a huge impact on care provision and societal standards.

During the times of the USSR, all citizens of the country underwent screening tests for cancer, STDs, diabetes, and so on, while today, patients often end up at clinics at the late stages of a disease, making successful treatment unlikely. A brain-drain scenario and a deficit of specialists is lowering the quality of care delivery and increasing risks.

HIV/AIDS healthcare services are just one example of the recent inefficiency of the Russian healthcare system. Initially, services for HIV/AIDS control were mostly staffed with low-qualified specialists who used to work at epidemiological stations in the 90s. Since then, however, we have witnessed a lot of improvement, both in the structure of the centres, and HIV diagnostics and treatment on the whole.

The Federal Scientific Center for AIDS Prevention and Treatment lists over 700,000 cases of HIV and AIDS patients who are citizens of the Russian Federation. The real numbers are, of course, higher.

160 new HIV cases are registered every day. Yearly growth of HIV positive patients exceeds 30,000. The fact that the average age of the HIV-infected contingency is slightly over 30 years old—the most economically and demographically significant part of the Russian population—is of particular concern. The HIV/AIDS epidemiological situation in Russia is on par with the worst in the world statistically, and compares to that of the Southern African states. In the autumn of 2011, at the Belgrade conference, Russia topped the list of the worst epidemiological statistics for this infection. Russian healthcare management inefficiencies, the low professional level of AIDS services, and constant shortages of antiretroviral medications and diagnostics deepen the anxiety present in the HIV positive community and shift HIV/AIDS detection to later stages of the disease.

> *"A blind, routine approach to handling HIV cases increases mortality in the era of highly active antiretroviral therapy (HAART)."*

Another absurdity is that HIV-infected Russian citizens (as well as citizens with other serious diseases), those who have valid obligatory medical insurance policies and who pay their taxes and comprise the most demographically significant groups of the population, cannot get the care that they are entitled to in their factual residence location. Lack of disease prevention, especially in central Russia,

Statistics:

Total Population †
142,958,000

Life expectancy at birth m/f (2009) †
62.8/74.7

Under-five mortality rate (per 1,000 live births) *
12

Estimated number of people (all ages) living with HIV (2009) *
980,000

Mother-to-child transmission: Estimated number of women (aged 15+) living with HIV (2009) *
480,000

GNI per capita (USD) *
9,910

Percentage share of household income receieved by the 40 percent of households with the lowest income (2000-2010)*
16

Figures are for 2010 unless otherwise indicated
Source:
† Organisation for Economic Co-operation and Development (OECD)
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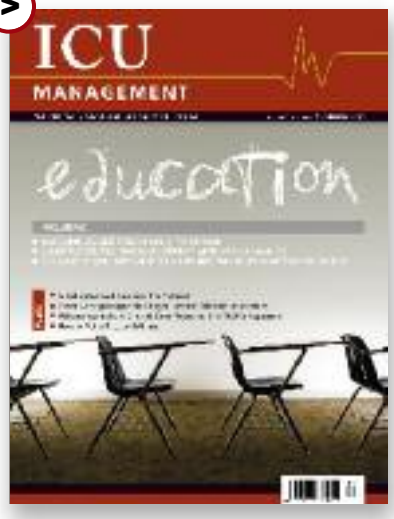

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lack of specialised clinics, and understaffed clinics all help little in lowering infection statistics. A blind, routine approach to handling HIV cases increases mortality in the era of highly active antiretroviral therapy (HAART).

Lately, the budgetary allocations for healthcare on the whole have been growing, including HIV/AIDS treatment and prevention, but a poor level of management within Russian healthcare authorities is characteristic of the last decades, while lack of official channels for feedback from the population lowers the overall efficiency of healthcare delivery.

ing families, help for the HIV-infected population is scarce. For example, there is only one maternity clinic for HIV-infected mothers for the 10-12 million population of Moscow. Hospitalisation at a mainstream maternity clinic will, at the very least, deprive them of the simple prevention of vertical HIV transmission to the child.

Urgent surgical care is provided promptly and free of charge to HIV positive patients in Russia, but mostly in the big cities. Sklifosovsky Emergency Care Institute in Moscow is open 24/7 and admits all patients,

> *"The HIV/AIDS epidemiological situation in Russia is on par with the worst in the world statistically, and compares to that of the Southern African states.""*

The dominant mode for HIV infection transmission in Russian territory remains parenteral. HIV transmission rates are also growing fast in substance abusing heterosexual population groups. Seeking medical or surgical help is a psychological challenge for HIV-infected individuals; often they prefer to conceal their HIV status for fear of being refused medical care.

Although the Government has lately come up with extra monetary provisions for growirrespective of their diagnosis and social status. The centre's laboratory diagnostic services are also well equipped for urgent care provision, including to those with the HIV infection. In other areas of the country, a lot depends on the authority figure at the HIV-centre. Generally, surgeons and maternity nurses find legions of excuses to refuse care to HIV-infected citizens, which evidently stems from their ignorance of the HIV pathogenesis and epidemiology.

Unlike in some other European countries, HIV positive citizens in Russia are often deprived of proper medical care and discriminated against in educational professions. All of these factors negatively affect our society. The abovementioned features of the Russian system of care provision complicate HIV monitoring and oversight, further worsening the situation and stigmatising HIV positive citizens.

I may add that of course a lot of positive changes have taken place in Russian healthcare in recent years. One of them is the ongoing building of hospitals and healthcare centres in various regions of the country. Previously, heart surgery took place only in Moscow and patients had to wait a long time to be treated, with their lifestyles consequently greatly affected before surgery could take place. In Beslan, North Ossetia, a modern MultiProfile medical centre opened for the whole of the Northern Caucasus, which now provides very modern equipment and qualified personnel. In addition, a lot of positive changes in paediatric surgery have been made under the direction and control of Prof. Leonid Roshal, among others. Of course, many constructive changes have been made, but still the Russian healthcare system is far from operating effectively and reaching its potential in care provision. President Vladimir Putin has made moves to help the situation, but the lack of control over public funds and linking of the state's Ministry of Health to patient needs makes the entire system still ineffective. ■

Continues from page 10

5. Summative examinations should be considered as one of the most important tools to assess and evaluate a trainee's progress and achievement.
6. Training and recognition of the faculty that provides medical education will stimulate creativity.

This new training model means that any "year counting" is meaningless. It takes the time it needs to obtain the competences. We do, however, state that it will take at least five years to do so, of which one year needs to be in intensive care medicine. The EBA does not regard all specialists in anaesthesiology as competent in running advanced intensive care departments; however, after this training, our colleagues will have a good base to build upon to fulfil the requirements in the CoBaTrICE programme. The EBA is aware of the efforts to get intensive care medicine recognised as a primary speciality. The board believes that this approach for defining required competencies is far better than installing new borderlines between yet more specialities. In this respect, the CoBaTrICE initiative has served as a guiding star for medical education in Europe. ■

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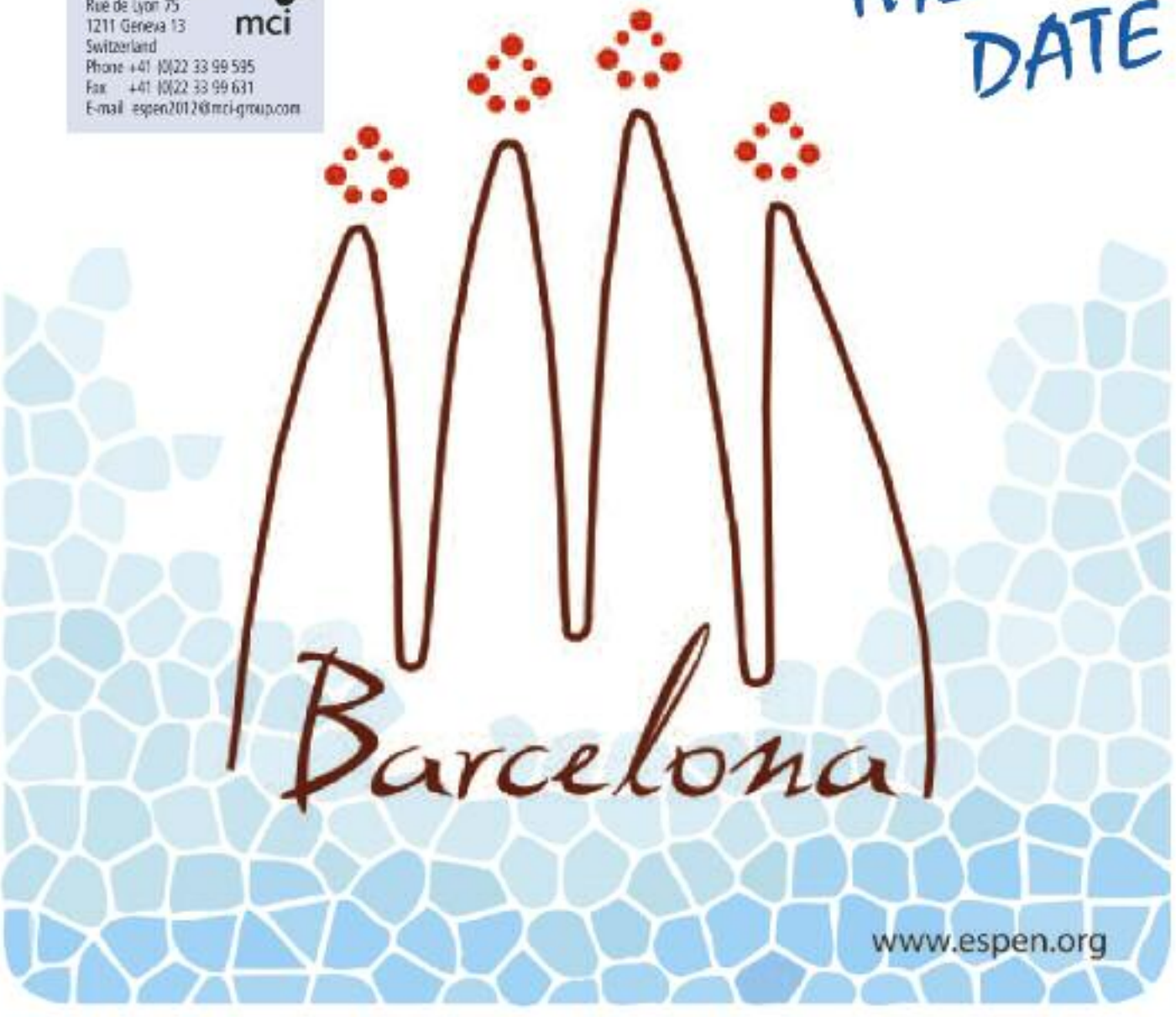

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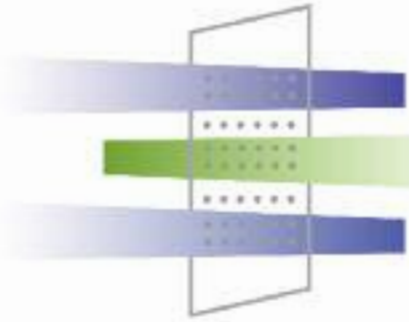

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