ICU MANAGEMENT

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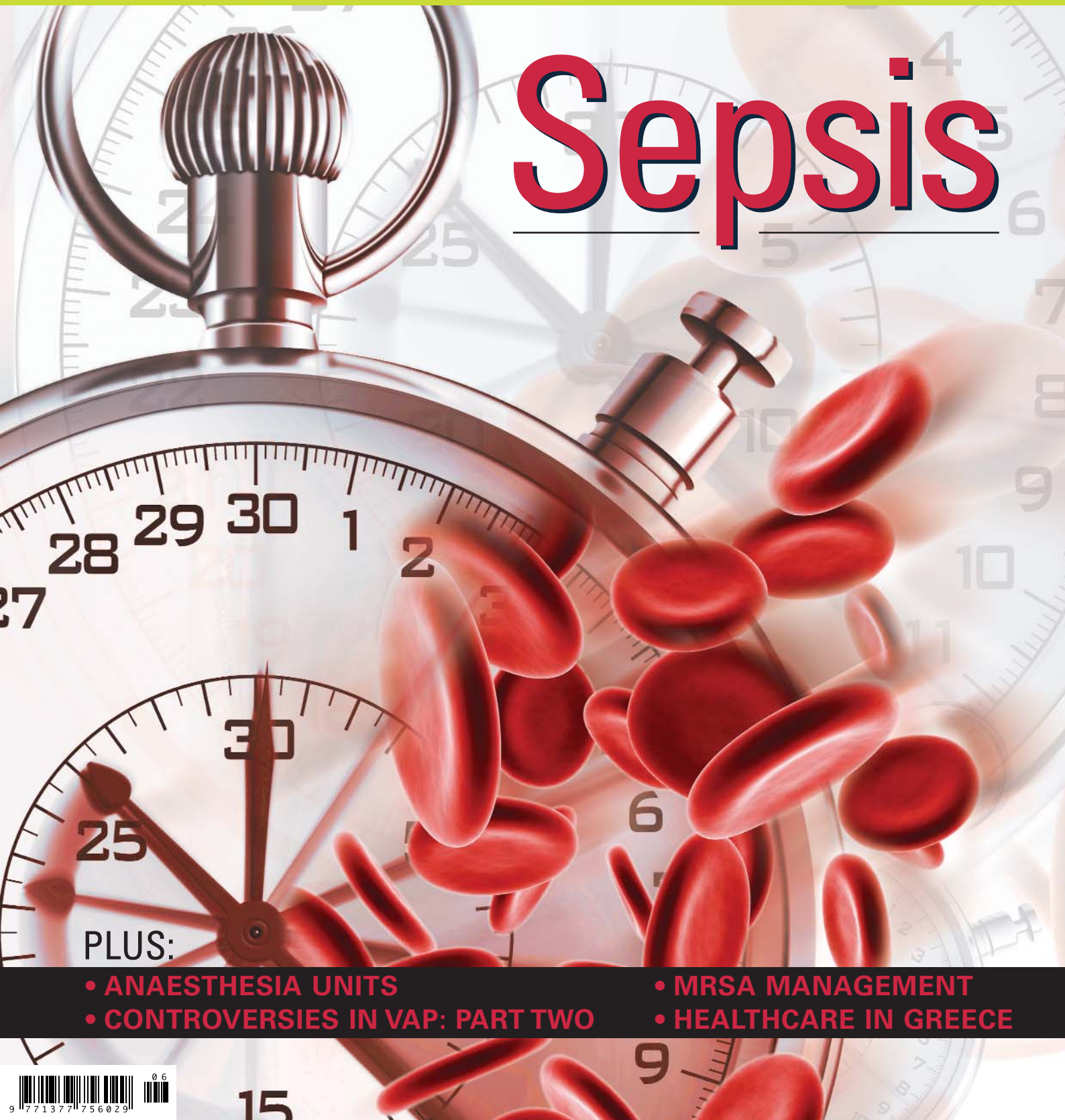
Sepsis



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*Ram FSF et al, The Cochrane Library 2005, Issue 4

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Sepsis

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Sepsis is one of the most difficult and challenging conditions to manage in our ICUs, as it can develop in many different situations and its' course varies widely from patient to patient.

As the incidence of sepsis increases, so too does our resolve to find effective treatments for what has rapidly become one of the most deadly conditions faced by ICU patients. It is now widely accepted amongst intensive care professionals in the field that early diagnosis and appropriate treatment are key aspects of effective management in this complex syndrome. However, the management of sepsis patients involves a variety of therapeutic interventions. Once a patient is diagnosed, prompt antibiotic therapy is needed to eliminate the underlying infection, and haemodynamic stabilisation must be achieved. Organ support and other interventions may also be required, dependant on the patient's condition.

In order to improve the diagnosis, management and outcome of patients with sepsis, the Surviving Sepsis Campaign (SSC) was created by the ESICM (European Society of Intensive Care Medicine), the ISF (International Sepsis Forum) and the SCCM (Society of Critical Care Medicine). The aim of the SSC was to set out clearer clinical definitions and standards of care to assist in the timely diagnosis and effective management of patients and, ultimately, to save lives.

In this issue, Dr. Dellinger and Christa Schorr outline the importance of improving performance within the critical first six-hours of severe sepsis, while Dr. Townsend updates us on changes to the treatment guidelines recently released by the SSC. Dr. Pugin discusses the management care bundles derived from the SSC guidelines and delves deeper into the challenges associated with choosing the right treatment for the right patient at the right time. In his contribution on this timely subject, Dr. Niederman questions the value of implementing the care bundle recommendations in their current form, arguing that there are a number of important elements that have been omitted.

Our Matrix features part two of Karen Pickett's comprehensive overview of the current controversies in ventilator-associated pneumonia, this time focussing on diagnosis and antimicrobial management of VAP; while Dr. Nulens of Belgium collaborates with his Dutch colleagues on an interesting article on the cost effectiveness of crossborder MRSA management.

Dr. Zugck and colleagues discuss the use of telemonitoring to improve cost effectiveness in patients with chronic heart failure; and, despite the current push for a more paper-free clinical existence, in our Views section, Dr. Alansari returns to **ICU Management** along with Dr. Maghrabi to argue that paper (in the form of a Daily Goal Sheet) can be the organisational key to well-managed quality care for our patients.

In **ICU Management**, we find ourselves in the sometimes enviable, always complex and inevitably changeable "driver's seat" of our units. It is our job to set standards of care, initiate training, monitor results and re-evaluate our progress, all the while remaining mindful of the bottom line. In battling sepsis, one of the deadliest threats to our patients in the ICU, we need to employ these same mandates. By raising awareness of sepsis, encouraging timely diagnosis and appropriate treatment, providing ongoing education into the complexities of sepsis and its management, and continually evaluating therapeutic strategies and patient outcomes, we can surely lessen— if not completely eradicate this serious, and often fatal condition.

Letters to the Editor & Requests for References Cited in ICU Management: **editorial@icu-management.org**

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News

News Europe

Survey: EU Doctors Slow to Adopt eHealth Practices

The use of ICT in the healthcare sector is becoming a daily practice, as general practitioners increasingly use computers either to store medical patients' data or assist patient consultation, according to a recent survey.

A report entitled 'Benchmarking ICT use among general practitioners in Europe', one of several EU pilots on eHealth indicators, shows that on average, 87% of European doctors use a computer. Furthermore, 80% of the practices in the 27 EU countries store administrative patient data electronically and computers can be found in 78% of consultation rooms.

However, continues the survey, "there is still room for improvement," notably regarding electronic networks connecting doctors' IT systems with other health actors, the electronic exchange and transfer of patient data and electronic interaction with patients.

The report, which draws on a survey involving some 7,000 general practitioners, points to huge variations in the use of ICT for health across Europe. The study, published on 25 April 2008, names Denmark, the Netherlands, Finland, Sweden and the UK as "the European frontrunners" in eHealth use by doctors. On the other hand, there is "considerable room for improvement" in the use of eHealth in Greece, Latvia, Lithuania, Poland and Romania. The other member states are considered to be a "large group of average performers".

Doctors were also surveyed on their general attitudes towards ICT and their perception of facilitators and barriers towards a wider uptake of eHealth. According to the results, EU doctors are "quite positive" about ICT's potential to improve the quality of healthcare services. As for boosting the further spread of eHealth, they think that the its inclusion in the curricula of medical education, more IT training for general practitioners and the existence of a clinical information network for all health actors could help.

News Research

Naturally-occuring Protein May Be Effective In Limiting Heart Attack Injury And Restoring Function

www.mcw.edu

Medical College of Wisconsin researchers in Milwaukee have shown for the first time that thrombopoietin (TPO), a naturally occurring protein being developed as a pharmaceutical to increase platelet count in cancer patients during chemotherapy, can also protect the heart against injury during a heart attack.

The study, led by John E. Baker PhD, professor of pediatric surgery in the division of cardiothoracic surgery, was published in the January 2008 issue of Cardiovascular Research. The importance of these findings was underscored in an accompanying editorial.

Currently there are no therapies available to directly protect the heart against the damaging effects of a heart attack. Dr. Baker's team has shown that administering a single dose of TPO to rats during a heart attack decreased the extent of permanent muscle damage to the heart and increased the ability of the heart to function afterwards, when compared with no drug treatment. Additionally, they found that a single cardioprotective treatment with TPO did not increase platelet count. This novel finding suggests the cardioprotective actions of TPO are separate from its ability to increase platelet count.

Dr. Baker has submitted a US and worldwide patent application on the tissue protective properties of TPO. Dr. Baker's discovery is licensed to Cardiopoietis, a Wisconsin LLC, formed to develop drugs for the treatment of heart attacks.

TPO is a hormone, which is naturally produced by the liver and kidney. Dr. Baker's investigative team had previously shown that erythropoietin, a protein and pharmaceutical currently in clinical use to treat anemia in end-stage kidney disease, protects the rat heart against injury during a heart attack. They found that although erythropoietin and TPO have separate functional roles, there were similarities in the structures of the two proteins that suggested TPO may have protective properties similar to erythropoietin.

"We hypothesized that a single treatment with TPO during a heart attack would be sufficient to protect the heart from injury," says Dr. Baker. "Our results suggest that TPO directly protects the heart and may represent a novel approach for the treatment of acute heart attack."

The study was supported by a grant from the National Institutes of Health, National Heart, Lung and Blood Institute.

News Industry

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Performance Improvement in the Critical First Six Hours of Severe Sepsis

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The Surviving Sepsis Campaign (SSC), an initiative of the European Society of Intensive Care Medicine, the International Sepsis Forum, and the Society of Critical Care Medicine, was developed to improve the treatment of sepsis. The Campaign was begun in 2002 with a pledge to demonstrate a measurable reduction in severe sepsis mortality by 2008. International guidelines for the management of severe sepsis were developed and published jointly in Critical Care Medicine and Intensive Care Medicine in 2004 with the first revision occurring in 2008. The guidelines are currently sponsored by 16 organisations with interest and involvement in sepsis.

In 2005 the SSC partnered with the US-based Institute for Healthcare Improvement to create the SSC performance improvement program consisting of two severe sepsis bundles, one for the first six hours and one for the first 24 hours of management. The bundle element goals were chosen by the steering committee of the SSC. Each bundle includes goals of therapy based on key recommendations from the guidelines, which are converted to measurable indicators ascertainable from concurrent or retrospective chart review. The metrics to assess these indicators, data collection tool and the associated software program were developed by Cooper University Hospital (Camden, USA), Rhode Island Hospital (Providence, USA), and the Institute of Healthcare Improvement (Cambridge, USA). Current thinking is that the most crucial time for influencing outcome in the patient with severe sepsis is the first six hours. The first bundle of quality indicators (also called the resuscitation bundle) targets the first six hours of severe sepsis management and has 3 to 6 goals (quality indicators) to achieve, the number depends on whether or not the patient has hypotension and/or shock (Figure 1).

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Severe Sepsis Resuscitation Bundle

Complete tasks within 6 hours of identifying severe sepsis.

1. Measure serum lactate.
2. Obtain blood cultures prior to antibiotic administration.
3. Administer broad-spectrum antibiotic within 3 hours of ED admission and within 1 hour of non-ED admission.
4. In the event of hypotension and/or serum lactate > 4 mmol/L:
   a. Deliver an initial minimum of 20 mL/kg of crystalloid or equivalent.
   b. Begin vasopressors for hypotension not responding to initial fluid resuscitation to maintain MAP > 65 mm Hg.
5. In the event of persistent hypotension despite fluid resuscitation (septic shock) and/or lactate > 4 mmol/L:
   a. Achieve a central venous pressure (CVP) of > 8 mm Hg
   b. Achieve a central venous oxygen saturation ($ScvO_2$) > 70% or mixed venous oxygen saturation ($ScvO_2$) > 65%

Implement the 6-hour bundle. Available at: http://ssc.sccm.org/6hr_bundles.

Surviving Sepsis: Updates to the Management Bundle

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There is considerable controversy and debate surrounding much of what we do at the bedside in critical care, and the management of sepsis is no exception. Developing a global standard of care for sepsis management, based on consensus amongst international experts is a real challenge. Much has been written and discussed about the value of protocols and bundles in general, and the individual elements of the sepsis bundles from the Surviving Sepsis Campaign (SSC) in particular. These bundles are officially being used and compliance data being collected in 250 hospitals in 30 countries. Several manuscripts have been already been published that demonstrate a significant reduction in mortality through the use of the sepsis bundles. Nonetheless, debate about the use of bundles, or protocols and the choice of specific strategies in the sepsis bundles, continues. Many feel that protocols or bundles are not necessary to improve care, while others argue that recent published studies mandate a change in some bundle elements.

The largest controversy surrounding the use of bundle strategies is whether bundles, once established, can keep up pace with the literature to remain up to date. In the interest of clarification, and since the publication of the 2008 Surviving Sepsis Campaign International Guidelines for the Management of Severe Sepsis and Septic Shock, it is now reasonable to discuss whether updates to the Surviving Sepsis Campaign's Management Bundle are now necessary (SSC 2008). The Management Bundle aimed to standardise, to the extent possible, care practices within individual hospitals for the first 24 hours of care that patients with severe sepsis and septic shock received. The three most common areas of debate at the time the bundles were built have remained even now the use of steroids, tight glucose control, and activated Protein C.

1. Low-dose steroids administered for septic shock in accordance with a standardised ICU policy
2. Drotrecogin alfa (activated) administered in accordance with a standardised ICU policy
3. Glucose control maintained > lower limit of normal, but < 150 mg/dl (8.3 mmol/L)
4. Inspiratory plateau pressures maintained < 30 cm H_2O for mechanically ventilated patients

Figure 1: Surviving Sepsis Campaign Management Bundle

Glucose Control

The two studies that have continued to raise the question of whether tight glucose control is safe and effective for patients with severe sepsis and septic shock were published in 2006 and 2008 respectively (Van den Berghe et al. 2006; Brunkhorst et al. 2008). Both articles have raised questions about the safety and efficacy of glucose control in medical ICU patients. The question for improvement minded physicians is does tight glucose control without hypoglycemia improve outcomes for patients with severe sepsis and septic shock?

Unfortunately, this is a case where the literature has confused physicians. The first reports from Van den Berge in cardiac surgery patients demonstrated a benefit from tight glucose control. In the second study in a medical ICU and in the VISEP trial there was a significant hypoglycemia rate. In the second Van den Berge trial, there was a benefit for patients who survived in the ICU longer than 3 days. One of the problems with these trials however, is that the experiment of tight glucose control without hypoglycemia was not tested since the glucose control was not tight but caused unacceptable hypoglycemia. The purpose of the VISEP trial was to determine if the benefit of strict glucose control, as seen in Dr. Van den Berghe's initial study, applies to patients with severe sepsis and septic shock. Using the same targets and protocol as Dr. Van den Berghe, investigators randomised patients to conventional insulin therapy (goal, 180 to 200 mg/dL) or intensive insulin therapy (goal, 80 to 110 mg/dL).

The trial was stopped early, after enrollment of 480 patients, due to the increased incidence of hypoglycemia in the intensive arm (17.6%) versus the conventional therapy arm (4.5%). The reporting of hypoglycemia as a life-threatening incident was also significantly higher in the treatment arm than in the control arm (5.3% vs 2.1%, respectively). There were no significant differences in the 28- or 90-day mortality rates between the two arms. A trend toward longer ICU stay by approximately two days was seen in patients in the intensive arm. Multivariate analyses showed intensive insulin therapy and the patients' age to be risk factors for hypoglycemia.

Both trials used the same insulin titration protocol, but all that we really know is that a protocol that worked in a surgical ICU did not work well in a medical ICU and that the protocol, when unrefined

and handed-off for implementation to nurses unfamiliar with the protocol, caused hypoglycemia. We do not know if a protocol that actually resulted in tight control in a medical ICU would result in benefit.

The other issue is does controlling in a wider range of 80 to 150 mg/dl give similar benefit? A few observational trials have suggested that protocols aimed at this level have lower incidence of hypoglycemia and most likely benefit patients compared to the no protocol to control glucose. All told, the Surviving Sepsis Campaign has evaluated the evidence in the new guidelines and chosen not to change the bundle element. The rationale and evidence grade and strength of recommendation are detailed in the guidelines themselves.

Corticosteroids in Sepsis

The CORTICUS trial was recently completed and showed no effect of steroids except earlier reversal of shock in those patients who had shock reversed and a non-statistically significant trend toward more patients with shock reversal (Sprung et al. 2008). Do we really need a policy on the use of steroids in the ICU with this new information?
It is important to recognise that the CORTICUS trial enrolled a different patient population than the trial conducted by Ananne, which showed a beneficial effect of steroids on patient survival (Ananne et al. 2002). The CORTICUS patients were less ill by severity score and it is postulated that many vasopressor refractory patients were not allowed entry into the trial by the treating physician since centers participating in the CORTICUS trial had steroids available to be given as an alternative to trial enrollment. This likely created selection bias. In the CORTICUS trial, patients could be enrolled up to 72 hrs after onset of septic shock (as opposed to 8 hours for the Annane trial). To get into the Annane trial, patients had to exhibit hypotension after fluid resuscitation and vasopressor administration which was not the case for the CORTICUS study where patients only needed to be on vasopressors after fluid resuscitation, thus the two patient populations were arguable very different.

The CORTICUS trial was considered in our new SSC recommendations for steroid administration. Our new recommendation suggests that steroids should be given to patients with blood pressure poorly responsive to fluid resuscitation and vasopressor therapy. This is a level 2 (weak) recommendation, which is prefaced by "suggest" with the implication being that the clinician probably should give them in the scenario listed in the recommendation. We no longer recommend a cortisol stimulation test to make decision for administering for the reasons alluded to in the CORTICUS paper, including variability in the cortisol stimulation test assays currently available.

Given the potentially different patient populations, as well as other factors, it is probably more imperative than ever that hospitals develop a policy in their ICU's for the rational administration of steroids. In using the steroid bundle element, it is important for hospitals participating in the SSC to remember that the steroid indicator is scored based on compliance with the hospitals' own policy (based on the practical considerations and controversies that appear as of yet unresolved). In the extreme, if a hospital makes a policy not to use steroids in septic shock, then technically that hospital would get credit for all patients just the same as a hospital that used steroids for all patients with septic shock. Likewise, if the policy is made to only use corticosteroids for patients within certain parameters for central venous pressure and moderate to high doses of vasopressors with ongoing hypotension and hypoperfusion, then again that is what the hospital is scored against.

Activated Protein C

The Surviving Sepsis Campaign downgraded their recommendation on the administration of recombinant human activated protein C (rhAPC) in the newest guidelines based on evidence published since the PROWESS trial. This determination again has raised the question, do we need a policy on the rational administration of rhAPC or should we even be considering using the drug? As with steroids, any controversy around the effect of the drug in the literature is probably best resolved by standardising your ICU's policy with respect to administering the drug.

We have updated our previous recommendation for use by recommending rhAPC with a level 2 (weak), which is prefaced by "suggest" with the implication being that the clinician probably should give them in the scenario listed in the recommendation. The recommendation for use is reprinted here:

"We suggest that adult patients with sepsis induced organ dysfunction associated with a clinical assessment of high risk of death such as APACHE II ≥25 or multiple organ failure receive APC (Grade 2B)."

Likewise, the new recommendations include a level 1 (strong) recommendation against use with APACHE II < 20 or with one organ failure (Grade 1A). Also included is a level 2 (weak) recommendation that patients within 30 days of surgery, otherwise qualifying for rhAPC, receive rhAPC (Grade 2C).

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Do Care Bundles Help in Implementing Sepsis Guidelines?

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A new set of guidelines has been published recently in Critical Care Medicine and Intensive Care Medicine (Dellinger et al. 2008a; Dellinger et al. 2008b), representing the consensus of a group of renowned sepsis experts, and supported by a large number of national and international critical care societies. All recommendations were graded according to a grading system based on both their strengths and levels of published evidence, after an extensive review of the literature. The result of this endeavor is a dense 43 page-text, with 46 different recommendations, and 341 references (Dellinger et al. 2008b). Although many recommendations were graded as "strong", few of them had high levels of published evidence, particularly in key elements of sepsis therapy.

Concerns

Physicians are now faced with the crucial decision of whether they should follow these recommendations or disregard them. Their decision depends both on their overall confidence in the guidelines as they are laid out, as well as their individual belief that a given therapy is good for their patients or not. It seems obvious that guidelines are made to guide in a general sense, and may not be applicable to all patients, particularly in the case of sepsis being such a heterogeneous syndrome. A blind application of guidelines as strict treatment rules is most probably even dangerous. Other factors need to be taken into consideration, such as co-morbidities, prognostic aspects, particular septic patients subpopulations, availability for some of these therapies, etc. It is impossible that guidelines may take into account all these different situations, and modulation of the therapeutic approach for a given patient is generally the rule. Another issue that invariably arises when it comes to guidelines is the possible conflicts of interest of panel members linked to their relation with the industry as well as their personal scientific interests, which may impact on grading strength and levels of evidence for a given recommendation. These conflicts need to be clearly stated in the guidelines document, which was the case for the 2008 sepsis guidelines, at least for relations with the industry (Dellinger et al. 2008a; Dellinger et al. 2008b). The need for a consensus among a large panel of experts is also likely to avoid biased decisions derived from significant conflict of interests of a small number of experts.

Guidelines

Physicians may like or dislike guidelines or protocol-oriented care, but evidence exists in the literature that when protocols are implemented in an ICU, they are generally associated with improved outcome. This has for example been elegantly shown for ventilator weaning protocols. This may be due to different factors, including the indisputable value of measuring performance, and that the development of a protocol requires us as physicians to rethink our approach, write it down, and make the effort to educate caregivers during the implementation process. Protocols have also, in our specialty, the great advantage of obliging us to deal with essential issues such as timing and logistics. A treatment is good not only because of its nature, but also because it is given to the right patient, at the right dose, and at the right time. Protocols may thus be considered as a minimal or basic standard of care on which modulation for a given patient or situation is possible.

Use of Protocols in Management of Sepsis

In the case of sepsis treatment, physicians still face the problem of generating and implementing a protocol based on > 40 different therapeutic measures. Implementing them all at once or alternatively one by one in a protocol seems both insurmountable and illogical. A group of sepsis experts, members of the Surviving Sepsis Campaign, extracted 10 therapeutic measures from the 2004 sepsis guidelines (Dellinger et al. 2004) that they felt were most important for the treatment of septic patients. They proposed to implement them all at once - the sepsis bundles - with the theoretical advantage of the addition of benefits of the 10 measures (www.ihi.org). This protocol was divided into two parts. This first part (resuscitation bundle, to be achieved within 6 hours after recognition of severe sepsis or septic shock) included items such as early recognition of the severity (lactate measurement), microbiological cultures before an early administration of antibiotic therapy, and early-goal directed fluid and vasopressor resuscitation. The second part (management bundle, to be achieved within 24 hr after recognition of severe sepsis or septic shock) included items such as glucose control, 'low stretch' mechanical ventilation, and the recognition and treatment of patients who may benefit from hydrocortisone and activated protein C therapy.

Implementing Guidelines

Implementing sepsis bundles is a challenge and takes resources. It is for example important to have a good knowledge of where in the institution the initial care of septic patients is performed, to

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target the right population of caregivers to instruct, and also (perhaps) to adapt the protocol to the local situation. It is also crucial to decide what educational strategy will be needed to have a chance to achieve the pre-defined goals. We also feel that it is important to make the effort of measuring performance, i.e. adherence to bundles and mortality, to be able to control for the efficacy of implementing the bundles, and to motivate the troops. We have recently implemented the sepsis bundles in our institution, and opted for a multimodal approach. We had previously identified that the initial care of septic patients was mostly performed in the emergency room. Educational tools included the publication of pocket guidelines and posters, dedicated courses for nurses, interns and fellows, frequent feedback to caregivers on their performance (% adherence to items of the bundles and % mortality), patrolling of a dedicated research nurse in the emergency department (ED) and in the ICU with one-on-one discussions with doctors in case of suboptimal care. Before implementing the sepsis bundles protocol, we had measured outcomes, which served as a baseline for further measurements during the implementation and follow-up periods. We have significantly ameliorated the compliance of caregivers for all the elements of the sepsis bundles. Preliminary analysis of the data on 200 patients shows that 71% of patients received adequate care according to the resuscitation bundle after the implementation period as compared with 48% before. Door-to-perfusion of antibiotics time was cut in half. Mortality in patients resuscitated according to the sepsis bundle (all items) was 12%, compared with a mortality of 27% in patients in whom one or more items were missing ($p = 0.02$). These results indicate that the implementation of sepsis bundles can modify clinical practice, positively and significantly impact survival rates (Gao et al. 2005).

Future of Sepsis Management

A reappraisal of the elements composing the sepsis bundles may be necessary in the future, given new publications on sepsis management. For example, recent papers on hydrocortisone therapy and glucose control cast some doubts on their usefulness in the management of patients with severe sepsis and septic shock (Sprung et al. 2008; Brunkhorst et al. 2008). In the most recent sepsis guidelines, both therapies received weak recommendations. For glucocorticoids substitution, it becomes apparent that not all septic shock patients may require this treatment. Doubts still exist whether the most severe patients may require substitution, and many clinicians still give steroids despite the publication of the CORTICUS trial (Sprung et al. 2008). Tight glucose control seemed to cause harmful effects in a recent multicentre German trial (Brunkhorst et al. 2008). However sepsis guidelines do not suggest tight control, but to prevent 'excessive' hyperglycemia with insulin treatment. The administration of activated protein C has also been a matter of intense debate. A multicentre placebo-controlled trial has been initiated in patients with septic shock, which will hopefully settle the issue with this treatment.

Conclusion

The implementation of guidelines using a bundle of measures seems to be a valuable approach, and large trials are now needed to confirm of infirm this. If anything, it forces caregivers to rethink, revise and perfect their treatment protocols, perform education, dialogue with other units and departments, and measure outcomes. Such a program is likely to favor 'state of the art' care, and positively impact on the outcome of patients with severe sepsis and septic shock. ■

continued from p. 8

CONCLUSION

As hospitals were allowed to review the literature with regards to the management bundles and make high level policies for their own institutions with regard to steroid and rhAPC administration, the SSC has, at this time deferred making changes to these bundle elements. It still seems prudent to us that hospitals work to standardise their care patterns so that they can measure their results and evaluate what works best for their patients. With respect to glucose control, the SSC standard has always been more liberal than the Leuven protocol consistent with a beneficial effect seen in subgroup analyses of these trials as well as some observational data. It will be essential to continue to monitor upcoming trial results and incorporate new information into future recommendations. Finally, the SSC itself will soon be able to comment directly on the experience of hospitals that have used the SSC bundles to treat patients with severe sepsis and septic shock with data when the greater than 16,000 patient database is fully analysed. ■

Are there Compelling Data that Sepsis Bundles Can Improve Patient Outcomes?

Sepsis bundles are a prescriptive approach to patient management that include a number of superfluous elements, and yet omit important interventions that can improve patient outcome. The benefits and limitations of this approach are examined.

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Introduction

In 2008, the standard of care for patients with sepsis is to implement a "sepsis bundle", as defined by the Surviving Sepsis Campaign (SSC), and endorsed by the US-based Institute for Healthcare Improvement (IHI). While my goal is not to argue against standards and protocols for care, I am unconvinced that the current sepsis bundles are valuable when used as recommended. Rather, there are some elements of the bundle that are useful (early goal directed therapy, EGDT), while others may be less valuable and implementation of these latter components may distract attention from essential interventions, some of which are not included in the bundles (such as how to select appropriate antibiotics and initiation of care by a rapid response team). In addition, bundles are very prescriptive and there is little opportunity to modify them for special patient populations such as the elderly, those in renal failure and those with heart failure. In fact, the SSC website states that all of the elements in the bundle must be used, and that addition of other strategies not found in the bundles is not recommended (SSC website, December 2007). Finally, several nihilists have questioned whether one of the recommendations in the bundle, the need to evaluate all patients for the use of activated protein C, is a consequence of undue industry influence (Eihacker et al. 2006).

What is Included in the Sepsis Bundle?

The currently endorsed and widely implemented sepsis bundle includes a resuscitation bundle to be achieved within 6 hours and a sepsis management bundle to be completed within 24 hours. The resuscitation bundle includes:

- Measurement of serum lactate,
- Collection of blood cultures prior to antibiotics,
- Administration of broad spectrum antibiotics within 3 hours,
- Providing aggressive fluids or pressors for those with hypotension, and
- Monitoring of central venous pressure and mixed venous oxygen tension in the setting of persistent hypotension.

The management bundle requires:

- A standard policy for use of low dose steroids,
- Evaluation of the need for activated protein C by a standard policy,
- Adequate blood glucose control, and
- Maintenance of inspiratory plateau pressures < 30 cm water for ventilated patients.

Do Sepsis Bundles have Benefits?

The data on the benefit of sepsis bundles are conflicting, but it is clear that when implemented, most, if not all, of the benefit comes from the use of early goal-directed therapy. In addition, the implementation of a hospital-wide rapid response team, not a specific recommendation of the bundle approach, is also invaluable to improve the outcome of sepsis patients. There are several studies describing a benefit from implementing a sepsis bundle. Gao et al. reported a significantly reduced mortality when sepsis bundles were used, but compliance was only 30% with the 24-hour elements, and 52% with the 6-hour elements, and timely antibiotic administration was given to only 74% of patients (Gao et al. 2005). These findings left it uncertain whether any of the individual bundle elements, beyond timely administration of antibiotics, were responsible for the differences in mortality. Shapiro et al. found a trend of reduced mortality in emergency department patients when managed with a sepsis protocol, compared to historical controls, but the major impact of using the protocol was to give antibiotics sooner, and to give more appropriate antibiotics. There was no difference in the use of corticosteroids or drotrecogin alpha in the protocol period, compared to the control period (Shapiro et al. 2006).

Nguyen and colleagues conducted a 2-year study of 330 emergency department patients with septic shock, and evaluated processes of care and outcomes over time, compared to a baseline period. Bundle compliance increased from 0 to 51.2%, and bundle completion led to lower mortality (21% vs. 40%), but in a multivariate analysis, only the completion of early goal directed therapy, and not the other bundle elements (CVP monitoring, broad spectrum antibiotics within 4 hours, monitoring of

lactate clearance, and corticosteroid therapy for suspected adrenal insufficiency), led to decreased mortality (Nguyen et al. 2007). One reason that timely antibiotic administration had no impact was that the rate of achieving this goal stayed at approximately 90% during the study, but this did not differ from baseline rates.

Early goal directed therapy (EGDT) is an essential element in sepsis bundles, and requires administration of 5-8 liters in the first 6 hours (Rivers et al. 2001), and in the original study of EGDT, this approach by itself led to a reduction of sepsis mortality from 46% to 30%. This type of fluid resuscitation is important for the success of sepsis bundles, and as discussed above, may be the major factor leading to reduced mortality, but the freedom to modify the amount of fluid in special populations seems at odds with the SSC recommendations. El Solh et al. used a sepsis protocol in 87 elderly patients, and administered 4-6 liters of fluid in the first 6 hours (El Solh et al. 2008). In addition to the elderly, the safety of large volume resuscitation for those with pre-existing heart failure or renal failure remains unknown.

What Should be Added to Sepsis Management that is not in Bundles and What is Superfluous?

Another problem with the sepsis bundle approach is that it does not include some key interventions that can reduce mortality, while it recommends other evaluations of questionable value. For example, development of a rapid response team as a mechanism to care for septic patients has been shown to reduce mortality from all forms of shock. The benefit comes from bringing critical care interventions to patients, even before they reach the ICU. When implemented, a rapid response team reduces mortality by shortening the time required to administer fluid resuscitation and by reducing the time to antibiotic administration (Sebat et al. 2007). While sepsis bundles do not suggest that this approach is wrong, they also do not include the need to establish this type of care plan. On the other hand, sepsis bundles do include the need for a standard policy for the administration of low dose steroids and activated protein C. In addition, glucose control is included in the 24-hour bundle. All three of these recommendations seem relatively limited in value, given new data. In addition, the latest sepsis guidelines have effectively withdrawn strong support for these interventions (Dellinger et al. 2008). Hospitals that made extra interventions to be compliant with these components of the bundles may now feel that the efforts were wasted.

One important area where there is not adequate guidance in either the sepsis bundles or the sepsis guidelines is how to actually achieve the administration of adequate empiric antibiotic therapy. The bundles assume that giving antibiotics rapidly is the only goal, with no focus on how to give the correct antibiotic for each patient situation. For example, a series of specific recommendations on therapy, depending on the suspected site of infection, could be valuable. In addition, comments on specific antibiotic issues are lacking. These issues include:

- The need to use third generation cephalosporin monotherapy very cautiously in the ICU,
- Limits of using quinolones because of current resistance issues,
- Risks and benefits of combination therapy for sepsis,
- Method to combine antibiotics (avoiding dual beta-lactam therapy),
- Mode of dosing antibiotics (continuous vs. intermittent infusion),
- Impact of recent antibiotic therapy on antimi crobial selection, and
- The need to adapt therapy to local microbiology.

The new sepsis guidelines tackle some of these issues, but the bundle itself simply recommends giving "broad spectrum" antibiotics quickly, implying that any therapy is acceptable, if it is given rapidly.

Finally, the use of a sepsis bundle requires some consensus about what should be included. Although the SSC bundle is most widely used, Fong and colleagues looked at 3 different sepsis bundles (IHI's, the Joint Commission's, and the VHA system's) and found that compliance rates in a given hospital were widely variable, depending on which sepsis bundle was used as the standard for measurement (Fong et al. 2007). With this being the case, which approach is optimal, and which one should be used?

Conclusions

For all of the reasons discussed, sepsis bundles are an ineffective attempt to standardise care for critically ill patients. They include many superfluous elements, while omitting essential interventions that are likely to improve outcome. My suggestion is that hospitals focus on the most important elements of patient care in sepsis, rather than the bundle approach. These elements include rapid delivery of care (rapid response teams), EGDT (adapted to specific patient populations' needs) and the timely and accurate administration of antibiotic therapy. ■

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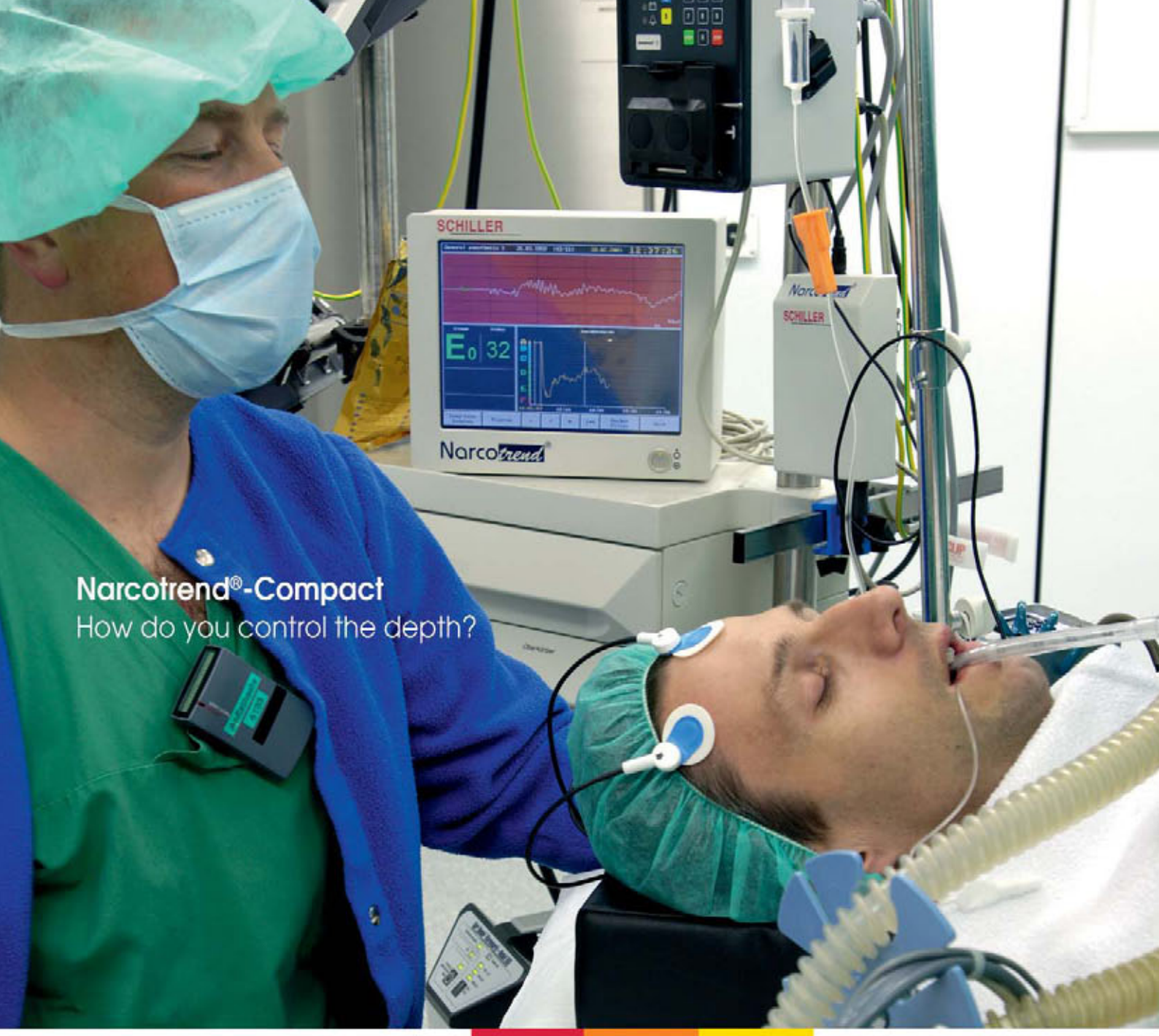

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Current Controversies in Ventilator-associated Pneumonia

Part II: Diagnosis and Antimicrobial Management

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A recent meeting in Berlin gathered six experts in the field of ventilator-associated pneumonia (VAP) to present an overview of the many aspects related to VAP that remain poorly defined. In part I of this report (ICU Management, March 2008), we highlighted the discussions surrounding the epidemiology and pathophysiology of VAP. In this second part, we will focus on controversies surrounding the diagnosis and management of VAP.

Agreement and Controversy in the Diagnosis of VAP

General Agreement

There is general agreement that the diagnosis of VAP can be difficult! There is also agreement that an accurate diagnosis is crucial in enabling rapid initiation of antimicrobial therapy when needed and in avoiding unnecessary antimicrobials in patients who are not infected.

Ongoing Controversy

The best means of making a diagnosis is perhaps the most controversial area in the field of VAP. The main problem is that there is no gold standard against which other techniques can be compared.

There are two main approaches to the diagnosis of VAP: Non-invasive, based largely on clinical features and endotracheal aspirate cultures; and invasive, based on quantitative culture of secretions collected by invasive techniques.

Non-invasive, Clinical Approach

Many of the standard diagnostic features of pneumonia, e.g., fever, leukocytosis, purulent sputum, are unreliable and non-specific in the critically ill, mechanically ventilated patient. The chest X-ray, an important part of the non-invasive diagnostic approach, has reasonable sensitivity but specificity is low as several conditions can mimic or hide the chest X-ray features of VAP, including atelectasis, cardiogenic edema, acute respiratory distress syndrome, pulmonary embolus, pulmonary fibrosis. Combining chest X-ray findings with other clinical features increases specificity, but reduces sensitivity. The Clinical Pulmonary Infection Score (CPIS), which includes five components - temperature, blood leukocyte count, tracheal secretions, oxygenation index, and chest X-ray - can also be used. In the original study, the diagnostic accuracy of the CPIS was quite good (Pugin et al, 1991); however, later studies did not confirm these results (Luyt et al, 2004). Sequential measures of biomarkers, like C-reactive protein (CRP) or procalcitonin (PCT), perhaps combined with the CPIS, may help improve the specificity of the clinical approach to diagnosis.

The clinical approach generally uses cultures of endotracheal secretions to aid diagnosis. Qualitative cultures of endotracheal aspirates are often not reliable enough to make a diagnosis of VAP as it is difficult to distinguish between colonising and pathogenic organisms, although a sterile culture in a patient without previous exposure to antibiotics suggests that VAP is unlikely. Quantitative cultures provide more reliable microbiological data but are not available everywhere as they are time-consuming and more costly.

The main advantages of the clinical approach are that it is non-invasive and requires no specialist equipment or skills.

Invasive Approach

The invasive approach replies more heavily on obtaining quantitative cultures of secretions by various techniques, including bronchoalveolar lavage (BAL) fluid culture, plugged telescoping catheter, and protected-specimen brush (PSB). The diagnostic accuracy of these techniques is generally good with high sensitivity and specificity although sensitivity depends on the cut-off thresholds chosen to distinguish between colonisation and infection. Importantly, diagnostic accuracy is dependent on several factors including appropriate selection of the sampling area and appropriate timing, ideally before introduction of new antimicrobial therapy, as accuracy decreases if performed after new antibiotics are introduced (Prats et al, 2002). Non-bronchoscopic, or mini-invasive, techniques have also been developed. These techniques have reasonable sensitivity and specificity, and seem to represent an attractive alternative to bronchoscopic techniques (Campbell, Jr., 2000). They are also associated with few complications, require fewer technical skills, and can be easily repeated at the bedside.

Advocates of the invasive approach argue that it enables a more accurate microbiological diagnosis to be made, thus assisting with antibiotic choices and reducing unnecessary antibiotic use. In addition, de-escalation may improve outcomes and invasive techniques may help in making de-escalation decisions (Giantsou et al, 2007). However, opponents argue that the invasive approach has several drawbacks, including that accuracy is strongly dependent on sampling time, results are not always reproducible and consistent, early forms of infection may be missed, specialised operator skills are required for bronchosopic techniques, microbiological collaboration is required, and there are few data that suggest that these strategies actually have any impact on outcomes.

Three randomised studies (Ruiz et al, 2000; Sanchez-Nieto et al, 1998; Sole et al, 2000) compared the use of invasive versus non-invasive techniques on outcomes and reported no differences in morbidity or mortality; however, these studies were limited by the small numbers of patients included, and by the fact that physicians did not adjust antibiotic therapy in many cases even when cultures were negative. In a study by Fagon et al (Fagon et al, 2000), organ failure rates and mortality rates were higher in patients managed according to a non-invasive protocol compared to those managed by an identical protocol but with invasive sampling. However, this study compared qualitative endotracheal aspirate culture with quantitative invasive cultures, thus limiting interpretation of the results. Finally, a recent prospective cohort study suggested no overall difference in mortality rates in patients managed with a clinical versus an invasive approach (Canadian Critical Care Trials Group, 2006). However, limitations in this study, including a high ratio of initially inappropriate therapy in the invasive group, exclusion of patients infected by MRSA or Pseudomonas, some of the most common but also most problematic pathogens in VAP, and poorly performed de-escalation therapy in the invasive group, again restrict the conclusions that can be drawn.

Currently, therefore, the jury is still out regarding the best approach to diagnosing VAP, despite recent American Thoracic Society/Infectious Disease Society of America (ATS/IDSA) guidelines (2005) encouraging the use of quantitative lower respiratory tract cultures.

Agreement and Controversy in the Antimicrobial Treatment of VAP

General Agreement

All experts agree that the aim of antimicrobial therapy in VAP is to target the most likely causative organism with the most appropriate antibiotic(s) as early as possible. There is little doubt that correct choice of initial antimicrobial therapy is associated with better outcomes in patients with VAP. Importantly not only spectrum, but also dose, route, and timing, must be considered when selecting antibiotics, and collaboration between intensivists and microbiologists can facilitate these decisions. Multiple factors can affect antibiotic doses in ICU patients, including haemodilution, permeability alterations, hypoalbuminaemia, renal dysfunction, haemodialysis. It is possible that higher doses are needed in ICU patients than in other patient groups, and this warrants further study.

If broad-spectrum antibiotics are given empirically, the spectrum should be reduced as soon as culture results become available as prolonged antibiotic therapy may be harmful; nevertheless, doctors seem to be reluctant to change antibiotics even when they have results to suggest they should (Aarts et al, 2007)!

Importantly, antimicrobial therapy needs to be tailored to the particular locality as each unit has its own, unique pattern of colonisation and infection. General guidelines must be individualised by each unit as giving antibiotics to one patient can modify local microbiological patterns and hence affect treatment for other patients for the near future!

Ongoing Controversy

The first area of controversy in terms of antimicrobial therapy is whether to give one or more empiric antibiotics. Giving one effective drug may be adequate if the drug is indeed effective against the microorganism in question; however, if there is any uncertainty about likely microbes it is probably better to start with two drugs, and to simplify therapy when microbiological results are known. The ATS/IDSA guidelines (2005) recommend combination therapy in patients with resistant organisms but no data have actually shown any benefit of combination over monotherapy in this situation. The recently updated Surviving Sepsis Campaign guidelines (Dellinger et al, 2008) make a weak 2D recommendation in support of two agents in cases of sepsis associated with P. aeruginosa.

Duration of therapy is another area of controversy. The Surviving Sepsis Campaign Guidelines (Dellinger et al, 2008) suggest (1D) that 7-10 days is adequate for most but may need to be extended in patients who have a slow clinical response or associated deficiencies, including neutropenia. Duration probably needs to be assessed according to each patient's clinical course, but sequential sepsis marker values, e.g., CRP or PCT, may provide useful confirmation.

Summary

Despite considerable research in the field of VAP, many areas remain controversial. However, while, or perhaps by, focussing on the controversies of VAP, this summit also highlighted several key areas of overall agreement: First, VAP is an important complication of mechanically ventilated ICU patients and is associated with considerable morbidity and costs, and possibly excess mortality. Second, development of newer rapid tests and antibiograms (Bouza et al, 2007) is an important step forward in the diagnosis of VAP. Third, inadequate initial therapy of VAP is associated with higher mortality, length of stay, and costs. Fourth, antimicrobial therapy should be targeted at the likely pathogen, guided by local microbiological patterns, and adjusted based on susceptibility patterns and clinical resolution. Finally, despite progress in recent years, there is still much room for improvement in terms of diagnosis, therapy, and prevention of VAP. ■

MRSA Management

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There is a great variation in prevalence of methicillin-resistant Staphylococcus aureus (MRSA) in different countries in Europe, with the lowest rates in the Scandinavian countries and in the Netherlands. The prevalence ranged from more than 35% in the Southern part of Europe to around 1% in the Northern countries including the Netherlands. These variations have hampered, among other things, free access of patients to healthcare facilities in the different countries of the European Union, and more particularly the transfer of patients from hospitals in countries with a high to those with a low prevalence.

University Hospital Maastricht

University Hospital Maastricht (UHM) is located in the Southern part of the Netherlands close to the border with Germany and Belgium, and works in close cooperation with the University hospital of Aachen (Germany) and the hospital of Tongeren (Belgium) in the field of surgery, especially cardiac surgery. Medical specialists working at UHM also perform surgery in Aachen and in Tongeren.

Within that context, it is interesting to look into the cost of the current MRSA policy at UHM as well as into the impact of this policy on the cross-border transfer of patients between healthcare institutions and more generally, on the cooperation between cross-border hospitals.

MRSA Policy at the UHM

The Netherlands (including UHM) and Scandinavian countries have implemented a so-called "Search and Destroy policy" against MRSA. Furthermore, patients who are at high risk of being MRSA carriers will be put in isolation (i.e. in a separate room) until the results excluding MRSA carriage are known.

This policy consists of
1. Actively screening patients and healthcare workers (HCWs) for the presence of MRSA. Both infections and colonisation (i.e. presence of MRSA without any complaints) of patients and HCW will be recorded. HCWs who appear to be MRSA positive are excluded from direct care of patients and decolonised with mupirocin. They are allowed to return to patient care as soon as screening cultures are MRSA negative. MRSA positive patients are decolonised with mupirocin and attended to in a separate room with a separate nursing team. When the therapeutic treatment is finished, control cultures will be taken to ensure eradication of MRSA.

2. All patients admitted to the UHM and presenting MRSA risk factors upon admission will be screened for the presence of MRSA. According to the estimated risk of MRSA colonisation, patients will be categorised in low or high-risk groups. High-risk patients include patients admitted to a foreign hospital for at least 24 hours as well as additional risk factors such as a recent operation or mechanical ventilation. These patients will be put in isolation (i.e. in a separate room) until the results excluding MRSA are known. If no MRSA is found, the isolation is discontinued. If the patient is MSRA positive, the isolation will be continued until control cultures are negative after treatment, on average this spans to at least 14 days. This also applies to patients admitted in cross-border hospitals.

Cost of the Current Search and Destroy MRSA Policy

Costs and the financial cost-benefit break-even point of the current MRSA policy were calculated using retrospective data from UHM. The annual cost of pro-active screening was 1,383,200 euros. MRSA prevention and treatment of S.aureus bloodstream infections amounted to 2,736,762 euros. Therefore, the total costs associated with deploying the Search and Destroy policy are lower than the costs of treating S. aureus blood stream infections. Simulation of different ratios of MRSA and methicillin susceptible S. aureus showed that even if the MRSA prevalence is 8% or lower, this policy is still cost-effective.

The Search and Destroy policy, which includes pro-active screening for the presence of MRSA and isolation of patients at risk is expensive, but the policy contributes substantially to the containment of the MRSA problem in the Netherlands and Scandinavia. Without preventive measures, the prevalence of MSRA will steadily increase as MRSA will spread both between patients, as well as between patients and HCWs.

In cross-border hospitals, the rate of patients at risk for MRSA will be higher compared to other hospitals and consequently more patients will be put in isolation until test results excluding MRSA

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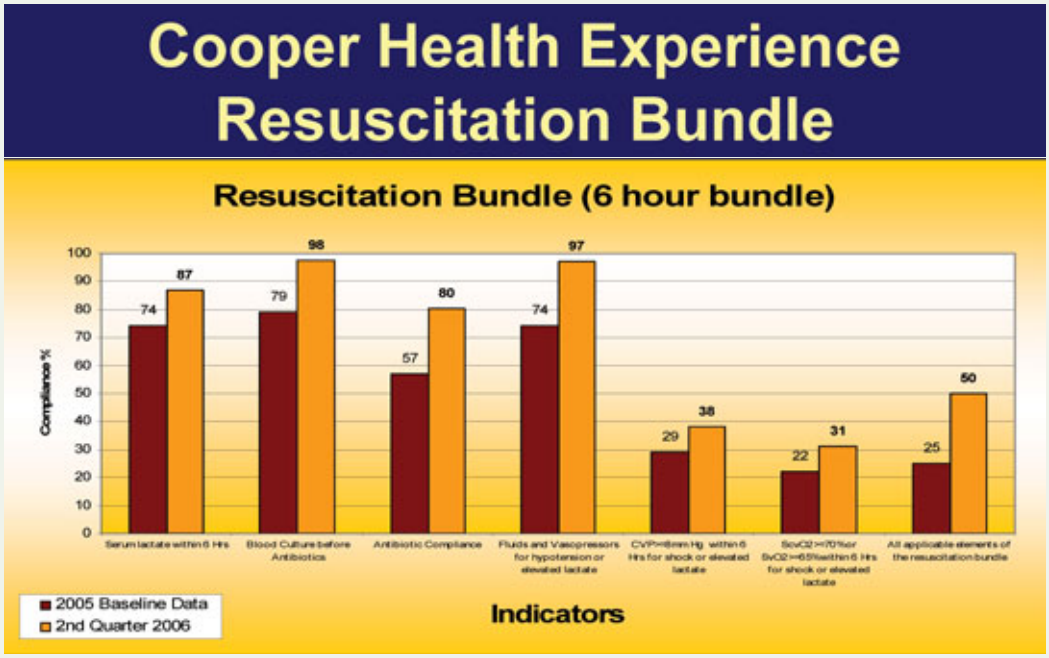
are known. The implementation of rapid (molecular) methods to identify MRSA will reduce the number of isolation days substantially. In cost studies, mortality is often not taken into account. When patients die unexpectedly, the length of stay is shorter, resulting in a decrease in hospital costs. Thus, when the cost of a human life is not taken into account, only the increased morbidity, and not the increased mortality adds to the hospital costs.

Conclusion

From an economic point of view, the Search and Destroy policy is an efficient way to maintain a low level of MRSA. Implementation of this policy, which includes actively searching for MRSA positive HCW and patients, both infected and colonised, is essential for cross-border hospitals. It facilitates cross-border healthcare and contributes to the reduction of the prevalence of MRSA and/or to the preservation of a low prevalence of MRSA. ■

continued from p. 6

Each patient who qualifies for severe sepsis according to a standardised screening tool is scored for performance as to compliance with achieving the indicators. A software program facilitates data entry for each severe sepsis patient and allows local and central creation of monthly, quarterly and yearly tabular and graphic reports of performance. De-identified data can also be transmitted to a central repository for analysis and benchmarking. Beginning in late 2005, hospitals in the U.S. and around the world began signing on to participate in the performance improvement program with data collection, education programs and performance feedback to healthcare practitioners. De-identified data is transmitted on a voluntary basis to a central database located at the Society of Critical Care Medicine. To date over 17,000 patients have been entered into the database from 120 hospitals in over 20 countries from around the world. The first formal data analysis is scheduled for June 2008. The plan is for an ordinal month analysis with first month data from all hospitals regardless of start-up time compared to later months of collection, i.e. summed historical controls month by month for all hospitals. Figure 2 contrasts baseline data from Cooper collected during alpha testing and prior to initiation of education and performance feedback with the first year of data after initiation of the program. ■



ICU MANAGEMENT

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Understanding and Preventing Sentinel and Adverse Events

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Preventable medical errors threaten patient safety and are all too common in hospitals throughout the world. These errors-the most severe of which are called sentinel events, the less severe, adverse events-are not limited to lower quality organisations; excellent healthcare organisations can and do experience undesirable events. What separates excellent quality organisations from lesser ones is whether they respond to sentinel and adverse events in a way that significantly reduces the risk of the event occurring in the future. By conducting intensive system analysis, revising processes found to cause or contribute to these events, and monitoring the effectiveness of any changes, quality hospitals create a safer patient environment following an undesirable event.

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With the release of the Joint Commission International Accreditation Standards for Hospitals, 3rd edition, US-based accreditation body Joint Commission International (JCI) introduced the international healthcare community to the term sentinel event, which when combined with the already familiar terms adverse event and near miss, describe the full range of undesirable events with varying degrees of serious outcomes. JCI also began requiring that all JCI-accredited hospitals heed JCI's Sentinel Event Policy (see Figure 1) as a baseline for compliance and develop a sentinel event policy of their own, as well as establishing a process to address a sentinel event when it occurs.

JCI defines a sentinel event as an unanticipated death or loss of function unrelated to the natural course of the patient's illness or underlying condition or wrong-site, wrong-procedure, wrong-patient surgery. Such an event is called sentinel because it signals a need for an immediate investigation and response. An adverse event is defined by JCI as an unanticipated, undesirable, or potentially dangerous occurrence in a healthcare organisation, and a near miss is any process variation that did not affect an outcome but for which a recurrence carries a significant chance of a serious adverse outcome; such a "near miss" falls within the scope of the definition of an adverse event.

Adhering to a sentinel event policy should not only reduce the occurrence of sentinel events, but should also help healthcare organisations create a culture committed to identifying errors before they occur as well as being comfortable reporting errors if and when they happen. A blame-free culture, recognising that sentinel and adverse events are often the result of total system failure rather than individual practitioners' failures, should be the basis of every sentinel event policy.

A blame-free culture is especially important in the intensive care unit (ICU). Because ICU work is intense, with many interactions occurring between patient and caregiver and as the nature of critical illness reduces both patients' natural resilience and their ability to defend themselves from the consequences of human error, patients in the ICU may be at a higher risk of experiencing a sentinel or adverse event. According to one study, 54.8% of patients who had been in an ICU during their stay had a serious adverse event as opposed to only 38.1% of those who never been in an ICU (The Joint Commission Guide to Priority Focus Areas, 2004). Researchers from the Harvard Medical Practice study also concluded that patients 65-years-old or older had twice the risk of experiencing an event due to negligence than did those between 16 and 45 (Brennan et al. 1991).

Although each event is unique, healthcare errors often have common root causes that can be prevented from happening in the future when all organisations are made aware of them. But, awareness of the most common sentinel events and root causes of them is only made possible when hospitals confidentially share their information with an organisation such as JCI. In the United States, voluntary sentinel event reporting has allowed the Joint Commission to create a database identifying risk factors and trends, and this information is available to healthcare organisations and others on the Joint Commission's website at

Joint Commission International (JCI) is a division of Joint Commission Resources, Inc., a wholly controlled, not-for-profit affiliate formed by The Joint Commission to provide leadership in healthcare accreditation and quality improvement. Since 2003, 140 hospitals in 26 countries have been accredited by JCI. There are currently 323 standards that hospitals must meet to receive accreditation. These standards allow for cultural differences while still requiring hospitals to standardise and provide patient care that promotes safety and quality. The accreditation is for a period of three years and therefore the implementation of standards must result in sustainable good practices.

http://www.jointcommission.org/SentinelEvents/Statistics/. Although JCI does not currently maintain such a database (it plans to establish such a resource in the near future) the US-based resource provides applicable data, trends, and guidance for organisations everywhere.

Conclusion

Because sentinel events have such a dramatic and devastating effect on patients, their families and also on the organisation and its staff, policies and procedures are necessary at such time of calamity. But ultimately, sentinel events are not about policies but all about people and learning and the resolve to not let such an event occur again. Ask any family of a patient who died from a sentinel event and they will relate that their one hope is that no other family will have to go through the same event.

Hospitals are learning environments that incorporate new knowledge and the latest scientific advances every day. The information and findings resulting from the root cause of a sentinel event needs to be elevated into that learning environment and the processes for improvement. To lock

Sentinel Events

In support of its mission to improve the safety and quality of healthcare provided to the international community, JCI reviews organisation activities in response to sentinel events in its accreditation process. The following apply:

- A sentinel event is an unanticipated occurrence involving death or major permanent loss of function unrelated to the natural course of the patient's illness or underlying condition.
- A sentinel event may occur due to wrong-site, wrong-procedure, wrong-patient surgery.
- Such events are called "sentinel" because they signal a need for immediate investigation and response.
- The terms "sentinel event" and "medical error" are not synonymous; not all sentinel events occur because of an error and not all errors result in sentinel events.

Goals of the Sentinel Event Policy

The policy has four goals:

1. To have a positive impact in improving patient care, treatment, and services and preventing sentinel events.
2. To focus the attention of an organisation that has experienced a sentinel event on understanding the causes that underlie the event, and on changing the organisation's systems and processes to reduce the probability of such an event in the future.
3. To increase general knowledge about sentinel events, their causes, and strategies for prevention.
4. To maintain the confidence of the public and internationally accredited organisations in the accreditation process.

Expectations for an Organisation's Response to a Sentinel Event

Accredited organisations are expected to identify and respond appropriately to all sentinel events occurring in the organisation or associated with services that the organisation provides, or provides for. Appropriate response includes conducting a timely, thorough, and credible root cause analysis; developing an action plan designed to implement improvements to reduce risk; implementing the improvements; and monitoring the effectiveness of those improvements.

Reasons for Reporting a Sentinel Event to JCI

Although self-reporting a sentinel event is not required and there is no difference in the expected response, time frames, or review procedures, whether the hospital voluntarily reports the event or JCI becomes aware of the event by some other means, there are two major advantages to the hospital that self-reports a sentinel event:

- Early reporting provides an opportunity for consultation with JCI central office staff during the development of the root cause analysis and action plan.
- The organisation's message to the public that it is doing everything possible to ensure that such an event will not happen again is strengthened by its acknowledgement and collaboration with JCI to understand how the event happened and what can be done to reduce the risk of such an event in the future.

Figure 1. JCI Sentinel Event Policy (Sections only)

away the findings out of shame or fear of loss of prestige is a disservice to those affected by the event and leaves the same system vulnerabilities in place for another day and another event - eventually. Organisations also need to learn from the events that occurred in other organisations. This is facilitated by the JCI International Center for Patient Safety where organisations can access the best science and aggregate learning of the larger healthcare community. Patient safety solutions are available for immediate review and action by organisations ready to learn and incorporate new knowledge. This is a neverending cycle necessary for quality and safe patient care today and tomorrow. ■

Question: What is the purpose of JCI's Sentinel Event Policy?

Answer: JCI's Sentinel Event Policy was developed to foster a more consistent exchange of sentinel event information between an accredited organisation and JCI. The overall goal is to share knowledge and ultimately reduce future occurrences of such events in accredited organisations.

Question: How does JCI's Sentinel Event Policy relate to events that involve staff?

Answer: Certain events that involve patients also have the potential to involve staff members. A fire that results in the death of a patient also places staff at risk. The electrocution of a patient by faulty biomedical equipment also could place staff at risk. Thus, the review of sentinel events should also consider actions to reduce the potential of the same or similar events that could involve staff, family and visitors as well as patients.

Figure 2. Questions and Answers: What Your Organisation Needs to Know About the JCI Sentinel Event Policy

Anaesthesia Units: Purchase Considerations

ECRI Institute Recommendations

ECRI Institute
The Discipline of Science. The Integrity of Independence.

Included in the accompanying comparison chart are ECRI Institute's recommendations for minimum performance requirements for anaesthesia units. The recommendations are listed in two categories: basic and high performance. ECRI Institute considers certain minimum safety measures necessary for all anaesthesia units. Among these measures are:

- O_2 fail-safe and hypoxic mixture fail-safe systems,
- Gas cylinder yokes for O_2 if central supplies fail, and
- An internal battery (for units with automatic ventilators) capable of powering the unit for at least 30 minutes.

The unit must be able to measure O_2 concentration, airway pressure, and either the volume of expired gas or the concentration of expired CO_2 (ETCO2). (Note: ASA recommends monitoring of $ETCO_2$ in all intubated patients; this can be accomplished by the anaesthesia unit or by a separate device [e.g., capnograph, multigas monitor].)

Gas cylinders should be attached through hanger yokes with the proper pin index safety system and check valves. Each pipeline gas cylinder supply should have a pressure gauge with scale numbers large enough to be easily read. Gas hoses and machine receptacles should use DISS fittings to prevent misconnection. It is advantageous if the anaesthesia unit accepts medical-air input to allow delivery of either air and/or N_2O as the gas carrier.

In the event of a partial or complete loss of O_2 supply, an undefeatable audible alarm should activate and the flow of N_2O gases should automatically shut off or decrease proportionately to the flow of O_2 to prevent a hypoxic condition. Also, flows and the mixture ratios determined from flowmeter settings should be accurate to within 10% of set values. Anaesthetic vapor concentration delivered to the common gas outlet should be accurate to within 0.2% vapor concentration of agent or 10% of the set value (whichever is greater) at any gas flow. It is preferable that ventilation rate and PEEP values be monitored. It should not be possible to silence or disable a ventilator monitor alarm for longer than two minutes.

Units should have a power-loss alarm, and the battery backup should have an automatic low-battery alarm. All units should include a backup battery to guard against power loss. The anaesthesia unit should automatically switch to the internal battery if line power is interrupted; also, the loss of line power should be accompanied by an alarm. The battery should also operate the anaesthesia unit and integral monitors for at least 30 minutes. A low-battery alarm should visually and audibly indicate when the battery voltage falls to a level below which the unit may fail to perform satisfactorily. The battery should not require more than 16 hours to recharge completely after depletion.

High-performance systems are distinguished largely by their ability to serve a wide range of patients and to operate with little or no supplemental equipment. Features that make this possible include ventilator modes and tidal volume ranges suitable for neonates and adults, as well as integrated gas and sometimes physiologic monitoring. (Although most models tend to include only a small number of standard ventilation modes, additional modes can typically be added via software upgrades following purchase.) High-performance units generally include more automated features, including storage of trends and self-tests at the beginning of each procedure. Basic systems include only the most vital monitoring capabilities (i.e., O_2 and CO_2 volumes or pressures) and have only one or two automatic ventilator modes. When equipped with appropriate stand-alone monitors, these units are adequate for treatment of most patients but may remain ill-suited for use on neonates and very sick patients, as well as for monitoring-intensive procedures (e.g., certain types of cardiac surgery). These fundamental systems may also include units designed for military or field use, which often lack ventilators and pipeline gas inlets.

Other Considerations

Some anaesthesia units require stand-alone physiologic monitors (modular approach) and/or anaesthetic agent monitors, while others have integrated monitors (preconfigured approach). The advantages of preconfigured monitoring include convenience and electronically integrated displays and prioritised alarms. Modular systems can be less expensive than preconfigured systems,

especially if the facility already owns the monitors. Hospitals can purchase customised modular systems assembled from standard components, or they can assemble their own modular systems. These systems must meet all national and regional safety standards.

Advantages of the modular approach include flexibility in choosing and upgrading monitors and ease of service; drawbacks include assembling a system that may not be successfully integrated and thus has multiple alarms and/or displays.

Anaesthesia units and patient monitoring systems should be carefully chosen to ensure that all essential monitoring functions recommended by the American Society of Anaesthesiologists are obtained and to ensure optimal integration and an adequate standard of care. For legal reasons, the level-of-monitoring and anaesthesia-delivery capabilities for each anaesthesia station should be uniform so that all patients receive the same standard of care for the same surgical procedures. Integrated anaesthesia workstations, along with the gas/vapour dispensing subsystem and individual physiologic and equipment monitors, may also include a device for automatically dispensing injectable drugs. Consequently, the anaesthesia workstation can be viewed as an integrated monitoring system that dispenses anaesthetic drugs.

Hospitals should also consider the standardisation of anaesthesia equipment; that is, purchasing systems that are compatible with equipment already in operating rooms or other areas of the hospital (e.g., intensive care units). The purpose of standardisation is to allow a reduced parts inventory, minimize the number of suppliers and service personnel, and reduce confusion among the staff.

Pulse oximetry is considered a standard of care for monitoring arterial O_2 saturation in the operating room during procedures requiring anaesthesia and in intensive care units and recovery. Pulse oximeters non-invasively measure O_2 saturation of blood hemoglobin (SpO_2) and, along with O_2 monitors and CO_2 monitors, are increasingly being required for anaesthesia units by law. Hospitals should check with their department of health for any regulations that may apply to their area. Pulse oximeters provide a spectrophotometric assessment of hemoglobin oxygenation by measuring light transmitted through a capillary bed, synchronised with the pulse. The detection system consists of single-wavelength LEDs (light-emitting diodes) and microprocessors located within a sensor.

CO_2 monitors measure end-tidal CO_2 and can help identify leaks and misconnections as well as indicate when the trachea has not been properly intubated. Many features of anaesthesia systems are optional, allowing hospitals to choose those that best fit their needs. Among anaesthesia units with essentially equivalent mechanical gas/vapour dispensing subsystems, the monitors included in the system and the ways in which information is integrated and displayed are often the primary distinguishing features.

Cost Containment

Because anaesthesia systems entail ongoing maintenance and operational costs, the initial acquisition cost does not accurately reflect the total cost of ownership. The anaesthetic agents are the biggest ongoing expense associated with anaesthesia units. Therefore, a purchase decision should be based on issues such as life-cycle cost (LCC), local service support, discount rates, and non-price-related benefits offered by the supplier. An LCC analysis should be conducted to determine the cost-effectiveness of all units that meet users' needs.

Although costs associated with many of the following may be similar for a number of anaesthesia units, they should still be carefully considered to determine the total LCC for budget purposes:

- Maintenance, service, and inspection
- Accessories, such as monitoring equipment, necessary to comply with standards
- Optional accessories
- Vaporisers (some have been offered at discounted prices or at no cost upon the introduction of a new anaesthetic agent)
- Gases, including O_2, N_2O, and anaesthetic agents
- Anaesthesia circuits
- Recording and storage of anaesthesia-related data
- Disposables
- Utilities

Hospitals can purchase service contracts or service on a time-and-materials basis from the supplier. Service may also be available from a third-party organisation. The decision to purchase a service contract should be carefully considered. Most suppliers should provide routine software updates, which enhance the system's performance, at no charge to service contract customers. Purchasing a service contract also ensures that preventive maintenance will be performed at regular intervals, thereby eliminating the possibility of unexpected maintenance costs. Also, many suppliers do not extend system performance and uptime guarantees beyond the length of the warranty unless the system is covered by a service contract. Hospitals that plan to service their anaesthesia units in-house should inquire about the availability and cost of service training and the availability and cost of replacement parts. ECRI Institute recommends that, to maximize bargaining leverage, hospitals negotiate pricing for service contracts before the system is purchased. Additional service contract discounts may be negotiable for multiple-year agreements or for service contracts that are bundled with contracts on other similar equipment in the department or hospital. Buyers should make sure that applications training and service manuals are included in the purchase price of the system. Some suppliers offer more extensive on- or off-site training programs for an additional cost. ■

Anaesthesia Units

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ECRI Institute is a totally independent nonprofit research agency designated as a Collaborating Center of the World Health Organization (WHO). Such organizations are appointed to contribute to WHO's public health mission by providing specialized knowledge, expertise, and support in the health field to the WHO and its member nations. ECRI Institute is widely recognized as one of the world's leading independent organizations committed to advancing the quality of healthcare with over 240 employees globally.

ECRI Institute is pleased to provide readers of **ICU Management** with sample information on Basic Performance Anaesthesia Units from its Healthcare Product Comparison System (HPCS), which contains over 280 reports. The HPCS reports contain extensive information about the technology, its purpose, its principles of operation, stage of development specifications and reported problems. The Basic Performance Anaesthesia Units comparison charts include ECRI Institute's 'Recommended Specifications' (generic templates) which can be used for comparison and tendering purposes. The comparative tables overleaf are extracted from ECRI's 2005 database and have additionally been reviewed and updated by the respective manufacturers.

Publication of all submitted data is not possible. For further information please contact editorial@icu-management.org or visit www.icu-management.org.

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Footnotes used in page 27

1. These recommendations are the opinions of ECRI Institute's technology experts. ECRI Institute assumes no liability for decisions made based on this data.
2. 1 vaporizer connected to the ventilator and up to 3 vaporizers in parking.
3. Fresh-gas compensated.

Healthcare Product Comparison System

SUPPLIER	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS[1]	SPACELABS HEALTHCARE
MODEL	**Basic Performance Anesthesia Units**	**BleaseFocus**
WHERE MARKETED		Worldwide
FDA CLEARANCE		No
CE MARK (MDD)		Yes
CONFIGURATION		Mobile
PIPELINE GAS INLETS	All	3 (O_2, N_2O, air)
GAS CYLINDER YOKES	O_2	3 maximum
VAPORIZERS, AGENTS	Isoflurane, halothane, enflurane, desflurane, sevoflurane	Sevoflurane, isoflurane, halothane, enflurane
Type		Plenum-type variable bypass, fully compensated
Number	1	2 maximum
Interlock	Yes (if >1 vaporizer)	Fully compatible
SUCTION SYSTEM	Optional	Optional direct/venturi
O_2 FAIL-SAFE	Audible, visual, N_2O shutoff	Multigas cutoff, full alarms
HYPOXIC MIXTURE FAIL-SAFE	Yes (methods vary)	Gear-driven ratio system[2]
AUTOMATIC VENTILATOR	Yes	Blease700/900
Bellows, size		Adult/pediatric
Type		Ascending, bag in bottle
Ventilation modes	Manual, spontaneous, VCV	Adult, pediatric, CMV, PPCV, SIMV+PSV, AdPSV
Tidal volume		Yes
Range, cc	50-1,200	20-1,500
Minute volume		Yes
Range, L/min	>20	0.3-25
IE ratio		2:1 to 1:5
Inspiratory pause	Optional	Off, 5-50%
Pressure limit, cm H_2O	Adjustable, <70 preferred	10-70, 10-50 pediatric, adjustable
PEEP, cm H_2O	0-20	0-20 electronic variable PEEP
Other controls		Adult and pediatric modes, standby in both modes, spirometry MV/TV selection[3]
System checks	Pre-use vent, gas supply, ongoing system	Self-verification and leak test, dynamic compliance, compensation, fresh-gas flow compensation
SCAVENGING SYSTEM	Active or passive	Active vacuum or exhaust AGSS, high or low flow, passive
AUTO RECORD KEEPER	No	Optional
ANESTHESIA DATA MANAGEMENT	No	Optional
DISPLAYS	Yes	Optional
Number	1	Not specified
Type		Not specified
BACKUP BATTERY	Required	Yes
Type		Internal
Use per charge, hr	0.5	2
PURCHASE INFORMATION		
Price		Not specified
Warranty		1 year
Service contract		Optional
Delivery time, ARO		Varies
OTHER SPECIFICATIONS		Touchscreen ventilator control.
LAST UPDATED		May 2007

SUPPLIER	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS[1]	GE Healthcare	GE Healthcare	GE Healthcare
MODEL	Basic Performance Anesthesia Units	Aisys Carestation	Avance	Aespire 7900
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
CONFIGURATION		Mobile with locking casters	Mobile with locking casters	Mobile with locking casters
PIPELINE GAS INLETS	All	3 (O_2, air, optional N_2O)	3 (O_2, air, optional N_2O)	3 (O_2, N_2O, air)
GAS CYLINDER YOKES	O_2	3 (O_2, optional N_2O, air)	2 from O_2, N_2O, air	3 (O_2, N_2O, air)
VAPORIZERS, AGENTS	Isoflurane, halothane, enflurane, desflurane, sevoflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane
Type		Aladin cassette	Tec 7 temperature, flow, pressure compensated, EZ Fill	Tec 7 temperature, flow, pressure compensated, EZ Fill
Number	1	1	2	2
Interlock	Yes (if >1 vaporizer)	Yes	Yes	Yes
SUCTION SYSTEM	Optional	Optional	Optional	Optional
O_2 FAIL-SAFE	Audible, visual, N_2O shutoff	Electronic	Electronic	Pneumatic
HYPOXIC MIXTURE FAIL-SAFE	Yes (methods vary)	Electronic	Electronic	Mechanical link
AUTOMATIC VENTILATOR	Yes	7900 Smartvent	7900 Smartvent	7900
Bellows, size		1,500 mL	1,500 mL	1,500 mL
Type		Ascending, standing, multibreath	Ascending, standing, multibreath	Ascending, standing, multibreath
Ventilation modes	Manual, spontaneous, VCV	VCV, PCV, SIMV-VC, SIMV-PC, PSVPro, CPAP, PCV-VG	VCV, PCV, SIMV-VC, SIMV-PC, PSVPro, CPAP	VCV, PCV, SIMV-PC, PSVPro, CPAP
Tidal volume		1,500 mL	1,500 mL	1,500 mL
Range, cc	50-1,200	20-1,500	20-1,500	20-1,500
Minute volume		Yes	Yes	Yes
Range, L/min	>20	0 and 200ml to 15L/min	0 and 200ml to 15L/min	0.08-120
IE ratio		2:1 to 1:8	2:1 to 1:8	2:1 to 1:8
Inspiratory pause	Optional	0-60% Ti	0-60% Ti	0-60% Ti
Pressure limit, cm H_2O	Adjustable, <70 preferred	12-100	12-100	12-100
PEEP, cm H_2O	0-20	4-30 electronic	4-30 electronic	4-30 electronic
Other controls		Electronic mixer breath-to-breath tidal volume compensation	Electronic mixer breath-to-breath tidal volume compensation	Float-type flowmeters, breath-to-breath tidal volume compensation
System checks	Pre-use vent, gas supply, ongoing system	Electronic, semiautomatic	Electronic, semiautomatic	Manual pre-use test, ventilator self-test
SCAVENGING SYSTEM	Active or passive	Active, passive, or open reservoir	Active, passive, or open reservoir	Active, passive, or open reservoir
AUTO RECORD KEEPER	No	Optional using Centricity	Optional using Centricity	Optional using Centricity
ANESTHESIA DATA MANAGEMENT	No	Optional using Centricity	Optional using Centricity	Optional using Centricity
DISPLAYS	Yes	Not specified	Not specified	7900
Number	1	One 30.5 cm (12"); optional 30.5 cm (12"), 38.1 cm (15"), 43.2 (17")	One 30.5 cm (12"); optional 30.5 cm (12"), 38.1 cm (15"), 43.2 (17")	1
Type		Full color	Full color	ICE
BACKUP BATTERY	Required	Yes	Yes	In ventilator
Type		Lead acid	Lead acid	Sealed lead acid
Use per charge, hr	0.5	0.5 maximum load	0.5 maximum load	0.5
PURCHASE INFORMATION				
Price		$60,000-95,000	$60,000-85,000	$40,000-55,000
Warranty		1 year	1 year; 3 years, vaporizer	1 year; 3 years, vaporizer
Service contract		Available	Available	Available
Delivery time, ARO		2-6 weeks	2-6 weeks	2-6 weeks
OTHER SPECIFICATIONS		2.7 liter volume in vent mode; vaporizer storage brackets; breathing system/bag alarms; number of cylinder yokes and gases; auxiliary common gas outlet; O_2 flowmeter; IV poles; CastrGard; integrated suction. Meets requirements of ASTM F180, CSA, EN 740, JIS, and UL.	2.7 liter volume in vent mode; vaporizer storage brackets; breathing system/bag alarms; number of cylinder yokes and gases; auxiliary common gas outlet; O_2 flowmeter; IV poles; CastrGard; integrated suction. Meets requirements of ASTM F180, CSA, EN 740, JIS, and UL.	2.7 liter volume in vent mode; vaporizer storage brackets; breathing system/bag alarms; number of cylinder yokes and gases; auxiliary common gas outlet; O_2 flowmeter; IV poles; CastrGard; integrated suction. Meets requirements of ASTM F180, CSA, EN 740, JIS, and UL.
LAST UPDATED		May 2008	May 2008	May 2008

	GE Healthcare	Dräger medical	Dräger medical	Dräger medical	Dräger medical
	Aestiva MRI	**Fabius Plus**	**Fabius GS**	**Fabius GS Premium**	**Fabius Tiro**
	Worldwide	Worldwide, except North America	Worldwide	Worldwide	Worldwide
	Yes	No	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	Mobile with locking casters (footrest)	Trolley, pendant, wall	Trolley	Trolley	Trolley, pendant, wall
	4 optional (O_2, N_2O, air)	2 (O_2, N_2O or O_2,AIR) or 3 (O_2, AIR, N_2O)	3 (O_2, AIR, N_2O), 2 optional (O_2, air)	3 (O_2, AIR, N_2O), 2 optional (O_2, air)	3 (O_2, AIR, N_2O), 2 optional (O_2, air)
	4 optional (O_2, N_2O, air, CO_2, heliox)	2 (O_2, N_2O)	3 (2 O_2, air or N_2O)	3 (2 O_2, air or N_2O)	2 (O_2, N_2O), 2 (O_2, air)
	Sevoflurane, enflurane, halothane, isoflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane
	Tec 7 temperature, flow, pressure compensated, EZ Fill	Variable bypass, removable mount	Variable bypass, removable mount	Variable bypass, removable mount	Variable bypass, removable mount
	2	1 or 2	2 or 3 (autoexclusion system)	2 or 3 (autoexclusion system)	1 (removable), optional 1 park holder
	Yes	Yes	Yes	Yes	N/A
	Optional	Optional	Optional	Optional	Optional
	Pneumatic	Acoustic alarm, N_2O lock	Yes	Yes	Yes
	Mechanical link	O_2 ratio controller	O_2 ratio controller	O_2 ratio controller	O_2 ratio controller
	7900	Yes, electronically driven and controlled	Yes, electronically driven and controlled	Yes, electronically driven and controlled	Yes, electronically driven and controlled
	1,500 mL	N/A, piston for adult/pediatric	N/A, piston for adult/pediatric	N/A, piston for adult/pediatric	N/A, piston for adult/pediatric
	Ascending, standing, multibreath	Piston driven ventilator, 1400ml	Piston driven ventilator, 1400ml	Piston driven ventilator, 1400ml	Piston driven ventilator, 1400ml
	VCV, PCV, SIMV-VC, SIMV-PC, PSVPro, CPAP	Manual/spontaneous, volume, optional pressure, pressure support, SIMV with pressure support	Manual/spontaneous, volume, optional pressure, pressure support, SIMV with pressure support	Manual/spontaneous, volume, optional pressure, pressure support, SIMV with pressure support	Manual/spontaneous, volume, optional pressure, pressure support, SIMV with pressure support
	1,500 mL	Yes	Yes	Yes	Yes
	20-1,500	20-1400ml	20-1400ml	20-1400ml	20-1400ml
	Yes	Yes	Yes	Yes	Yes
	0.08-120	0.3-25	Up to 25	Up to 25	Up to 25
	2:1 to 1:8	4:1 to 1:4	4:1 to 1:4	4:1 to 1:4	4:1 to 1:4
	0-60% Ti	0-50% Tip:Ti	0-50% Tip:Ti	0-50% Tip:Ti	0-50% Tip:Ti
	12-100	15-70, adjustable	15-70, adjustable	15-70, adjustable	15-70, adjustable
	4-30 electronic	0-20	0-20	0-20	0-20
	Float-type flowmeters, breath-to-breath tidal volume compensation	Pmax (pressure limit), inspiratory flow (pressure control), inspiratory pause (Tip:Ti)	Pmax (pressure limit), inspiratory flow (pressure control), inspiratory pause (Tip:Ti)	Pmax (pressure limit), inspiratory flow (pressure control), inspiratory pause (Tip:Ti)	Pmax (pressure limit), inspiratory flow (pressure control), inspiratory pause (Tip:Ti)
	Manual pre-use test, ventilator self-test	Semiautomatic leak and compliance check, self-diagnosis of processor	Semiautomatic leak and compliance check, self-diagnosis of processor	Semiautomatic leak and compliance check, self-diagnosis of processor	Semiautomatic leak and compliance check, self-diagnosis of processor
	Active, passive, or open reservoir	Active AGS	Optional active AGS or passive scavanger	Optional active AGS or passive scavanger	Optional active AGS or passive scavanger
	Optional using Centricity	Optional	Optional	Optional	Optional
	Optional using Centricity	Optional data export of all ventilation data via RS232	Optional data export of all ventilation and gas flow data via RS232	Optional data export of all ventilation and gas flow data via RS232	Optional data export of all ventilation and gas flow data via RS232
	7900	Yes, optional color mode	Yes	Yes, color display	Yes, optional color mode
	1	1	1	1	1
	LCD monochrome	TFT flat panel (16.5cm/6.5"), color option	TFT flat panel (16.5cm/6.5"), monochrome (black-amber)	TFT color flat panel (16.5 cm [6.5"])	TFT flat panel (16.5cm/6.5"), color option
	In ventilator	Yes	Yes	Yes, up to 120min with min 45min	Yes, up to 120min with min 45min
	Lead acid	Sealed lead-acid	Sealed lead-acid	Sealed lead-acid	Sealed lead-acid
	0.5 maximum load	Up to 2hours with min 0,75min	Up to 2hours with min 0,75min	Up to 2hours with min 0,75min	Up to 2hours with min 0,75min
	$55,000-65,000	Not specified	Not specified	Not specified	Not specified
	1 year; 3 years, vaporizer	1 year	1 year	1 year	1 year
	Available	Yes	Yes	Yes	Yes
	2-6 weeks	30 days	30 days	30 days	30 days
	Gauss alarm; vaporizer storage brackets; breathing system/bag alarms; number of cylinder yokes and gases; auxiliary common gas outlet; Bain module; O_2 flowmeter; IV poles; additional shelf; CastrGard, integrated suction. Meets requirements of ASTM F180, CSA, EN 740, JIS, and UL.	Electrically driven ventilator; fresh-gas decoupled; compact breathing system; warmed breathing system (optional); modular; wall, ceiling, and trolley version, easy access to ventilator and breathing system for sterilization	Electrically driven ventilator; fresh-gas decoupled; compliance compensated; compact breathing system; electronic export of fresh-gas data to an anesthesia information system; warmed breathing system (optional); easy access to ventilator and breathing system for sterilization	Electrically driven ventilator; fresh-gas decoupled; compliance compensated; compact breathing system; electronic export of fresh-gas data to an anesthesia information system; warmed breathing system; easy access to ventilator and breathing system for sterilization	Electrically driven ventilator; fresh-gas decoupled; compliance compensated; compact breathing system; electronic export of fresh-gas data to an anesthesia information system; warmed breathing system (optional); modular; wall, ceiling, and trolley version and various military variants with shipping cases available; easy access to ventilator and breathing system for sterilization
	May 2008	May 2008	May 2008	May 2008	May 2008

Healthcare Product Comparison System

SUPPLIER	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS[1]	SMITHS MEDICAL INTERNATIONAL	HEYER MEDICAL	TAEMA
MODEL	**Basic Performance Anesthesia Units**	**110**	**MODULAR**	**Alys 2000**
WHERE MARKETED		Worldwide, except USA	Worldwide, except USA	Worldwide, except North America
FDA CLEARANCE		No	No	No
CE MARK (MDD)		Yes	Yes	Yes
CONFIGURATION		N/A (handheld, portable machine)	Mobile, wall mount	Mobile
PIPELINE GAS INLETS	All	2 (O_2, N_2O)	3 (O_2, N_2O, air)	3 (O_2, N_2O, air)
GAS CYLINDER YOKES	O_2	No	2 optional (O_2, N_2O)	2 optional (O_2, air)
VAPORIZERS, AGENTS	Isoflurane, halothane, enflurane, desflurane, sevoflurane	Halothane, sevoflurane, isoflurane, enflurane	Sevoflurane, enflurane, halothane, isoflurane, desflurane	Sevoflurane, enflurane, isoflurane, halothane, desflurane
Type		Variable bypass	Variable bypass	Variable bypass, heated (desflurane)
Number	1	1 maximum	2	2
Interlock	Yes (if >1 vaporizer)	N/A	Yes	Yes
SUCTION SYSTEM	Optional	Optional	Optional	Optional
O_2 FAIL-SAFE	Audible, visual, N_2O shutoff	Audio and visual	Acoustic with N_2O shutoff	Acoustic alarm, N_2O block
HYPOXIC MIXTURE FAIL-SAFE	Yes (methods vary)	Yes	Ratio system, >25% O2	Mechanical limit, O_2 alarm
AUTOMATIC VENTILATOR	Yes	Optional	Yes	Electronic controls, pneumatically driven
Bellows, size		350 or 1,500 mL	1 for all patients	1 size
Type		Ascending, bag in bottle	Descending, bag in bottle	Descending
Ventilation modes	Manual, spontaneous, VCV	CMV, manual	Manual/spontaneous, CMV, PCV	Manual, spontaneous, VC, PCV
Tidal volume		Yes	Yes	Yes
Range, cc	50-1,200	5-2,000	20-1,400	20-1,500
Minute volume		No	Yes	Yes
Range, L/min	>20	N/A	0-20	0.5-45
IE ratio		Infinitely adjustable	1:1, 1:1.5, 1:2, 1:2.5, 1:3, 1:4, 1:5, 2:1, 3:1	1:3 to 1:1
Inspiratory pause	Optional	No	Yes	0-20% Ti
Pressure limit, cm H_2O	Adjustable, <70 preferred	60	12-80, adjustable	10-90, adjustable
PEEP, cm H_2O	0-20	Optional	0-15	0-25 electronic
Other controls		None	Plateau (end inspiratory), 20% or 30% of inspiratory, volume/constant ventilation, O_2 flush	Plateau sigh, expiratory pause
System checks	Pre-use vent, gas supply, ongoing system	None specified	Automatic at startup	Autotest, leakage, compliance
SCAVENGING SYSTEM	Active or passive	No	Optional	Vacuum/exhaust
AUTO RECORD KEEPER	No	No	External optional	Not specified
ANESTHESIA DATA MANAGEMENT	No	No	External optional	External optional, digital output, RS232
DISPLAYS	Yes	No	Yes	Yes
Number	1	N/A	1	2
Type		N/A	EL	ED
BACKUP BATTERY	Required	Not required	Yes	Optional
Type		N/A	Lead gel	Not specified
Use per charge, hr	0.5	N/A	0.5	Not specified
PURCHASE INFORMATION				
Price		€1,236-5,044 (US$1,416-5,780)	Not specified	Not specified
Warranty		1 year	2 years	1 year
Service contract		Available	Not specified	Yes
Delivery time, ARO		60 working days	6 weeks	Not specified
OTHER SPECIFICATIONS		Portable unit with handles; pipeline gauges. Meets requirements of BS 4272, EN 740, and ISO 5356-1, 5358, and 9703-1.	Patient circuit: integrated compact bloc-heating device to avoid condensation; 65° pivoting; low- and minimal-flow ability; automatic compensation for patient system compliance; fresh-gas decoupling; automatic Vt constant.	Automatic compliance compensation; automatic sensor calibration.
LAST UPDATED		December 2005	May 2007	December 2005

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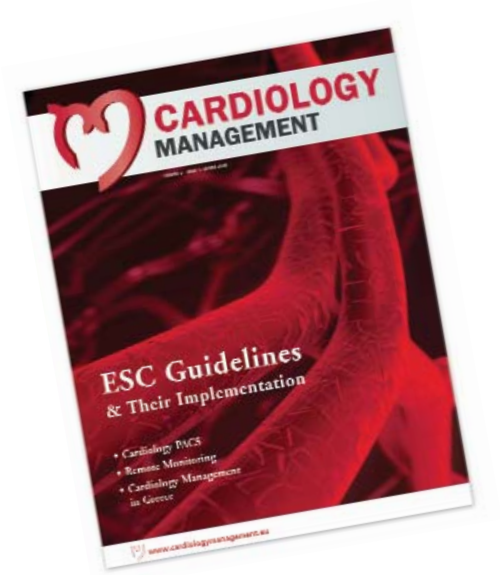

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Medical Doctors (respond below)

1. What is your occupation? (check only one)
   - ❑ Chief Cardiologist
   - ❑ Other Physician (please specify)

1a. What is your Cardiology sub-specialty? (check only one)
   - ❑ General Cardiology
   - ❑ Interventional Cardiology
   - ❑ Cardiac Radiology (Cardiac MRI, Echography, Cardiac CT)
   - ❑ Cardiac Surgery/ Cardiovascular Surgery
   - ❑ Paediatric Cardiology
   - ❑ Other (please specify)

1b. I am Chief of my Department
   - ❑ Yes
   - ❑ No

Non-physician professionals (respond below)

1c. What is your occupation? (check only one)
Administrator/Manager:
   - ❑ Cardiology Administrator
   - ❑ Cardiology Business Manager
   - ❑ Cardiology PACS Administrator

Executive
   - ❑ Chief Information Officer / IT Manager
   - ❑ Chairman / Managing Director
   - ❑ Director
   - ❑ Chief Financial Officer / other executive titles

Other
   - ❑ Medical Physicist
   - ❑ Academic
   - ❑ Chief Technologist
   - ❑ Manufacturer
   - ❑ Business Consultant
   - ❑ Distributor / Dealer

All respondents reply to the questions below

2. In what type of facility do you work? (check only one)
   - ❑ Private clinic
   - ❑ Hospital (check number of beds)
   - ❑ More than 500 beds
   - ❑ 400-499 beds
   - ❑ 300-399 beds

3. How many beds is your ward equipped with?
   - ❑ More than 30 beds
   - ❑ 15 - 30 beds
   - ❑ Less than 15 beds

4. With what technologies or disciplines do you work? (check all that apply)
   - ❑ Echography
   - ❑ Interventional Cardiology
   - ❑ Angiography
   - ❑ Cardiac CT
   - ❑ Cardiac MRI
   - ❑ Cardiology PACS

5. What is your role in purchasing
   - ❑ Final say
   - ❑ Influence
   - ❑ No role

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Making Both Ends Meet - Telemonitoring Improves Clinical and Economical Effectiveness in Chronic Heart Failure

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Multiple hospital readmissions for acute decompensation are characteristic for CHF patients, deleteriously affecting their quality of life and imposing a major burden on national healthcare costs. The direct costs of CHF-related hospitalisations in Germany amount to 2.7 billion euro per year (Statistisches Bundesamt Deutschland). Due to the demographic evolution of westernised societies, the number of hospitalisations is likely to further increase. [Figure 1]

Adherence to guidelines will improve survival and reduce hospitalisation rates thus lowering the socio-economic burden. However, disease management strategies should not only focus on drugs, but also comprise means to react to changes of health status and to coordinate adaptation of the individual patient to his disease and environment alike. Telemedicine could be the key to integrate these prerequisites, to facilitate communication with the patient and between caregivers, and to reduce overall hospitalisation rates and costs (Kielblock et al. 2007). Furthermore, a recent meta-analysis (Clark et al. 2007) concluded that telemonitoring may be even more effective at shortening hospital stay than reducing admissions, which would in turn have a considerable effect on hospital capacity needed, patient "turn-over" and patient costs to the hospital.

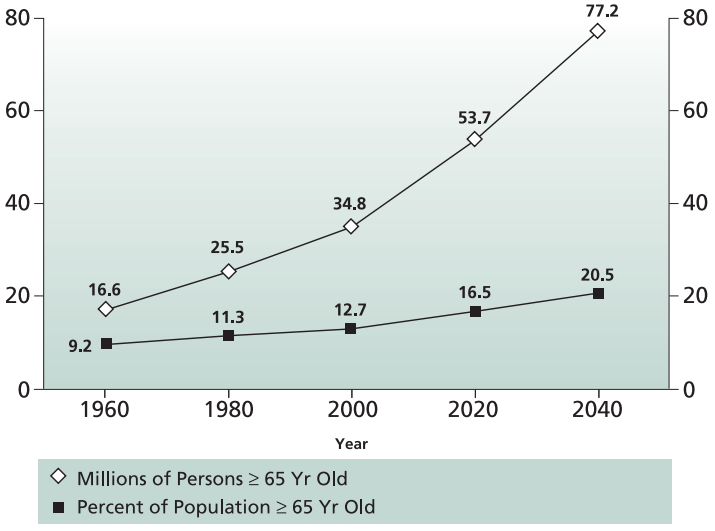

Figure 1: Projected Increases in the U.S. Population 65 Years of Age or Older; Data are from the U.S. Census Bureau; accessed on http://www.census.gov.

The Concept of Telemedical Care

Predefined vital parameters (e.g. weight, blood pressure, heart rate) are transmitted automatically via modem to the telemedical centre, which is available 24 hours a day ("24/7/365"-concept). In case individual limits for vital parameters are exceeded, an alarm is triggered, allowing for immediate therapeutic action. Furthermore, to enhance medical compliance and to detect changes of the individual health status, all patients could be pro-actively contacted alongside with counselling on nutrition, exercise and drug therapy in adjustment with the primary care physician. [Figure 2]

The Concept of Clinical and Economical Effectiveness of Telemonitoring

Prospectively, 478 patients were included in the protocol, 270 (men: 85.5%; mean age 62.5 + 10 years; NYHA II, III, IV: 80 vs. 17 vs. 3%; main diagnosis: coronary heart disease, hypertension, cardiomyopathy) were monitored via telemedical care and analysed in comparison to a matched control collective.

During an observation period of 3 months, the following rates were significantly reduced in the group of patients with telemedical care:

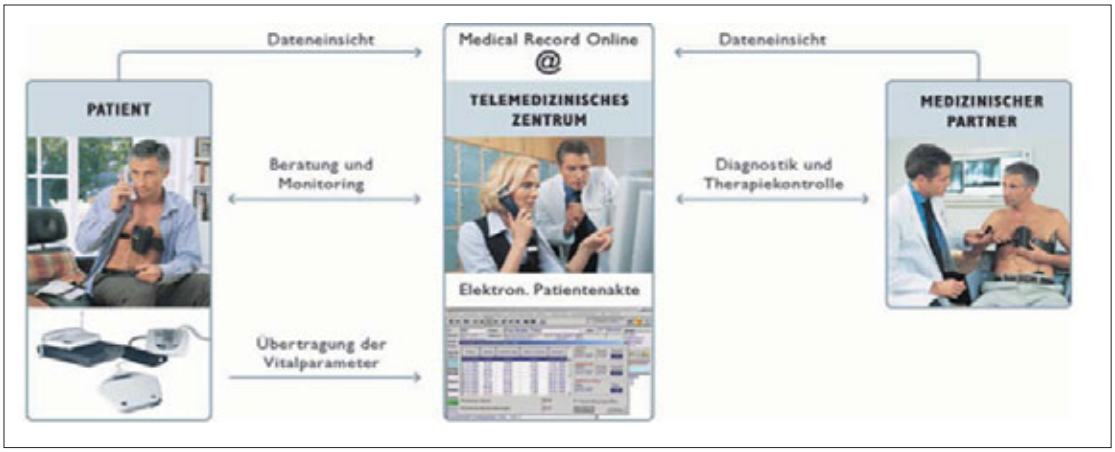

Figure 2: The concept of telemedical care (Korb et al. 2005).

- Hospitalisation: NYHA II - 2.4 vs. 5.2
  NYHA III - 3.0 vs. 8.1
  NYHA IV - 1.2 vs. 2.4
- Length of Stay: NYHA II - 21.9 vs. 50.7
  NYHA III - 27.5 vs. 78.4
  NYHA IV - 10.9 vs. 23.0
- Number of contacts with GP: 83.2 vs. 303.7
- Number of contacts with Cardiologist: 30.4 vs. 105.3

In addition, increased compliance with a more appropriate adaptation of medication could be clearly demonstrated by standardised questionnaires. Furthermore, an independent economic analysis (Clark et al. 2007; Rychlik 1999) demonstrated a significant decrease of CHF related costs (about 3000€ per patient per year) in patients monitored via telemedical care, predominantly due to a reduction of hospital days. Results can be seen in Table 1.

Impact of Telemedicine on Hospital Management

Since 2004, the German Diagnosis-Related-Groups system (G-DRG) has made a prospective payment system an obligation in the budget determination and thus hospital financing in Germany

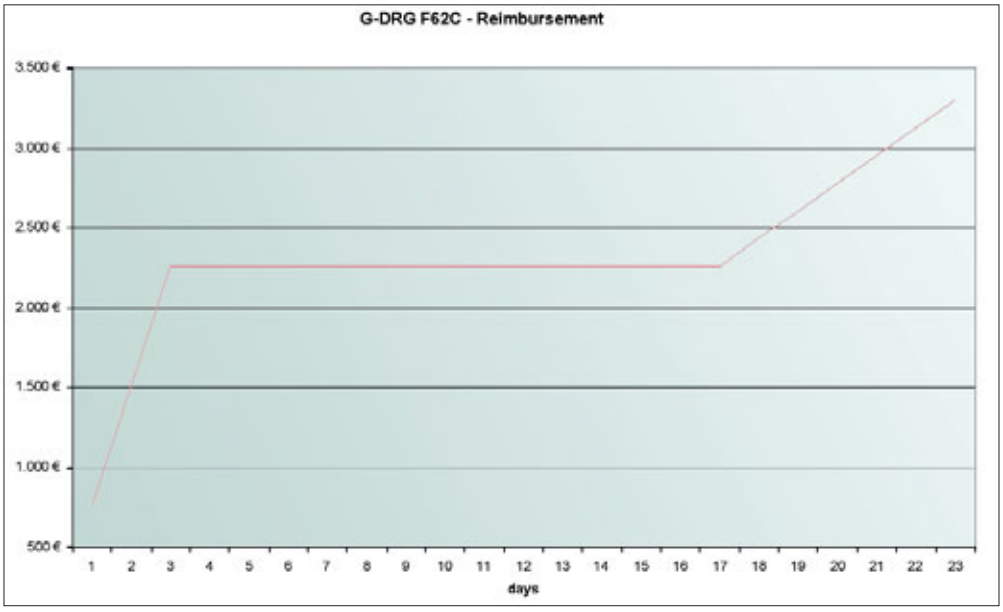

Figure 3: The average length-of-stay for the DRG: F62C (heart insufficiency) is 9 days in Germany. Since the reimbursement per case remains on casemix points and not on hospital days, reduction in length-of-stay by telemedical care could improve the net yield in patients. (Reimbursement for the G-DRG system 2007 calculated with a rate of 2.800 €).

	cohort with standard care	cohort with telemedical care
Number	111	111
Mean days of inability to work	6,46	2,91
Number of referrals	63	37
Hospitalisations per patient	0,5676	0,3333
Hospitalised patients	46	28
Number of days in hospital	754	196
Mean number of days in hospital per case	11,97	5,3
Inhospital rehabilitations	28	3
Days of inhospital rehabilitation	660	65
Mean duration of inhospital rehabilitation	5,95	0,59
Costs of hospitalisation (DRG)	304.897 €	94.725 €
Costs of hospitalisation incl. rehabilitation	370.031 €	101.329 €
Costs of rehabilitation	65.134 €	6.604 €
Costs of rehabilitation per case	2.326 €	2.201 €
Costs of rehabilitation per patient	587 €	59 €
Mean total costs	**5.873,50 €**	**2.739 €**

Table 1: Economic analysis of hospitalisation-related costs after 180 days (Rychlik 1999; Rychlik 1999)

(Statistisches Bundesamt Deutschland). Meanwhile, based on the Australian Refined DRGs (AR-DRG) more than 1,000 different DRGs allow the categorisation of medical cases in homogeneous groups of the same economic expenditure. The sum of all casemix values (Statistisches Bundesamt Deutschland) per year corresponds to the budget of a hospital granted by the German health insurance companies. Therefore a clinic, specialised in heart failure treatment might worry about losses by the decrease of the gained casemix points as in-hospital days could be reduced by application of telemonitoring systems.

However, two aspects ensure for the fact that telemonitoring leads, apart from the improved medical patient`s care, also to an improvement in the economic situation of a hospital. If a patient is hospitalised with the same DRG (due to repeated cardial decompensations) within a defined time interval to the same hospital, the hospital must connect both hospital stays to one case. Thus, the high costs of the individual cases are no longer covered by the DRG-reimbursement system. Therefore reduction of hospital readmission in patients monitored via telemedical care reduces the danger of uneconomical unification of the individual heart failure cases.

The second aspect is the clear decrease of length-of-stay (LOS) in hospital due telemedical care. Since the LOS is insignificant for the hospital's reimbursement [Figure 3], a shortened stay only leads to reduced costs for the individual case.

Thus, use of telemonitoring by reduction of readmissions and length of stay in heart failure patients could improve the net yield in patients, as reimbursement per case remains on casemix points and not on hospital days.

Implications

Following this analysis, telemedicine appears reasonable both on economic and medical grounds. Intelligent algorithms for vital parameters allow efficient monitoring of multiple patients. More importantly, doctors can contact their patients earlier to prevent hospitalisations or to individually adjust medication. After a given hospitalisation and during titration of medication a concept of technical de-escalation on a modular basis alongside with counselling measures appears possible to improve both patient awareness and CHF management. Finally, this implementation of telemedical care can work cost efficiently.

Acknowledgements

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Safety in the Intensive Care Unit:

Daily Goal Sheet

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Although all patient care settings present safety challenges, observational studies support that intensive care units (ICU's) are among the highest risk due to the number of activities performed, the complexity of those activities, and the fragile health status of the patients (Alansari and Hijazi 2006). A recent qualitative study of intensive care patients found that their overwhelming need was to feel safe (Hupcey 2000). High volume of patient data has long been identified as one of the important factors contributing to errors in ICUs. Extrapolating from previous studies, it is estimated that about 85 000 medical errors occur each day in American ICUs, 24 650 of which are potentially life threatening (Pronovost et al. 2004). Root causes of sentinel events showed that many of these errors are as a result of failure of communication between the physicians and nurses (Donchin 2003). Greater than 50% of the $17-$29 billion national cost associated with these errors is preventable (Studdert et al. 1999).

Daily Goal Sheet

Earlier research on patient safety focused on errors of commission (what we do). However, errors of omission (what we fail to, but are suppose to do) may pose an even greater threat to health. 172,263 deaths could have been prevented in an ICU from failing to use interventions like steroids in sepsis and glucose control among others (Pronovost et al. 2004). Errors of omission cannot be reduced unless the systems of care are changed. Focus on interpersonal communication and use of "smart tools" rather than people, are now accepted as a basic science of patient safety.

A keystone ICU patient safety project was launched in Michigan Health and Hospital Association Keystone Center in 2005. This project designed and implemented unit-based safety programs and daily goals sheets to help eliminate major ICU complications (bloodstream infections and ventilator-associated pneumonia). The daily goal sheet was found to improve communication, teamwork and enhance "situational awareness" in the ICU. It also enhances understanding of the patient care goals for the day. It is used daily by physicians and nurses to improve communication. After implementation of the daily goals sheet, the percent of members who understood the daily goals increased significantly. In addition, ICU length of stay has also decreased. The reduced length of stay translates into space for an additional 670 admissions per year in the 16-bed ICU. Based on a predictive model and data collection from ICU patient safety project participants, between March 2004 and June 2005, the project is estimated to have saved 1578 patient lives, 81 020 hospital days, and $164 534 736 in healthcare expenditures (Clancy 2006).

The daily goals sheet (Appendix 1) is organised into "bundles of care" that are evidence based for ICU patients on ventilators, central lines, and antibiotics. We have added to this form space for documentation of nurses concerns, as it was often a problem of communication between nurses and doctors that lead to adverse events. Moreover, we have added a section for documentation of family concerns that can be filled in by a nurse or a family member. The rounding team should assure accuracy and completeness of this sheet before moving to the next patient. The ability to guarantee accurate flow of information between various disciplines in the ICU is also essential.

The distribution of complex patient information among disciplines is a constant challenge. Taking time to contact each team member individually to inform them of the plan of care leads to lost time. Compilation of the daily action plan for each of the disciplines involved necessitates numerous discussions with colleagues who may have varying degrees of accessibility. This is also true when attempting to contact team members who are in other parts of the hospital or who are absent from the ICU. Primary team and consultation services concerns are also considered in this sheet and space for documentation is provided. Because "Daily Goal Sheets" are records of thought processes and decision making by the multidisciplinary team, we have recommended that they be posted beside the patient's head for high accessibility. Using this approach in the critical care setting provides the team with thoughtful, concise information, enhances efficiency and increases consistency of care, thereby reducing errors and complications. We think that the newly adopted sheet in our unit is likely to further enhance teamwork; increase understanding of a

patient's necessary daily goals and decrease ICU and hospital stay.

The US-based National Quality Forum, with support from the Agency for Healthcare Research and Quality (AHRQ), has identified 30 safe practices that can work to reduce or prevent adverse events and medical errors. Amongst these is the documentation of verbal orders in order to verify the accuracy of what was heard such as use of Daily Goal Sheet (AHRQ Publication 2005). In addition, Group Interaction in High Risk Environments (GIHRE) investigators recommended the use of Daily Goal Sheets as one of the ways to improve team performance (Sexton 2004). This short-term goal sheet has broad applicability for in-patient medicine and is now used in many ICUs. More than 50 ICUs in a wide variety of hospitals have adopted it as part of their rounds since the system was first developed at Hopkins.

Appendix 1: Highly Accessible Form "The Daily Goal Sheet"

Patient Name: _____ Bed Number_____ Date____/____/_____

GOAL	Goal for Today	Goal Met?	RN Initials *7-3Am*	RN Initials 3-11Pm	RN Initials *11-7Am*	Nurses Conserns	Other service Concerns
What needs to be done for this patient to be discharged from the ICU? What is this patient's greatest safety risk?							
Ventilator bundle: 1. HOB 30 degrees or greater. * 2. Sedation Vacation ** 3. Assessment of readiness to extubate*** 4. PUD prophylaxis 5. DVT prophylaxis							
Hemodynamics · Acceptable MAP · Volume Status, · Net goal for 12 MN							
Prophylaxis · Decubiti assessment / treatmnt Neuro/Pain Mgt/Sedation Nutrition- Caloric delivery/goals							
Glucose Control What is the glucose level? Goal- 61-120 mg/dl							
Mobilization/OOB (Any Rehab needs?)							
ID, Cultures, Drug levels							
Medication changes (Can any be discontinued?)							
Tests/Procedures needed Today							
Consultations needed/pending							
Can central lines or other catheters/tubes be DC'd?							
Issues to communicate with the Family							
Emotional/spiritual and sleep issues							
Code Status Addressed?							
Advanced Directive in place?							
Parameters for calling MD							

* Unless contraindicated). ** Ability to follow commands once every 24 hours. *** T piece trial.

Concerns raised by family (can be filled by nurse or family	

Conclusion

The day is fast approaching when quality improvement will be universally viewed as a core component of providing safe patient care. Due to the complexity of information being shared in the ICU, a tool is needed to focus all recommendations coming from various sources, thus producing a reliable action plan. Creating tools like daily goal sheets, discussing patient's care in a multi-professional team setting, and outlining objectives of the day will generate an efficient and streamlined approach to your work. It will create a consistent flow of communication and thus provide high quality care with attention to details and patient safety. ■

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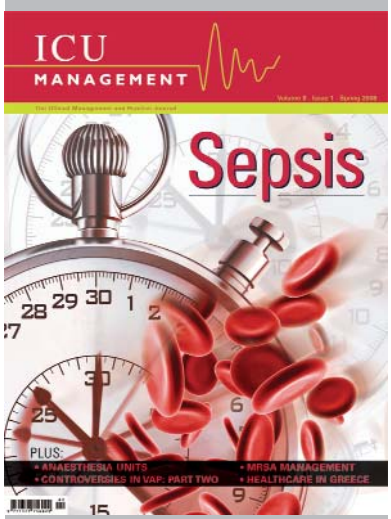

The Greek Healthcare System

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The Country

Greece covers an area of 131,957 km^2, with hundreds of scattered islands around its coastline. The country is divided into 13 administrative regions.

Over the last 15 years, a great many economic immigrants - some legal, others not - have been entering the country. According to official statistics, the population (in 2005) stood at 11,120,000 people. Women make up 50.5% of the total population. In 2005, the workforce amounted to 4,850,000 and unemployment was at 9.6%.

Greece is a parliamentary democracy. The capital is Athens with 4 million inhabitants. The official language is Greek (98%). Other languages are spoken in border zones (2%).

In 2005, the GDP was 181 billion (16,277 per capita), with an annual growth rate of 3.7%. In 2004 health expenditure was 10% of GDP; estimates showed that it would increase to 10.3% by the end of 2006. Life expectancy at birth is 82 years for women and 77 years for men (in 2005).

The Structure

The current Greek healthcare system was established by Law 1397/1983, on which the Greek National Health System (GNHS) was founded. The principles of law include:

- Equity in delivery and financing of healthcare services
- Primary healthcare development
- A new public-private mix in the service provision
- Responsibility of the state for the provision of healthcare services
- Decentralisation in the planning process, improvements and community participation
- Establishment of new payments methods for healthcare providers

As a result of this law, all hospitals that had been subsidised by the State became public; the employees became civil servants; and the establishment of new private clinics was prohibited. (This prohibition was suppressed nine years later.) Initially, vast numbers of doctors and other health professionals were appointed in the public sector, and many new hospitals and more than 200 rural health centres were built.

Interestingly enough, numerous legal provisions have not yet been enforced such as decentralising the system, organising primary healthcare and modernising administrative and economic processes in the public health sector.

Financing

The Greek healthcare system is mixed, having elements both of the Bismarck and Beveridge models.

continued on p. 40

Public Sector		Private Sector
NHS	Insurance Funds Health Services	
• Hospitals • Health Centres • Rural Surgeries • Emergency Pre - Hospital Care	• Hospitals • Polyclinics	• Hospitals (clinics) • Diagnostic Centres • Independent practices • Independent Surgeries and Laboratories

Table 1: The current structure of Greek healthcare services

The Greek Hospital System

George J. Stathis
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The current hospital system in Greece is a direct result of Act 1397/1983 that established the National Health System (NHS). Laws that were later enforced brought about some changes, but did not modify the basic characteristics of the system.

The Greek National Health System is responsible for 327 hospitals, both in the public and private sector, totalling 51,762 beds (according to statistics from 2005). The average bed occupancy is 80% and the average length of stay is six days for the public sector and eight days for the private sector (excluding rehabilitation, chronic and psychiatric cases).

Public Sector

Act 397/1983 stipulated that all hospitals that received government subsidies had to be become public. This also applied to certain hospitals e.g. academic, military or those funded by social insurance funds. Staff in these hospitals became civil servants. Only two hospitals did not change their status, since they received funding from private donators; they have, however, maintained certain characteristics of a publicly operated enterprise. An important regulatory innovation was established by Law 3293/2004, allowing - for the first time within the healthcare system, a state-owned company in the healthcare sector.

Today there are 148 public hospitals in Greece: 115 general and 33 specialised, offering 35,814 beds in total. The largest hospital has 1,100 beds, while smaller hospitals have 242 beds on average. Thirty percent of public hospitals - which allocate 40% of all beds - can be found in and around Athens.

In 2005, GNHS hospitals employed 98,226 people. Doctors represent 23.5% and all nurses 42.5% of the total. Only 19% of hospital staff members are graduate nurses (i.e. registered nurses). NHS doctors have their own salary scale, which is higher than that of other specialised hospital staff. In addition, doctors receive compensation for after-hour service (night duty).

Up to 2000 all public hospitals were solely dependent on the Ministry of Health and Social Solidarity for their annual budgetary funding. With the introduction of Act 2889/2001, an effort was made to decentralise health services and Regional Health Systems were created. However, these bodies do not have any power. Important decisions are still taken centrally by the Ministry. Currently there are 17 Regional Health Systems, but the Greek government recently announced that they will be cut back to seven and later abolished all together. The same Act also introduced the position of hospital manager for the first time; larger hospitals also have a deputy hospital manager.

Private Sector

The 179 private hospitals, called clinics, have a total of 14,528 beds, which translates into 75 beds per hospital. About 15 of these clinics are large, offering a few hundred beds. These clinics are usually owned by a group of companies. Their patients either have private health insurance or pay from their own pockets. As these private clinics determine the cost of treatment and doctors' salaries themselves, their cost structures are much higher than those of public hospitals that inevitably lead to conflict with insurance companies.

Some small private clinics work within the parameters of social insurance funds. So, they charge daily hospital fee, as defined by the government. Most of the larger clinics are general hospitals, while 53% of smaller clinics are specialised. According to law, the stocks are nominatives if a private clinic belongs to a company.

Hospital Managers

A board of directors - seven members for hospitals with up to 399 beds or nine for hospitals with more beds - manages public hospitals. The government appoints the majority of the members along with the Chairman of the Board who is the hospital manager. Until 2004 hospital managers were appointed for five years and could not be released, unless there was a serious official reason. From 2004, hospital managers have been appointed by the Minister for two years, without a contract and they can be released before the end of their term, without compensation.

In the private hospital sector, general managers are selected according to meritocracy criteria. They already have already extensive experience as a CEO and would thus receive remuneration reflecting their status.

Internal Organisation

The organisational structure of Greek hospitals is more or less similar in both the public and private sector.

Although GNHS hospitals have a Medical Directorate, each department or unit (e.g. pathology, surgery, nephrology) functions autonomously and has its own director, as in the private sector.

There is also a Nursing Directorate that is divided into sectors and departments. In public hospitals,

there is a nursing department for every medical department or unit (e.g. operating room, intensive care, etc.). In private hospitals, it is more likely that one nursing department would take care of various medical departments.

The Administrative Directorate with sub directorates for the administrative and financial issues, deal with all administrative matters. The Administrative Director is in charge of staff, hospital budgets, moving patients, dietary needs of patients, secretarial support of all services, developing IT, etc.

All hospitals have a Technical Directorate, which is responsible for the maintenance of buildings and mechanical installations and biomedical equipment. In public hospitals, the biomedical engineering department falls under this directorate. ■

continued from p. 38

Health expenditure is covered by:
- State Budget
- Social Insurance Funds
- Private Insurance Companies
- Official out-of-pocket payments by patients
- Underground (black) payments by patients

Total health expenditure is covered (2005) by:
- By state and social funds: 52%
- By private payments of patients: 48% (Private insurance covers about 2%).

GNHS hospitals receive funds to pay all personnel directly from the State budget. Additionally, they receive one daily fee for each patient from the social insurance fund, which is low - considering the real cost of hospitalisation. As a result, they often face substantial deficits, which are afterwards covered by the State budget. However, in many cases, patients pay doctors in public hospitals some money "under the table" to minimize waiting time or because they think this will ensure better medical care.

In private hospitals (clinics) hospital fees and doctors wages are higher, as these are paid by private insurance companies, or directly by patients. Patients who have social insurance prefer to pay in private clinics, as this guarantees fast service and more luxurious conditions.

Problems

The main problems in the Greek healthcare sector can be summarised as follows:

• The number of doctors per capita is high. Experts estimate that the country needs 27,000 to 30,000 doctors. Currently there are more than 68,000, equivalent to 1 doctor for every 163 inhabitants. Some doctors supplement their income in rather unorthodox ways, resulting in unjustifiable increases in healthcare.

• In contrast, there are few registered nurses - one nurse for every 250 inhabitants - primarily because this profession lacks the same social prestige. As a result, hospitals employ nurses' assistants to deal with the workload. Unfortunately, these assistants are not sufficiently trained.

• Primary healthcare is not organised by a central body, especially in urban areas. General practitioners represent less than 2% of the total number of doctors. Hospitals offer their services, covering both primary and secondary healthcare. As a result, there are waiting lists, a tendency to direct patients to the private sector or patients engage in unethical out-of-pocket payments.

• The fact that GNHS staff have a job for life and the lack of active HR evaluation and incentives are negative factors that impact on the productivity and effectiveness of the system. In a lot of cases, problems arise in the supply chain of technological equipment, sanitary materials and medicines, resulting in financial loss for public hospitals.

• Modern management methods and cost control systems, such as global budgets and DRGs, have yet to be applied in GNHS hospitals.

Regarding the establishment of modern and integrated Health Information Systems and despite the generous EU funding, absorption rates are very low, application has been very slow and therefore the system cannot have powerful and accurate tools to achieve optimum operation and planning, or perform financial and clinical audits.

In November 2006, the Minister of Health and Social Solidarity announced that he would propose three new bills to Parliament regarding the (i) central procurement of hospital supplies; (ii) administrative reengineering of the GNHS; and (iii) organisation of the primary healthcare. ■

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Society of Critical Care Medicine
The Intensive Care Professionals

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Greece Health News

Hospitals Run on Scant Staff

Many state hospitals are operating at below the emergency-staff level due to a chronic absence of personnel, says the leader of the country's hospital workers' union.

Even university hospitals are unable to maintain self-sufficient specialist units as there are too few employees to staff them, according to the president of the Panhellenic Federation of Public Hospital Workers, Stavros Koutsiobelis. He cited the example of Larissa's University Hospital, whose cardiac and urology units have been merged due to a lack of staff to maintain them separately.

Koutsiobelis said that one in four permanent posts at state hospitals are vacant and stresses that this situation is certain to worsen over the coming years with the next anticipated "wave" of retirements. Recruitment to permanent posts at state hospitals in Greece does not exceed 800 staff per year, while at least 1,200 are retiring on an annual basis - a rate expected to reach 2,500 over the next few years.

In some hospitals, understaffing is obstructing the smooth running of crucial units. The Metaxa Hospital in Piraeus has had to postpone scheduled operations for cancer sufferers - who now have to wait up to two months to be seen. According to the hospital's chief doctor Thanassis Karambelis, 142 of the 441 permanent hospital posts remain vacant. Meanwhile, another 40 nurses are on long-term leave. As a result of the shortages, doctors are often obliged to conduct blood tests - usually the role of nursing staff - which contributes to the backlog, he said.

The immediate recruitment of extra staff to fill these crucial gaps in the state health system is the main demand of hospital staff. Workers are also calling for their profession to be classified as hazardous and a health risk - a category that offers special benefits.

They have threatened to stage a two-month strike unless their demands are satisfied.

www.ekathimerini.com

Health Costs 'Bankrupt' the Poor

Some 50,000 Greek households go bankrupt every year as they pay way beyond their means for health services, particularly when it comes to serious illnesses.

"The problem with our health system is that the have-nots are paying much more than their incomes allow," said Yiannis Kyriopoulos, an expert on health economics.

In Greece, some 2.4 percent of households face bankruptcy as they pay out more than 40 percent of their total income on health services. These are "catastrophically high expenses" and a significantly higher rate than in Europe, where an average of 0.4 percent of households are bankrupted by excessive medical expenses. In the USA the equivalent rate is 1.2 percent.

The problem is particularly acute when it comes to treating serious illnesses. "Recovery after a heart attack differs for patients from different income levels due to the difference in their access to medical care," according to Kyriakos Souliotis of the University of Peloponnese.

Some 35 percent of the population avoid using health services when they have a medical problem as a way of avoiding excessive costs, Souliotis said.

But a significantly larger proportion - some 65 percent - have a different approach: They prefer to go private and pay more than endure the time-consuming state system, missing days from work and thus losing out on salaries.

www.ekathimerini.com

Can the Country Afford to Turn to Private Healthcare?

By Lykourgos Liaropoulos

It was recently said that Greece's health system is now the most privatized among the Organization for Economic Cooperation and Development's 30 developed countries.

Private spending, either officially permitted or done against the law, is growing to a greater degree than the GDP and now meets over 50 percent of the overall spending on health. On the other hand, public expenditure on health has shifted toward social security funds. But these, as their capacity to meet growing demand is diminishing, produce deficits and are incurring huge debts to health providers.

As the state's ability to fund social services drops, there is less and less state funding to the supply side.

Such underfunding has helped public health infrastructure remain in the same state it was 25 year ago.

Public health sector employees - professionals, medical practitioners and others - feel neglected and are turning for a living to private facilities, which have been enjoying steady inflows of fresh capital.

In 1976, there were around 900 smaller private clinics operating around the country but not even one major private hospital. In 2006, private clinics numbered less than 200, with a number of major private hospitals (owned by three or four big groups), claiming an extensive portion of private health turnover.

In the 32 years since 1976, we have seen dramatic changes in technology and medical science, which have considerably enhanced therapeutic potential. The private sector responded promptly, initially entering the diagnostic segment and later turning to providing treatment services.

Private health services are now expanding into other, neglected areas, such as rehabilitation, primary healthcare and home care. In the period 1995 to 2004, private investment in health rose an incredible 1,400 percent.

The state, on the other hand, simply keeps falling behind. In the past decade, this was primarily the result of the state's long-established sloth and its habitual ineffectiveness in managing all kinds of organised service provision systems.

To date, it seems that the state's backing off is a much more intentional move, though still not acknowledged.

Ceding public duties to private hands is being done gradually, pursuant - sadly, one could say - to the latter's business plans. An increasing number of public-private partnerships, exemplified by a rumored concession of primary healthcare to the private sector, are just some of the signs pointing to the privatization of the National Health System.

A question that still needs to be answered is whether Greek society is willing to consciously turn over its health to private hands.

Lykourgos Liaropoulos is a professor in health economics at the University of Athens.

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28th ISICEM - Reflections

Jean-Louis Vincent
Dept of Intensive Care
Erasme Hospital
Free University of Brussels
Belgium

The 28th ISICEM, held in Brussels from March 18-21, was attended by almost 5000 participants from 84 countries. With a program of more than 700 separate sessions, it is difficult to select individual highlights and every attendee will have their own key points. So, rather than discussing individual sessions, I've selected some important themes that were covered in several presentations.

One area of common ground in many presentations, and the focus of a pre-symposium Round Table, was the problems with the design, conduct, and interpretation of randomised clinical trials (RCTs) in intensive care. Many interventions we use daily in our critically ill patients have never actually been tested in RCTs, and most of the few studies that have been conducted have been criticised or not confirmed in subsequent trials. This leaves practicing clinicians in considerable confusion. With the promotion of evidence-based medicine, there is pressure to perform more RCTs to prove that our interventions do work; however, perhaps we have been too hasty and need to return to the basics of clinical trial design to ensure trials are carefully thought-out and targeted so that some of the pendulum-like results we have seen in recent years are avoided.

Following the clinical trial theme, a topic of debate for many years, and yet for which there are relatively few RCT data is the optimal choice of vasopressor agent during resuscitation of patients with shock. Analysis of data from the recent observational SOAP study suggested that dopamine may be associated with higher mortality rates than noradrenaline, leading the SOAP investigators to compare the two drugs as first-line vasopressor in patients with shock. Dr. De Backer presented initial results from this recently completed RCT which included more than 1600 patients. There was no significant difference in outcomes between groups, although mortality rates trended to be higher in dopamine-treated patients who also more frequently developed complications (mainly cardiac arrhythmias).

Another subject of much controversy in clinical practice has been the optimal use of transfusions in critically ill patients. Since the often-cited study by Hebert et al. published in 1999, after which many clinicians reduced transfusion thresholds and developed a more restrictive approach to transfusion, blood transfusion has become safer with increased donor screening, improved blood sterilization treatments, and the introduction of leucoreduction. Indeed, some studies have suggested that transfusion is no longer associated with a worse outcome, and that transfused patients may rather have better outcomes. Faculty members presented arguments for and against use of blood transfusion in various situations, and created considerable debate.

Finally in my brief selection of this year's key 'themes' is the potential role of medical emergency or rapid-response teams in facilitating early diagnosis and therapy of potentially unstable acute patients. There does seem to be evidence that early appropriate therapy saves lives, but is the medical emergency team the best way to achieve this? This approach was first proposed in Australasia but is now employed in hospitals worldwide. Protagonists believe that by sending the "ICU" to the patient, unnecessary ICU admissions can be avoided and therapy started sooner, thus improving outcomes. Antagonists are concerned that, by taking responsibility away from ward staff, levels of training will be reduced. In addition, with concerns about ICU staff shortages, where are the personnel necessary to be able to run such teams effectively going to come from? While such systems may work for larger centres, where does that leave smaller, less well-staffed hospitals? This discussion leads on to the larger question of the future of intensive care medicine as a whole. Patients treated in ICUs manned by dedicated ICU-trained physicians have better outcomes, but there are not enough such physicians to go round and the situation will worsen as the number of patients requiring intensive care continues to increase. How can we attract more intensivists into training? Should we be centralising ICU services so that resources are located in a few key centres? Should we be moving towards more tele-consultations, so that smaller hospitals can have support of trained ICU physicians if not onsite then online? These and many other questions need to be tackled urgently by today's ICU and hospital managers and leaders to ensure that in the future we will all be able to receive good intensive care when we need it. ■

EUROPEAN SOCIETY OF INTENSIVE CARE MEDICINE

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European Society of Intensive Care Medicine

Lisbon, Portugal
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Controversies in Critical Care

Andrew Rhodes
Chairman of the ESICM Congress Committee

Rui P Moreno
ESICM President Elect

The 21st Annual Congress of the European Society of Intensive Care Medicine will be held in Lisbon, Portugal from September 21-24, 2008. This congress is likely to be the biggest critical care meeting taking place in the world this year. Held over three days, it will feature ten parallel sessions with over 800 lectures, presentations, debates, round table discussions, tutorials and interactive educational sessions. Invited speakers are all well-known international experts in their field, and we anticipate having a faculty of over 220 speakers that will participate with us. Presentation of original research is one of the priorities of this series of congresses and we are pleased that over 1200 abstracts have been submitted to the meeting. Many of these will be presented in either oral or poster format to congress registrants. This combination of thematic presentations, education, discussion and debate of new data is an intoxicating mixture that will make the congress an event that should not be missed.

Lisbon lays lazily on the Tejo River, very close to the Atlantic coast, near the history and the beauties of Estoril, the fish restaurants of the picturesque fisherman's village of Cascais and the wild, green landscapes that inspired Byron in Sintra. Historically, Lisbon was the European hub of commerce with Africa, the Far East and Brazil. Lisbon today remains a stunning city, a prior cultural capital of Europe. Add to that its multicultural diversity, where Africa, South America and Europe mix in complex sounds and tastes, the laid-back feel and architectural time warp, and you have one of the most enjoyable cities in Europe. To recognise Lisbon's tradition of discovery and integration of diverse cultures as well as the joys of learning from different points of view, this meeting has been designed around a number of key controversies pertinent to Critical Care [Table 1]. These will be presented in a series of debates that will run through the meeting.

The objectives of this meeting are to update clinicians, nursing staff, allied health professional and industry partners on all the relevant and recent data and changes that pertain to critically ill patients and emergency medicine. We will focus not only on patient management decisions but also on organisational and management topics that are important in this area. Prior to the start of the congress, we will host a number of postgraduate courses. There will be a refresher course included among these courses, which is designed to update participants on all relevant subjects. This course will suit anyone thinking of taking the European Diploma in Intensive Care or other 'more senior' parties wanting to refresh themselves on a broad number of topics. We will also be hosting postgraduate courses on trauma, sub-arachnoid haemorrhage, patient safety, chronic obstructive pulmonary disease and asthma, in addition to echocardiography and microcirculation.

Lisbon is the city for fado, funiculars, feasting and frolicking and remains one of the cheapest cities in Europe. Good fish and fresh seafood can be found just steps away from traditional fisherman, cooked in thousands of small familiar restaurants. We look forward to you attending our 21st annual congress in Lisbon where we will offer both an enjoyable and exciting scientific program together with an entertaining social and cultural spectacle. ■

Some of the controversies that will be debated in Lisbon
Do we need a biological based definition of sepsis?
Is EGDT applicable in ICU patients with septic shock?
Is there a place for steroids in septic shock?
Ventilating the patient with TBI: should protective ventilation always be used?
Should neurointensive care patients be managed in specialist units?
Should antibiotics be used in combination or as monotherapy?
Antibiotics: How long should the course be?
Is there a role for non-invasive cardiovascular monitoring in intensive care units?
Should we try to predict fluid responsiveness or just give a fluid challenge?
Fluid management in the critically ill burned patient - Is less more?
Do patients want autonomy?
Is an ethics consultant mandatory in the ICU?
Should age be a factor for triage decisions to the ICU?
Should Intensive Care Medicine be an autonomous specialty?
Is arginine supplementation beneficial in sepsis?
Is there a role for low dose steroids in septic shock?
Should tight glycaemic control be mandated in critically ill patients?
Do we need protocols to wean patients from mechanical ventilation?
Do recruitment manoeuvres do more harm than good?
Should The thromboelastogram always be used to monitor coagulation at the bedside?
Should electrolytes be normalized in ICU patients after surgery?

Table 1

21st annual congress, Lisbon, Portugal, 21-24 September 2008

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Agenda

JUNE 2008

3-6 17th International Vicenza Course on Hemodialysis and 1st Congress of the International Society for Hemodialysis
Vicenza, Italy
www.nefrologiavicenza.it

6-8 7th Summer Conference in Intensive Care
Athens, Greece
www.esicm.org

22-25 15th International Symposium on Infections in the Immunocompromised Host
Thessaloniki, Greece
www.ichs.org

SEPTEMBER 2008

21-24 21st Annual Congress European Society of Intensive Care Medicine (ESICM)
Lisbon, Portugal
www.esicm.org

OCTOBER 2008

1-4 2nd Therapeutic Temperature Management (TTM) Congress
Barcelona, Spain
www.ttmcongress2008.com

4-8 European Respiratory Society Annual Congress
Berlin, Germany
www.ersnet.org

24-28 2nd Congress of the European Academy of Paediatrics (EPA)
Nice, France
www.kenes.com/paediatrics

NOVEMBER 2008

19-22 Sepsis 2008
Granada, Spain
http://sepsisforum.org

JANUARY/FEBRUARY 2009

23-24 14th International Symposium on Infections in the Critically Ill Patient
Berlin, Germany
www.infections-online.com

31-04 38th Critical Care Congress SCCM
Nashville, Tennessee, USA
www.sccm.org

In our Next Issue

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-Biomarkers
MATRIX
- Eldercare: Managing Aging in our ICU's
MANAGEMENT
-Importance of the Organisation of Care
HYPOTHERMIA SERIES
- Hypothermia Post-arrest: Does it Work in Kids?
COUNTRY FOCUS
-Isreal
CONGRESS PREVIEW
- SCCM's 2009 Congress

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[1]Branson R, et al. A comparison of reflective forehead oximetry and digit transmission oximetry in mechanically ventilated patients. Critical Care Medicine. 2003;30:A91.

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