

## Commentary

# Recently published papers: Changing practices in the modern intensive care unit

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'By far the best proof is experience.'

*Sir Francis Bacon, 1561–1626*

One always reviews the journals in January with some trepidation. Wading through the instructions for authors (a problem not encountered with the electronic press!), one is worried that the scientific literature may need resuscitating from the post-holiday somnolence. Fortunately, 2003 has been greeted with a fanfare of important papers in the critical care press, not least in the shape of some well conducted observational studies. Those involved in the intensive care arena often find themselves making difficult decisions, including that of cessation of therapy or, indeed, whether to admit a particular patient to the intensive care unit (ICU). The latter dilemma often causes much debate between clinicians. Two studies were published in *Critical Care Medicine* that may help in determining patient selection.

The study by Benoit and coworkers [1] attempted to assess outcome and early prognostic indicators in a global population of patients with haematological malignancies following admission to intensive care. This is a group of patients in which resistance among intensivists to admission is often encountered, despite the undoubted improvements in treatment of both solid tumours and haematological malignancies. This study from Belgium examined 124 consecutive critically ill patients admitted to the ICU over a 3.5-year period. The overall ICU mortality rate was 42%. The in-hospital mortality rate was 54% and the 6-month mortality rate was 66%. This somewhat flies in the face of other studies, which have suggested mortality rates of 75–85% in patients with haematological malignancies who require mechanical ventilation.

The usual statistical models of multivariable logistic regression analysis were applied to the data and four variables were independently associated with outcome. It is worth noting that no patient with oliguria survived, but oliguria was not included in the multivariable analysis. Leukopenia, use of vasopressors and an elevated urea were independently associated with an increased risk for death. Interestingly, proven bacteraemia was associated with a lower risk. This latter finding was teased apart in more detail but the analysis was somewhat limited by the number of patients, although it appears that there is some correlation, with Gram-positive bacteraemia having a slightly lower mortality rate. Of note, only patients with potential long-term survival or with a treatable relapse were admitted, and the fact that the average Acute Physiology and Chronic Health Evaluation II score was 26 suggests that this was a dependant group.

Perhaps the most useful aspect of this paper is not in highlighting that such patients may survive life-threatening complications but rather in helping to indicate which patients will do particularly badly. No patient with an elevated urea, leukopenia and vasopressor requirement survived at 6 months. Such predictive data aid clinical judgement with regard to escalation of therapy, and this may prove useful. What is clear from the study is that the attitudes of intensivists toward active management of such conditions appears to be changing from that of the late 1980s [2].

In the same issue of *Critical Care Medicine*, a study conducted by Tanvetyanon and Leighton [3] examined the use of life-sustaining treatments in patients who died in chronic congestive heart failure as compared with in those

who died of metastatic cancer. This was a retrospective medical record review and highlighted quite clearly that patients who died of chronic refractory congestive heart failure received significantly more intensive treatment than did patients with metastatic cancer. What was interesting is that the primary care physicians for many of the patients with congestive heart failure noted the expected poor prognosis in the admission notes. Despite this, many then went on to receive full life support and spent time in the coronary care unit. Although end-of-life decisions are often discussed in patients with terminal malignancy, this does not appear to be applied quite so enthusiastically to those with severe congestive heart failure. Hopefully, as more knowledge with regard to end-of-life care becomes both more available and acceptable, perhaps those who die from congestive heart failure may not have to suffer more than those with cancer.

Perhaps the study that will attract most attention is that by Sandham and coworkers [4]. This is an impressive randomized trial that compared goal-directed therapy guided by pulmonary artery catheter with standard care without such intervention. Almost 2000 patients underwent randomization over a period between March 1990 and July 1999. Baseline variables between the two treatment groups were similar and the patients were all aged over 60 years and were at least American Society of Anesthesiologists class III. The conclusions were that there was no benefit to therapy directed by pulmonary artery catheters over standard care in this patient group. Indeed, there was a higher rate of pulmonary embolism in the catheter group than in the standard treatment arm. The physiological goals and treatment priorities in the pulmonary artery catheter group were defined by the investigators before the study began, and assessment of achievement of these goals was based on the highest value obtained; however, it does not appear that preoperative optimisation was achieved. No such treatment aims in the standard catheter group were specified, although interestingly the reported central venous pressures for both groups did not differ significantly but both were increased from preoperative values, suggesting that in the control group significant 'goal-directed' therapy was employed. No conclusions can be made that goal-directed therapy is not beneficial to high-risk surgical patients given that in this trial it would be expected that clinicians would deliver appropriate fluid therapy governed by changes in the central venous pressure, as well as other parameters indicative of circulatory changes. Indeed, no data is presented with regard to total volumes infused, although the treatment arm did receive slightly more colloid than packed red cells. Also slightly worrisome is that the overall numbers collected were not great given the ten year period of study, which may reflect changes in practice or indeed the exclusion of those patients who would be expected to benefit most, such as the sickest surgical patients.

This is an important study in the context of elderly high-risk surgical patients, but whether goal-directed therapy should

be applied to other groups is a different matter. Many ICUs still employ the use of a pulmonary artery catheter in patients with acute lung injury and/or circulatory and/or septic shock. It is perhaps in this group that more trials should be conducted, at a time when other technologies such as the oesophageal Doppler are being adopted with the same enthusiasm as that of the balloon directed pulmonary artery catheter in the early 1980s. There is some good news for the pulmonary artery catheter enthusiasts – there was no excess mortality in the treatment arm!

A report in *Critical Care Medicine* carries an interesting hypothesis based on the application of an artificial neural network to estimate pulmonary artery occlusion pressure (PAOP) from the pulsatile pulmonary artery waveform [5]. Personally, I found this particularly intriguing. Many of us use the pulmonary artery catheter as a surrogate for left atrial filling pressures in our day-to-day ICU practice, but we all acknowledge that obtaining this requires time, effort and some skill, as well as involving some risk to the patient. The fact that this technique is so operator dependant can occasionally lead to misinterpretation of data. The study involved catheterization of the right external jugular vein in dogs and assessment of the pulmonary artery waveforms via digital sampling. The neural network was 'trained' on 80% of the sample and then tested on the remaining 20%. It appears that this neural network could accurately estimate PAOP and could provide accurate real-time estimates of PAOP in critically ill patients. With luck, in the future neural networks may provide the answer to the European time working directive.

The initial papers discussed here dealt with patients that intensivists until recently have tried to avoid. However, the acute respiratory distress syndrome (ARDS) continues to be much loved, providing challenges in treatment and much discussion. ARDS continues to occupy much of health care resources, but little is known regarding the long-term outcome of survivors. The paper by Herridge and coworkers [6] must be applauded on several counts. A total of 109 survivors of ARDS were evaluated at 3, 6 and 12 months after discharge. Patients were interviewed at these times as well as undergoing a physical examination, pulmonary function testing, a 6-min walk test and quality of life evaluation. One of the most impressive feats for those of us who live and work on this small island is that, when follow-up appointments were missed, the patient was given the opportunity to reschedule or request a home visit. The home visits were limited to a round trip travel time of 10 hours from the Greater Toronto area (approximately 700 km). The tenacity of the investigators cannot be underestimated – their enthusiasm is almost the equivalent of me performing a domiciliary visit in Manchester!

The study had a 36-month recruitment period and 198 of 228 eligible patients were recruited, of whom 117 survived. The major differences between surviving patients and those

who succumbed was that the survivors were in the main younger, had a lower Acute Physiology and Chronic Health Evaluation II score (23 versus 28), lower maximal lung injury score, lower rates of sepsis, and a higher rate of trauma-related ARDS. Also, those who survived had a lower requirement for renal replacement therapy. In terms of follow up, one may expect that limitations to daily activity would be associated with pulmonary compromise, but this was not the case. By 6 months after admission lung volumes were normal, although diffusion capacity did remain low throughout the 12-month follow-up period. The patients stated that functional limitation was due to muscle weakness and fatigue. The results implied that the inability to exercise was primarily due to extrapulmonary complications rather than pulmonary ones. The report is particularly convincing in that all patients reported some degree of fatigue and muscle weakness and, although 6-min walk times did improve after 12 months, the median was still only 66% of that predicted. Questions then arise as to whether such problems are a sequela of ARDS, but this seems highly unlikely. It would be difficult to hypothesize that such problems would not affect those with other critical illnesses, given that ARDS is not so much a disease but a consequence of severe injury. What the study does highlight is the fact that our knowledge of critical illness polyneuropathy and myopathy is scant. The challenge now is to try to identify risk factors for such debilitating sequelae as well as to include such problems as outcome measures in trials on ICU survival.

Napoleon Bonaparte was no great lover of physicians: '[Medicine is] a collection of uncertain prescriptions the results of which, taken collectively, are more fatal than useful to mankind.' Let us hope that this is not the case in our long-stay patients!

## Competing interests

None declared.

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