

## Commentary

# Recently published papers: A clinical conundrum, new from old and advances in ventilation?

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### Abstract

'Every day' clinical conundrums are all too infrequently addressed in the mainstream literature, but in the past few months two reports attempted to tackle the thorny problem of the occult cervical spine injury on the intensive care unit. Are we approaching the death knell for prone ventilation, and how much more can we squeeze out of the PROWESS study? Also, we must of course mention noninvasive ventilation.

**Keywords** cervical spine trauma, noninvasive ventilation, severe sepsis, ventilation

### Cervical spine injury

Clearance of potential cervical spine (C-spine) injury in the awake and cooperative patient with no distracting injury is a standardized procedure. The process becomes more problematic in the unconscious patient, leading to delay in C-spine collar removal and consequent complications such as tissue necrosis, raised intracranial pressure, excessive sedation and so on. Two recent reports addressed this issue [1,2].

In the first of these [1] a postal questionnaire was sent to 32 neurosurgery and spinal injury departments in the UK, with the aim of determining how they assessed the C-spine in unconscious, adult trauma patients, and at what point immobilization was discontinued. The response rate was 84% ( $n = 27$ ).

The results demonstrated little consistency between units. The majority of the units questioned had no formal protocol for either screening investigations or criteria for discontinuation of C-spine immobilization. All patients underwent at least one plain C-spine X-ray. Out of 27 units, 12 used two X-ray views alone, and only 10 out of 27 units routinely used computed tomography (CT) scanning. One unit used magnetic

resonance imaging routinely and two used dynamic fluoroscopy. Following negative imaging of one variety or other, 12 units discontinued immobilization immediately, 10 continued until they were able to clear spines clinically, and the remaining five were prepared to discontinue if the patient's condition required it. Over half of the patients had immobilization discontinued on the basis of plain X-rays alone, despite evidence that plain X-rays have poor diagnostic sensitivity for C-spine fractures [3–5] and are inferior to CT.

The results suggest that there is often suboptimal and inconsistent investigation, with a subsequent lack of rationale for discontinuation of immobilization. It is suggested that head injured patients receiving a CT scan of the brain should routinely undergo C-spine CT scanning at the same time, and that magnetic resonance imaging and dynamic fluoroscopy are not necessary in these patients.

The second article [2], also employing a postal questionnaire (95% response), looked at the major differences between clinicians of differing specialities in the management of potential C-spine injuries in unconscious adult patients. The specialities included were intensivists, neurosurgeons, and orthopaedic and

APACHE = Acute Physiology and Chronic Health Evaluation; APC = activated protein C; ARF = acute respiratory failure; BiPAP = bilevel positive airway pressure; CPAP = continuous positive airway pressure; CT = computed tomography;  $FiO_2$  = fractional inspired oxygen; ICU = intensive care unit; NIV = noninvasive ventilation;  $PaO_2$  = arterial oxygen tension.

spinal surgeons. The report also reviews the available literature and goes on to suggest a management protocol.

Consistent with the findings of Jones and coworkers [1], Morris and Mullan [2] demonstrated great variations in practice, attitudes and perceptions with regard to management and evaluation of the potentially injured C-spine in the unconscious patient. No consensus existed as to the minimum standard of investigations required to clear the C-spine in these circumstances. Recognition of the complications of prolonged C-spine immobilization in the critically ill patient was also patchy, with some clinicians suggesting that immobilization should be indefinite until clinical examination could be carried out in the awake patient.

Based upon a literature review and available consensus, the working group devised a protocol for the investigation and subsequent clearing, or not, of the C-spine in an unconscious patient. Essentially, the protocol requires three-view X-rays of the C-spine, an anteroposterior and a lateral thoracolumbar X-ray, and a high-resolution CT of the craniocervical junction. Exclusion of the injury should be within 48–72 hours.

This must be a step in the right direction, providing an evidence-based approach to an all too common dilemma in the intensive care unit (ICU).

### Prone ventilation

A randomized controlled trial, recently reported in *JAMA* [6], aimed to resolve the tricky issue of whether prone positioning for acute hypoxaemic respiratory failure improves patient survival. The trial involved 21 ICUs with a total of 791 patients being assigned to one of two groups: continually supine or intermittently prone. Randomization occurred between 12–24 hours following ICU admission. Twenty-eight day mortality was the primary outcome measure. Patients were eligible if they were intubated (or tracheostomized) with an arterial oxygen tension ( $\text{PaO}_2$ )/fractional inspired oxygen ( $\text{FiO}_2$ ) ratio  $<300$  mmHg and had an expected duration of ventilation in excess of 48 hours. Patients were excluded if they were at risk for harm from the prone positioning (e.g. raised intracranial pressure) or had recently been ventilated in the prone position.

Patients in the supine group were managed entirely in that position with a  $30^\circ$  head up tilt. Patients assigned to the prone group were placed in a complete prone position for at least 8 hours per day. However, if a patient developed severe hypoxia in the supine position, then they could crossover to the prone group. If a major complication attributable to prone position occurred, then the patient was reverted to the supine position.

Sadly 28-day mortality rates were not significantly different between the two groups (31.5% for supine versus 32.4% for prone). Ninety day mortality was also similar (42.2% for supine versus 43.3% for prone). The duration of mechanical

ventilation and rates of successful extubation did not differ significantly. However, ventilator associated pneumonia was found to be significantly reduced in the prone group. Serious side effects of positioning were significantly more frequent in the prone group. These included accidental extubation, tube obstruction and incidence of pressure sores.

The authors acknowledged several limitations in their trial, including significant treatment group crossover and a failure rate in excess of 25% in the prone positioning protocol. However, the trial failed to show a reduction in mortality after early prone positioning for acute hypoxaemic failure, despite an improvement in oxygenation and a reduction in ventilator associated pneumonia; also, it did demonstrate an increased incidence of serious side effects from ventilation in the prone position.

This report echoes the findings of Gattinoni and coworkers [7] and begs the question, is there any evidence to justify prone ventilation?

### PROWESS

The November issue of *Critical Care Medicine* included reports on two retrospective studies [8,9] based on the PROWESS (Recombinant Human Activated Protein C Worldwide Evaluation in Severe Sepsis) study [10] data base, and discussed new post-28-day data.

In the first of these reports [8], outcome beyond 28 days and health care resource utilization, employing the simplified Therapeutic Intervention Scoring System, were examined. Previous investigators have concluded that the cost-effectiveness of activated protein C (APC) in the management of severe sepsis compares favourably with that of other health care interventions, despite its high up-front cost. However, these findings were largely based on 28-day data, and as such they do not take the entire hospital stay into account. Laterre and coworkers point out that, at 28 days, more than 40% of the PROWESS survivors were still in hospital and little is known of their health care consumption from there on. Subgroup analysis, based on previously defined groups, was also carried out.

Conclusions from that analysis are generally encouraging. Survival from severe sepsis is significantly better at hospital discharge for those treated with APC than for those not treated with APC, and this remained the case for the majority of subgroups. Furthermore, this increase in survival was not associated with an increase in resource consumption, as measured using the Therapeutic Intervention Scoring System, or in terms of ICU and hospital length of stay. In addition, a greater number of survivors in the APC group than in the placebo group were discharged directly home.

Not happy with follow up to hospital discharge, Angus and coworkers [9] collected long-term survival data up to

3.5 years after PROWESS. They aimed to determine the effect of APC on hospital survival (as described above) and then to investigate the ensuing long-term survival and to analyze these results for selected subgroups based on age, premorbid functional dependency, Acute Physiology and Chronic Health Evaluation (APACHE) II score and number of organ dysfunctions, all of which are known to have prognostic significance in severe sepsis. Sadly, despite survival to hospital discharge being better in those treated with APC, rates of overall median survival and survival at 3 months, 6 months, 1 year and 2.5 years were not significantly different between the APC and placebo groups. This finding was consistent for subgroup analyses other than for APACHE II scores. In *post hoc* analysis, patients with an initial APACHE II score in excess of 25 had a survival benefit when treated with APC. This persisted to 30 months.

Both groups of authors emphasized the significant limitations to these types of studies. Retrospective, cross-sectional observations, use of *post hoc* analysis and small sample sizes that are not powered for the analysis in question must temper over interpretation. However, it is unlikely that a new long-term prospective trial studying the effect of APC in severe sepsis is now possible, and we must therefore tailor our clinical practice with these findings in mind.

### Noninvasive positive pressure ventilation

In the past few months the journals, as has become the norm, have been peppered with studies investigating noninvasive ventilation (NIV) in the management of acute respiratory failure (ARF) of varying aetiology.

The immunocompromised patient presenting with ARF has been thought to carry a very poor prognosis, and as such intensive care physicians have been reluctant to institute invasive respiratory support. However, recent studies have demonstrated the efficacy of NIV in this patient population, providing us with an alternative to endotracheal intubation [11,12]. Carrying this concept forward, Rocco and colleagues [13] reported a case-control study comparing NIV delivered via traditional face mask versus the much discussed helmet interface for immunocompromised patients with hypoxaemic ARF and fever. Accepting that numbers in this study were small and that patients in the helmet group were matched with historical control individuals receiving facemask NIV, both groups demonstrated a similar improvement in PaO<sub>2</sub>/Fio<sub>2</sub> ratio, but importantly the helmet group demonstrated a more sustained improvement. This was probably due to a lower incidence of complications, leading to patient intolerance of the device. A trend toward reduced mortality in the helmet group was also shown.

An equally unappetizing prospect is the combination of ARF and haematological malignancy. A further study appearing in *Chest* [14] compared NIV with invasive intubation and ventilation for this patient group. This was a retrospective study

using a pair-wise matching system to compare the two treatment modalities and logistic regression analysis to identify factors affecting in hospital mortality. Conclusions need to be drawn carefully because the study population was quite heterogeneous with varying types of malignancy and differing aetiologies to the respiratory failure. In addition, the technique of NIV changed significantly during the study period. Despite this the authors identified increasing severity of illness and a diagnosis of acute myeloid leukaemia as markers of poor outcome, whereas being female, intubated in the first 24 hours and the presence of recent positive blood cultures were markers of good outcome. Make of this what you will.

To end, we return to *Critical Care Medicine*, December issue. A prospective randomized trial [15] suggested that continuous positive airway pressure (CPAP) and/or bilevel positive airway pressure (BIPAP) is superior to oxygen therapy alone in acute cardiogenic pulmonary oedema. Specifically, CPAP and BIPAP resulted in much improved PaO<sub>2</sub>/Fio<sub>2</sub> ratios and a lower incidence of endotracheal intubation. No increased incidence of myocardial infarction was demonstrated in the CPAP/BIPAP groups. However, there was no significant difference in mortality at hospital discharge between the groups.

### Competing interests

The author(s) declare that they have no competing interests.

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