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CLINICAL INVESTIGATIONS

The Brussels sedation scale: use of a simple clinical sedation scale can avoid excessive sedation in patients undergoing mechanical ventilation in the intensive care unit†

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Sedation is an important component of patient comfort in the intensive care unit (ICU), especially in those undergoing mechanical ventilation. Sedation that is too light or too deep can have important consequences, and therefore assessment of the degree of sedation should be an important part of patient management. Although there are many methods available to assess the degree of sedation, none is ideal. Therefore, we developed a new sedation scale and analysed its clinical impact in the management of patients undergoing mechanical ventilation. The study comprised two consecutive phases. In the first phase, the medical team did not use a sedation scale. In the second phase, the medical staff used the new sedation scale, comprising five levels, depending on the perceived degree of sedation: levels 1 and 2=oversedation; levels 3 and 4=correct sedation; and level 5=undersedation. There were no significant differences in mean or highest levels between patients in the two phases (mean 2.89 (SD 0.11) *vs* 2.67 (0.13), $P=0.22$; highest 3.16 (0.11) *vs* 3.10 (0.14), $P=0.78$). However, the lowest level was significantly greater in patients in the second phase than in those in the first phase (2.61 (0.11) *vs* 2.16 (0.13); $P=0.011$), indicating that the number of patients with excessive sedation was significantly reduced with the introduction of this scale. Thus the use of this scale can have a real clinical impact for patients undergoing mechanical ventilation, principally by avoiding excessive sedation.

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One of the key factors in good patient care is appropriate analgesia and sedation to ensure patient comfort, and in the intensive care unit (ICU) patient this is of particular importance.[1–4] However, optimizing pain control and sedation is not easy. Difficulties in communicating with the ICU patient may mean that pain and anxiety are overlooked and under-treated while alternatively, it may be tempting to sedate a 'difficult' or unco-operative patient more heavily. The use of deep sedation is restricted to specific medical conditions, such as severe respiratory failure, status epilepticus, uncontrolled intracranial hypertension or tetanus, and the need for deep sedation in such cases is not disputed.[5] Lighter levels of 'conscious' sedation are indicated for relief of anxiety, to assist with sleep, to facilitate mechanical ventilation, to protect against myocardial ischaemia and to enable nursing procedures to be conducted with minimal discomfort to the patient; it is in these patients that the degree of sedation should be assessed and optimized. Importantly, a distinction must be made between analgesic drugs and sedative agents, although pain and anxiety are inextricably linked. Increasing the degree of sedation in a patient with inadequate pain control is not warranted and similarly, increasing analgesia in an over-anxious patient would not be adequate. Importantly, the relief of anxiety should not be restricted to pharmacological methods;

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Table 1 Brussels sedation scale

Level	Description
1	Unrousable
2	Responds to pain stimulation (trapezius muscle pinching) but not to auditory stimulation
3	Responds to auditory stimulation
4	Awake and calm
5	Agitated

Table 2 Principal diagnoses of patients

	Phase 1	Phase 2
Surgical		
Cardiothoracic	13	5
Abdominal	5	2
Neurosurgical	3	6
Medical		
Respiratory failure	6	9
Cardiac failure	1	2
Metabolic disorders	1	0
Pancreatitis	1	0
Septic shock	1	0
Total	31	24

psychological factors play an important role and the need to keep patients well-informed and maintain good communication should not be underestimated. In most situations, the target is to have a co-operative, calm patient whose pain is controlled.[6]

Undersedation has negative effects, including pain, tachycardia, hypertension and failure of ventilator–patient synchrony leading to hypoxia.[5] However, sedative agents are not without side effects and excessive sedation may lead to respiratory depression, hypotension, bradycardia, ileus, renal failure, venous stasis and immunosuppression.[5 7] Therefore, it is essential that the dose of sedative be titrated and adapted according to the changing condition of the patient.[4] However, assessment of the appropriate degree of sedation may be difficult, especially in patients undergoing mechanical ventilation where communication is restricted. Many subjective and objective methods of assessing the degree of sedation have been described[8–13] but none is universally accepted or used. Subjective methods are limited by inter-observer variability and more objective methods are often too complex to be used routinely.[14] We decided to develop a new, easy to use sedation scale comprising five levels (Table 1). The aim of this study was to evaluate the clinical usefulness of such a scale, with particular attention to whether or not it would modify the management of sedation treatment in patients undergoing mechanical ventilation, and whether it would help avoid excessive or insufficient sedation.

Patients and methods

All patients who had undergone ventilation for more than 24 h in the ICU were included, except those who were comatosed and those who required heavy sedation for specific therapeutic reasons, such as severe respiratory failure or severe intracranial hypertension.

The prospective study was performed in two phases:

(1) *Observation*. During a 2-month period, the ICU team, who were aware that a study on sedation was in progress, continued to manage the sedation of patients undergoing mechanical ventilation as normal in our unit (i.e. based on clinical evaluation). Meanwhile, the principal investigator (O. D.) estimated the sedation level of these patients three times a day using the new sedation scale (Table 1).

(2) *Application*. After a 6-week training period in which all ICU staff were coached in the use of the sedation scale, nursing staff were asked to evaluate the sedation level of each patient every 4 h and to note the levels on a sedation sheet at the bedside. Doctors were asked to use this sedation scale to manage sedation, with the aim of maintaining a sedation level of 3–4. If doctors felt that a higher, or lower, degree of sedation was necessary, specific reasons had to be given. The principal investigator, who had no access to the sedation sheets used by the care team, continued to independently assess the sedation level of all patients.

For each patient, we determined the lowest, highest and mean sedation level each day. Data were analysed using the Mann–Whitney *U* test and chi-square test, with the Statistical Package for Social Sciences program for Windows, version 8.0 (SPSS, Chicago, IL). $P<0.05$ was considered statistically significant.

Results

The first phase included 31 consecutive patients for a total of 67 observation days. The second phase included 24 consecutive patients studied for a total of 77 observation days (Table 2). There were no significant differences in mean (2.67 (SD 0.13) *vs* 2.89 (0.11); $P=0.22$) or highest (3.10 (0.14) *vs* 3.16 (0.11); $P=0.98$) sedation levels among patients from the two phases. However, the lower levels of the two groups were significantly different (2.16 (0.13) *vs* 2.61 (0.11); $P=0.011$) (Fig. 1).

In the first phase (67 days), 20 patients (30% of observation days) had a sedation level of 1 in the morning, and eight of these 20 patients (40%) had a greater sedation level in the evening. In the second phase (77 days), nine patients (12% of observation days) had a sedation level of 1 in the morning and six of these nine patients (67%) had a greater level in the evening. Thus fewer patients in phase II compared with phase I had a low sedation level in the morning (12% *vs* 30%; $P<0.02$) and in the evening (4% *vs* 18%; $P<0.02$).

Sedation levels assigned by the investigator were identical

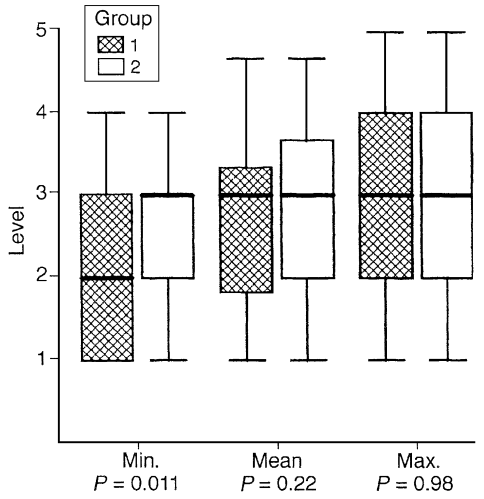


Fig 1 Box plot showing median, 25th and 75th percentiles for level of sedation, as measured using our new sedation score. There was no significant difference between the two groups in mean and highest sedation levels, but the lower sedation levels were significantly different between groups.

to those of the nurses, assessed independently during the second period, with no exception. All nurses and physicians indicated that they had no difficulty in using the sedation scale.

Discussion

Adequate sedation is essential in patients undergoing mechanical ventilation to increase tolerance to the tracheal tube, improve synchronization with the ventilator and ensure patient comfort.[15] However, sedation can also reduce respiratory drive and hamper weaning.[6] The degree of sedation used in patients undergoing mechanical ventilation in the ICU is clearly of importance but there is no universally accepted method of assessment. The Ramsay scale described 25 yr ago[8] is still probably the most commonly used sedation assessment system. The Ramsay scale was developed specifically to provide objective assessment of drug-induced sedation and is based on a six-point scoring method, three while awake and three while asleep. However, although relatively simple to use, it can be difficult to differentiate between levels 4 (quiescent with brisk response to light glabellar tap or loud auditory stimulus) and 5 (sluggish response to light glabellar tap or loud auditory stimulus).[16] Other methods of assessing the degree of sedation have been proposed, including monitoring the electroencephalogram (EEG). However, these techniques are complex and expensive and while some have shown a decrease in high frequency activity and an increase in low frequency activity with increasing sedation,[17] other groups have not confirmed these findings. Therefore, these techniques remain experimental.[18]

Hence the degree of sedation in ICU patients is frequently assessed by clinical evaluation alone. We developed a new, very simple sedation scale which is easy to use, reproducible and objective, and assessed its value in the clinical situation. We limited our scale to five levels, but in contrast with the Ramsay scale we reversed the order, with the level increasing with decreasing sedation. This order was selected as we felt it would be more easily applied, being analogous to the Glasgow coma scale[19] in which a low value indicates a more profound alteration of consciousness.

We believe our study demonstrated that the use of this new sedation scale offers several advantages. First, the use of a sedation scale is clearly better than clinical assessment. It may be easy to identify a patient who is inadequately sedated (agitated, distressed, etc.,) but it is not as easy to detect oversedation. Our study showed that the use of the simple sedation scale did not influence the mean sedation level of patients, but helped to avoid excessive sedation. High sedation scores were not different between patients in whom sedation was controlled by clinical assessment and those in whom sedation was controlled using the scale, suggesting that clinical assessment was effective in adjusting sedation at the 'agitated' end of the range. However, at the other 'oversedated' end of the range, the use of the scale resulted in fewer patients being oversedated than when clinical assessment alone was used. While we acknowledge that the focus on sedation may have introduced some intrinsic bias to our results, we believe that as the ICU team were aware that a study on sedation was in progress from the start of the first phase, the only difference between the two phases was the use of the scale, and thus our results are attributable to the introduction of the scale and not to the study *per se*. Second, the care team reported no difficulties in using the scale. Moreover, the sedation levels assigned by the investigator were identical to those assigned by the nurses. Thus the scale is reproducible, objective and reliable.

Our study also revealed that there were more patients with lower sedation levels in the morning in both phases, suggesting that sedative agents were used more liberally during the night. There are several possible reasons for this, including the perception that sedation aids sleep. Sleep plays an important part in recovery, and inability to sleep is an important cause of stress in ICU patients.[20] Chronic sleep deprivation has been associated with the development of ICU psychosis and with impaired physical performance, tissue repair and cellular immune function.[6 21] ICU patients are frequently disorientated in time as their normal circadian rhythm is disrupted and increasing sedation at night may be considered a means of restoring normal patterns. However, there is little evidence that sedative agents create physiological sleep and they may in fact interfere with normal sleep architecture,[6] creating a vicious cycle of increasing tiredness–increasing sedation. Alterations to the ICU environment, such as reduced lighting, noise and interruptions at night may be more effective in maintaining diurnal rhythms and assisting sleep than the overzealous use of sedative agents.[22]

In summary, our study indicated that patients undergoing

mechanical ventilation in our unit are sometimes over-sedated, and that the use of our new, simple scale can reduce the number of patients with excessive degrees of sedation. The chief purpose of sedation in those undergoing mechanical ventilation in the ICU is to keep the patient calm, comfortable and co-operative. This reliable, easy to use scale to assess sedation can help achieve this target.

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