Nurses' sedation practices during weaning of adults from mechanical ventilation in an intensive care unit

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Background

Mechanical ventilatory support for adults with acute respiratory failure is potentially lifesaving, but carries burdens of distressing and invasive interventions and can induce pain, fear and anxiety in patients having an influence on patient's outcome.[1] Ventilated patients generally receive some form of sedative therapy,[2,3] particularly based on various combinations of opioids and benzodiazepines.[4-7] There are however also clear benefits to sedation such as reduction of pain, anxiety, agitation, and stress responses, preservation of monitoring devices, facilitation of ventilation, and providing comfort and safety;[2,3,8,9] however sub-optimal sedation is common and is associated with numerous adverse events.[10] The type of agent[11-13] and administration route[1,11,14-17] influence patients' outcome. Multiple studies indicate that continuous intravenous sedation is the most frequently applied strategy for sedation, despite its association with prolonged mechanical ventilation (MV),[14,15] increased risk of ventilator-associated pneumonia (VAP)[16] and an added intensive care unit (ICU) and hospital length of stay (LOS).[14,17]

Optimally sedated patients should be awake, comfortable, calm and co-operative which would enable faster discontinuation of MV.[1,18] This situation is, however, often difficult to achieve. Various strategies have been attempted to reach this goal, including sedation algorithms, guidelines,[18,19] sedation protocols,[15,17,19] also in a combination with weaning protocols,[20,21] and daily interruption of sedation (DIS).[1,13,15,16,19,22,23] Daily interruption of sedation contributes to faster liberation from MV by decreasing the use of sedatives, preventing drug accumulation, promoting patient's awareness and facilitating patient's interaction with the environment. [11,15,16,19] Daily interruption of sedation is also suggested to protect against depression and post- traumatic stress disorder (PTSD).[1,11] Therefor DIS and target sedation

goals are recommended to be incorporated in a sedation protocol[21]. There is however lack of strong evidence supporting the use of sedation protocols and DIS, possibly due to organisational and contextual factors of the studied settings. Available studies show rather positive influence of sedation protocols and DIS on patient outcome.[1,13,15-17,19,22,23] However, additional research is needed to summarize the available data, thus guaranteeing more stable results.[5,10]

In the last years, research has focused on identifying the most appropriate sedative and analgesic agents. These should have a rapid onset of action and be easy to manage. Above, they should cause few complications, not accumulate in the tissues, and be affordable. Although the ideal drug does not exist yet, strategies for sedating patients have changed the last few years towards lighter sedation.[1,8,24] The most recent guidelines of the Society of Critical Care Medicine[18] emphasize the importance of lighter and analgesia-based sedation, recommend the use of non-benzodiazepine agents, the limitation of neuromuscular blocking agents (NMBA), and the monitoring of patients' sedation level. Despite efforts to standardize sedation care worldwide, substantial variety remains between clinical practice in European, North-American and Australian practitioners.[6,7,25-30,32,33] A detailed inventory of current sedation practices might be useful to identify the factors contributing to this discrepancy.

The role of the nurse in assessing and maintaining optimal sedation is paramount.[27,28] Nurses' perception on sedation practice, their attitudes, knowledge and experiences as well as the level of multidisciplinary collaboration have been recognized as being essential in understanding and guiding nurses' behaviour.[27-30] Organisational and cultural differences make it challenging to identify the rationales of nursing decisions in the ICU.[6,23,24,28,29,33] Recognition of the patterns having an influence on these substantial differences in practice is

important in order to assure effective, homogenous and evidence based care for all ICU patients.

Aim

The aim of this study is to map nurses' sedation practices in the context of weaning patients from MV in adult ICUs in Flanders (Belgium) by means of a self-constructed questionnaire. We particularly explored the prevalence of and adherence to sedation protocols, as well as the use of DIS and nurses' barriers towards this practice. We also sought to describe the range and type of analgo-sedative agents used for sedation in the ICU and the extent of nurses' autonomy in sedation practice.

Methods

Questionnaire development

A cross-sectional survey using a self-administered questionnaire (appendix 1) invited ICU nurses to evaluate their daily sedation practices. The questionnaire gathered socio-demographic data and included 18 questions derived from recent literature. Of these, eleven were closed-ended multiple-choice questions, and four were single-answer questions. The three remaining questions were to be answered using 4-point Likert scales.[34] The questionnaire's content validity[35] was assessed through a Delphi-procedure[36] in which four independent experts in ICU nursing research and one ICU physician participated. The panel members remained anonymous to one another throughout the procedure.

Data collection and analysis

As approved by the board of the Flemish Society of Critical Care Nurses, the questionnaire was distributed as congress bag content among 640 attendants of the 32nd Annual Congress

of the Flemish Society of Critical Care Nurses in Ghent, Belgium (December 12, 2014). This non-profit Flemish Society from the northern, Dutch speaking part of Belgium is one of the largest European congresses that attracts an average of 700 critical care nurses/year.

The chairman of the Society presented the aims of the survey to the delegates in a Microsoft Power Point presentation and a time interval of 30 minutes was provided for completing the questionnaire. Delegates were requested to return the questionnaire by dropping it in boxes provided at each door of the congress room.

Data were entered by MB in the SPSS Statistics software program (version 21). Only the responses of nurses working bedside in adult ICUs were analysed. Descriptive statistics were used to analyse categorical variables and presented as frequencies and percentage. Differences in responses between nurses working in academic and general hospitals were tested using Chi-square test for categorical variables. Statistical significance level for Chi-square was set at $P < 0.05$. Statistical analysis was conducted by MB and SB.

Ethical considerations

Ethical approval was obtained from the ethics committee at Ghent University Hospital. The respondents were orally informed during the congress about the purpose of study and its voluntary character. In the introduction to the survey a written assurance of anonymity of the study was given and its voluntary character was emphasized. Informed consent was assumed when respondents filled out the questionnaire. The data were only accessible to the research team and data were stored on a password protected computer.

Results

Response rate and demographics

Completed questionnaires were obtained from 423 congress delegates (66.1%; n=423/640). Of these 342 were bedside ICU nurses whose responses were included in the analysis. Table 1 shows the demographic characteristic of the respondents.

Sedation practices

For sedation ≤24 hours, mainly short acting agents are used (Figure 1). For sedation >24 hours, both short- and long acting agents are administered (Figure 2). Respondents indicated that patient-ventilator dyssynchrony was the most frequent indication for use of NMBAs (77.5%; n=265/342). Less common indications included acute lung injury/acute respiratory distress syndrome (ALI/ARDS) (38.0%; n=130/342), prevention or treatment of shivering in patients with induced therapeutic hypothermia (30.4%; n=104/342), and cases of high intracranial pressure (22.2%; n=76/342). Most nurses administer sedation in continuous infusion with bolus doses if needed (81.0%; n=277/342).

Nurses reported changing sedative infusion rates (74.9%; n=256/342) and delivering sedative bolus doses (78.7%; n=269/342) without a physician's order. Less than half of the nurses (43.7%; n=149/341) reported the presence of a sedation protocol in their ICU while 10.3% (n=35/341) were not aware of a protocol being available. Sedation protocols were reported as being more frequently available in academic hospitals compared to general hospitals (72.0%; n=54/75 vs. 41.5%; n=93/224 p<0,001).

Sedation protocols were reported to be routinely used by 61.8% of nurses (always 8.1%; n=12/149, mostly 53.7%; n=80/149). A majority (83.5%; n=283/339) indicated that additional analgesic agents were generally administrated if sedation was withdrawn (Table 2).

Slightly more than half of respondents have a patient-targeted protocol (53.4%; n=78/146). Protocols are mainly developed by ICU physicians (78.5%; n=117/149) and nurses (51.7%; n=77/149), while other disciplines (anaesthetist, physiotherapist, respiratory therapist, pneumologist) are less frequently or not (psychologist) involved. Nearly 54% (n=80/149) of nurses will not use a protocol if the physician desires to work without it or if there is no physician's order available (19.5%; n=29/149). Reasons for not applying sedation protocols included a high workload (10.7%; n=16/149) and the use of short-term sedation (38.3%; n=57/149).

Level of sedation is generally evaluated every 2 hours (56.0%; n=188/336) (Table 3) and by means of Richmond Agitation Sedation Scale (RASS) (59.1%; n=195/330), Glasgow Coma Scale (GCS) (47.0%; n=155/330) or Ramsay Sedation Scale (RSS) (29.1%; n=96/330). Daily interruption of sedation is applied variably: never (27.4%; n=93/340), rarely (53.5%; n=182/340), mostly (14.4%; n=49/340) and always (2.1%; n=7/340). Nine nurses could not estimate how often they use DIS (2,6%; n=9/340). Daily interruption of sedation is used to evaluate patient's neurological status (86.3%; n=215/249) and to shorten the duration of MV (44.2%; n=110/249). Nearly 78% (n=193/249) do not apply DIS during night shifts.

Numerous barriers to perform DIS were reported. Patient's comfort is the most frequent concern (49.4%; n=123/249) followed by respiratory deterioration (46.6%; n=116/249). The most relevant barriers are presented in Figure 3.

A majority (65.8%; n=225/342) indicated agitation, confusion and ICU delirium as frequently occurring problems during reduction of sedative agents. Furthermore, major concerns include patients' comfort or pain (45.6%; n=156/342), need for physical restraints (34.8%; n=119/342), and patients biting on their endotracheal tube (ET), tongue or lips (37.7%; n=129/342).

Respondents were also requested to give their perception on multidisciplinary collaboration in their ICU. Of all team members, the attending physician is the most involved in decision making on reduction of sedative infusions (94.4%; n=323/342), cessation of sedative infusions (95.9%; n=328/342) and implementation of DIS (69.6%; n=238/342). Second most involved are nurses with 80.7% (n=276/342) involvement in 'reduction of sedatives', 65.8% (n=225/342) in 'cessation of sedative infusions' and 43.6% (n=149/342) in 'implementation of DIS'. The involvement of other disciplines, such as respiratory therapist and physiotherapist were reported as being rare (<2%).

Discussion

The results from our survey expose some current sedation practices among Flemish nurses. We found alarming low availability of sedation protocols and protocol compliance level. Daily interruption of sedation practice is not frequent and barriers to DIS are numerous. Analgo-sedation, based particularly on short-acting agents, is mostly provided as continuous infusion with bolus doses if needed. The level of sedation is frequently assessed using RASS.

Nurse-led sedation protocols have an important influence on weaning outcome, duration of MV, hospital and ICU LOS[16] and should be considered a standard practice in the ICU.[11,18,19,37] There is, however, lack of strong evidence supporting the beneficial influence of sedation protocols on patients' outcomes.[10] The available data are generally derived from non-

randomised studies resulting in conflicting conclusions. In our study, the use of sedation protocols was found to be low (43.7%) with a significant difference in responses between nurses working in academic and general hospitals (72.0% vs. 41.5%; p<0,001). Similar differences were reported in a Canadian survey of physicians.[6] The reported adherence to the protocol in our study was slightly above 60% giving a considerably low number of actual protocolized sedation care (PSC). In a Belgian survey of ICUs[30] the availability of a sedation protocol was reported even lower (by 26% nurses), however only 8% of nurses reported not using a protocol at all. Convenience sampling may be responsible for the differences between the two studies.

Results from other surveys[25,26,28,38-40] show further deficit in availability and implementation of sedation protocols and scales. Protocols are applied rather poorly in most European countries; however, a trend towards more frequent use of protocols has already been reported.[39] North-American studies do not show better results in this regard. In the study of Tanios[29] the overall presence of a sedation protocol is higher than in our survey (64.0%) with a low response rate (7.1%). The responders were mainly physicians. Comparable use of sedation protocols was reported in another American survey[27] (60.5% nurses) and in a Canadian[23] observational study (54.9%). In the study of Patel[7] the availability of a protocol was higher (71%), but the sample consisted of different professionals, and nurses were in minority (23%). Also in Australia[31,33] the interest in PSC increases however the benefits of their use are yet to be demonstrated.

Organisational and contextual factors, such as nurse-to-patient ratio, pre-existing practice and culture, level of multidisciplinary collaboration and nurses' attitudes and knowledge may affect every-day practice in the ICU.[27,28,33,41-43] The perceived level of collaboration on sedation

practices in our survey is high, with the physician most prominently involved in all decisions. We noticed that *multidisciplinary collaboration* applies almost exclusively for physicians and nurses with other disciplines being absent. Also, nurse-to-patient ratio was found to be low in comparison to other studies[28,31,44-45] which raises some questions about quality of care. We believe, that particularly in settings with a low nurse-to-patient ratio, the use of protocols should be recommended to ensure patients' safety. Unfortunately, we are not able to provide more insights into organisational or contextual factors.

The implementation of sedation scales into clinical practice remains problematic.[24] The RSS seems to be the most favourable scale in North-America,[7,27] and Europe[25,30,38,39] despite recommendations to use SAS or RASS.[18,19] Since the publication of the 2013 SCCM guidelines,[18] we might notice some increase in the use of RASS and SAS.[23,28] In our survey adoption of RASS (59.1%) is higher than in the other studies.[27,28,30] Although availability and use of sedation protocol in our study is low, the possible negative impact on sedation care might be limited by the frequent use of valid sedation scales.

Daily interruption of sedation is rarely executed by our respondents. Similar data were revealed by others where the percentage of practiced DIS is at highest around 50% or is described as poor.[23,26,28-30,38-40] Studies from the UK[25] and North America[7] reported more frequent adoption of DIS (77.8% and 77%), however according to the authors, these figures might be overestimated. Despite its proven safety,[1,15] multiple barriers to adopt DIS might be responsible for the low adoption rates. In our study barriers to DIS, included fear for respiratory deterioration, lack of patient's comfort and possible removal of the ET. Similar barriers were described previously.[24,29-30] Some recognizable nurses' concerns were reported in a qualitative study by Everingham and colleagues[46]. They reported that the rigid

application of targeted care rather than individual care distressed nurses. Nurses reported having to deal with the consequences of caring for agitated patients and they struggled to provide safe care. As a consequence, nurses reported a sense of failure, guilt and lack of satisfaction in care provided. They reported not only an increasing workload associated with sedation breaks, but also concerns about patients' experiences during the awake period[46]. The barriers to DIS provided by nurses in the context of questionable evidence supporting the use of DIS[5] warrant further research and should be an important nursing research priority.

The strategies designed to minimize the use of the sedatives, as sedation protocols and sedation scales have been shown to improve patients' outcome.[18] The limited use of NMBAs is important to achieve lighter sedation.[19,47] In our survey nurses indicated employment of NMBAs reserved particularly for patient-ventilator asynchrony and ALI/ARDS. Those findings differ from the results provided in the study of Reschreiter[25], where NMBAs were used by 71% of ICUs for less than 5% of the time and mainly for neurological patients. These data suggest differences across countries. Further exploration of the application of NMBAs in Flanders should be considered to reveal the reasons for the evidenced differences with other countries and to evaluate whether the use of NMBAs in Flanders is routine or occasional. Further the choice of analgo-sedatives regimen is also crucial in daily sedation practice. Although the ideal drug does not exist, sedation regimens based on short-working agents have favourable results.[1,11,13,18]

Sedatives in our survey are frequently administered as continuous infusion with bolus doses if necessary with possibility of overdosing the sedatives[2]. The short-working agents propofol and remifentanil were shown to be frequently used drugs by our respondents, as suggested

in the latest guidelines.[18] We suppose, that in this setting, where use of short-working agents is predominant, the deleterious impact of continuous infusions might be limited yet not eliminated.

According to our respondents the use of benzodiazepines is mostly reserved for sedation ≥24 hours. The use of benzodiazepines for sedation <24 hours (in mono- or combination therapy) is limited. Internationally the trend towards use of propofol is growing however a broad variation in choice of sedatives still exists.[24] Some authors found propofol to be the first-choice sedative agent[25,28,30,32,39] while others found it being used similar to benzodiazepines.[7,31,40] Comparable variations can be addressed towards analgesic agents with morphine and/or fentanyl being the most frequently used agents.[6,23,26,31,32,38] The use of remifentanil and dexmedetomidine is rare[24] potentially due to their high cost and limited experience[31]. Contrariwise, the use of dexmedetomidine and remifentanil was rather high in our study (resp. 19.3% and 12.3% in monotherapy).

Limitations

Because of the self-reporting nature of the study we cannot guarantee absence of response set bias. As participation in the study was on a voluntary base, our findings are prone to selection bias as well. Furthermore, our response rate might be negatively impacted by the length of the questionnaire, thus resulting in loss of potential important information. We recommend caution when extrapolating our data to other geographic regions as organizational and contextual factors are known to influence sedation practices. Finally, questions on psychosocial aspects of sedation, ICU delirium and pain protocols were not included in this survey although these are important issues as well.

Conclusions

There is an important discrepancy between international recommendations and actual sedation practices, which might result in prolonged patient weaning from MV. Quality improvement initiatives targeting implementation of safe and cost-effective sedation practices are recommended yet challenging. A collective engagement of the government institutions and some non-profit institutions is necessary to gain further insights in healthcare professionals' sedation practices. Promising well-designed quality improvement trials combining simultaneously applied different interventions[48] should be strongly considered while improving complex healthcare interventions. Standardisation of sedation practices on a regional (Flemish) or, preferably, national level may further improve the quality of sedation care.[10] Additional research on this subject, particularly on how nurses can improve sedation practices at the bedside should gain more attention of the researchers.

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