NURSES’ PRACTICE CONCERNING WEANING FROM MECHANICAL VENTILATION IN THE INTENSIVE CARE UNIT

Masterproef voorgelegd tot het behalen van de graad van
Master in de Verpleegkunde en de Vroedkunde

Door Marta Borkowska

Promotor: Prof. Dr. Stijn Blot
Co-promotor: Dr. Sonia Labeau
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VERTRouWELIJKHEID & OVERDRACHT VAN RECHT
EENZIJDIGE VERKLARING

Deze Verklaring wordt algemeen ten aanzien van

Universiteit Gent, openbare instelling met rechtspersoonlijkheid, waarvan de bestuurszetel gevestigd is te 9000 Gent, Sint-Pietersnieuwstraat 25, gekend onder ondernemingsnummer 0248.015.142 en vertegenwoordigd door prof. dr. Anne De Paepe, handelding in haar hoedanigheid van Rector (hierna korteweg aangeduid als "UGent")

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In het kader van zijn/haar opleiding aan UGent, zal ondergetekende kennis krijgen van bepaalde vertrouwelijke informatie toebetoond aan UGent of door derden toevertrouwd aan UGent.

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Ondergetekende draagt eveneens al zijn/haar rechten op onderzoeksresultaten behaald in het kader van het Project over aan UGent.

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Naam: [Naam]

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Foreword

Dit werkstuk werd geschreven om de graad van Master of Science in de Verpleegkunde en Vroedkunde te behalen. Het onderzoek heeft veel tijd in beslag genomen omdat er een aantal belangrijke en tijdrovende activiteiten moesten uitgewerkt worden: de literatuurstudie, het opstellen van de vragenlijst, de datacollectie, het analyseren en de resultaten beschrijven. Het is een lange en complexe opdracht geweest waarbij ik veel heb geleerd over het praktisch uitvoeren van een dergelijke studie. Ieder klein succes of tegenslag heeft bijgedragen tot deze leerrijke ervaring.

Vooreerst wil ik graag Thijs, mijn partner, bedanken voor zijn begrip en ondersteuning gedurende het volledige opleidingstraject. Na 3,5 jaar hard werken kan ik vaststellen dat zijn ondersteuning en bijstand er voor hebben gezorgd dat ik dit opleidingstraject succesvol kan afronden.

Daarnaast wil ik mijn promotor, Prof. Dr. Stijn Blot, en co-promotor, Dr. Sonia Labeau, bedanken voor hun expertise en begeleiding. De ondersteuning die ik gekregen heb, zowel intellectueel als emotioneel, is onbetaalbaar.

Vervolgens zou ik graag de Vlaamse Vereniging voor Intensive Zorgen Verpleegkundigen (VVIZV) willen bedanken voor de opportuniteit dat ik gekregen heb om mijn enquête te verspreiden tijdens hun jaarlijks congres. Deze masterproef zou moeilijk tot stand kunnen komen zonder deze bijdrage.

Nogmaals dank,

Borkowska Marta

Aantal woorden abstract: 249

Aantal woorden masterproef: 5761 (exclusief woord vooraf, inhoudstabel, abstract, tabellen en bibliografie)
1. Abstract

Introduction

International guidelines recommend performing a frequent formal assessment on patients’ readiness to discontinue mechanical ventilation. Non-physicians driven weaning and sedation protocols should be developed and implemented in ICUs.

Objectives

To identify sedation and weaning practices among ICU nurses.

Methods

A cross-sectional, self-administered survey was developed. Consensus on content validity was achieved through a Delphi procedure among experts. The survey was distributed and collected during the annual congress of the Flemish Society of Critical Care Nurses (Dec. 2014).

Results

342 ICU nurses were included in the study. These are employed in general (73%) or university hospitals (27%). Forty-four percent of nurses have a sedation protocol and in nearly 62% of the cases it is consistently used. Nurses in university hospitals reported higher availability of sedation (72% vs. 42%, p<0.001) and weaning protocols (44% vs. 29%; p=0.016) compared to nurses from general hospitals. Twenty-two percent of nurses reported the presence of both weaning and sedation protocol. Sedatives are in 81% of the cases administrated as continue infusion with bolus dose if needed. Adequacy of sedation is examined using Richmond Agitation Sedation Scale (RASS) (59%). Spontaneous breathing on T-tube (58%) is the most frequently chosen spontaneous breathing trial (SBT). SBT is successful if adequate gas exchange is maintained during the procedure (89%), and prematurely terminated in case of signs of exhaustion (89%) and inadequacy of gas exchange (90%).
Conclusion

There appears to be a considerable discrepancy between recommendations and weaning and sedation practice. This data demonstrate room for quality improvement initiatives.
2. Introduction

Mechanical ventilation (MV) is a strongly embedded therapy in the intensive care unit (ICU). It is also one of the most common life support techniques (Haas and Loik 2012, Esteban et al. 1994). Despite its lifesaving function, MV is associated with numerous pathophysiological and psychological complications having negative influence on mortality and morbidity of patients as well as high cost of care (Grap et al. 2003, Marelich et al. 2000, Lermitte and Garfield 2005). Most common negative sequels of MV as nosocomial infections including ventilator associated pneumonia (VAP), iatrogenic lung injury (baro/volutrauma) (Dasta et al. 2005, Lermitte and Garfield 2005, MacIntyre 2004, Rose and Nelson 2006, Boles et al. 2007) injuries of the vocal cords and complications associated with immobilisation (Blackwood et al. 2014), contribute significantly to patients’ outcome. ICU length of stay (LOS) and hospital length of stay have been proven in numerous studies to be directly associated with initial duration of mechanical ventilation and eventually the cost of care (Dasta et al. 2005, Tonnellier et al. 2005, Jordan et al. 2012). Psychological sequels as post-traumatic stress disorder (PTSD), depression, delirium (Boles et al. 2007, Kress and Hall 2006, Patel and Kress 2012) and negative experiences, as pain, anxiety, sleeping deprivation and lack of control (Rose et al. 2014, Schweickert and Kress 2008), are frequent phenomena observed in patients being mechanically ventilated and often sedated.

Sedation and analgesia together with non-pharmacologic therapies are crucial in optimal management of ventilated patients (Kress and Hall 2006, Mcgrane and Pandharipande 2012). However sedation has also been associated with numerous adverse effects. This depending on the medication (Patel and Kress 2012, Futier et al. 2012, Fraser et al. 2013) and administration way used (Patel and Kress 2012, Schweickert and Kress 2008, Kollef et al. 1998). Continuous intravenous sedation, being commonly applied during mechanical ventilation, contributes significantly to prolonged mechanical ventilation (Kollef et al. 1998, Kress et al. 2000), increased incidence of VAP (Schweickert et al. 2004) and longer ICU and hospital LOS (Arias-Rivera et al. 2008, Kollef et al. 1998).

These findings contribute to increased research interest in optimisation of MV and sedation strategies. Weaning from MV stands centrally in management of critically ill
patients. Weaning is often described as liberation from MV. It covers the time from endotracheal intubation through reduction of ventilatory support, spontaneous breathing to successful extubation (Boles et al. 2007, Lermite and Garfield 2005). Finding the balance for timely performed liberation from artificial airway demands a careful daily assessment of patient’s readiness to wean and ability to breathe spontaneously. Patients who passed a spontaneous breathing trial (SBT) should be extubated if they are capable of maintaining free airways by ensuring its patency through, for example, adequate coughing and lack of excessive secretions (MacIntyre 2004, Ely et al. 2001, Lermite and Garfield 2005, Caroleo et al. 2007). Unnecessary delays in withdrawal of invasive ventilation increase the likelihood of adverse events (MacIntyre 2004, Caroleo et al. 2007). Daily interruption of sedation (DIS), being widely described approach to timely weaning is suggestive of improving patients’ outcome (Kress et al. 2000, Boles et al. 2007, Schweickert and Kress 2008, Schweickert et al. 2004, Celis-Rodríguez et al. 2013, Girard et al. 2008). However the recent review on DIS (Burry et al. 2014) implies lack of strong evidence supporting this statement.

Collaborative decision making between different disciplines seems to be crucial in weaning and sedation practices. Nurses’ responsibilities and autonomy, as well as ICU context, existing culture and process of care vary strongly across countries. Some nurses are excluded in decision making despite existing evidence on their critical role in safe and effective weaning (MacIntyre 2004, Rose and Nelson 2006, Grap et al. 2003, Rose et al. 2011a, Rose et al. 2011b, Chan et al. 2001, Rose et al. 2007, Jordan et al. 2012). A substantial body of literature suggests that non-physician protocol-driven weaning and sedation improve patients’ outcome (Schweickert and Kress 2008, Mcgrane and Pandharipande 2012, Chan et al. 2001, Ramachandran et al. 2005, Boles et al. 2007, MacIntyre 2004, Blackwood et al. 2014, Haas and Loik 2012, Hansen et al. 2008). More specifically it decreases duration of MV, duration of weaning, ICU and hospital LOS, need for tracheostomy, and eventually the cost. Some of these advantages have been also described in automated weaning approach (Rose et al. 2013). Based on these findings numerous researchers recommend implementation of nurse-led protocols in daily practice. Nevertheless tool-based approach should not replace clinical judgement (Anifantaki et al. 2009) and careful translation of the researches into the context of local practice is desirable due to substantial differences in pre-existing practice and culture in
some ICUs (Blackwood et al. 2006, Bucknall et al. 2008, Rose et al. 2011a, O'Connor et al. 2010).

Additionally some studies suggest that nurses’ attitudes (Guttormson et al. 2010), perceptions, satisfaction (Blackwood and Wilson-Barnett 2007), knowledge, and experience have a strong impact on sedation and weaning practices. Including patients and their family members in the process of weaning together with acknowledgment of patients’ individual needs may contribute to successful weaning (Rose et al. 2014). Therefore identifying critical barriers to efficient and durable implementation of evidence-based strategies is necessary in order to ensure optimal patients’ care (Tanios et al. 2009, Miller et al. 2012).

To our knowledge there is very restricted amount of data available concerning context and processes of care in weaning from mechanical ventilation in Belgium. Flanders, the northern part of Belgium has been ignored in the literature about nurses’ practices and perceptions on weaning despite evidence on their strong influence in weaning process (Rose and Nelson 2006). Therefor the main objective of this study was to highlight the usual weaning practices in several Flemish hospitals. The second objective was to determine some perceived barriers toward use of protocols. We also sought to explore the level of multidisciplinary collaboration.
3. Methods

3.1 Design

A cross-sectional, self-administrated survey was chosen to highlight the practices of weaning from MV among Flemish nurses. Prior to the study and survey development an international expert in weaning, Dr. Bronagh Blackwood was contacted to share her expertise on the subject.

The questionnaire used in this study was developed using recent relevant literature. Therefor a literature search of Pubmed, Cochrane, Web of Science and Cinahl database was conducted with the terms ‘weaning’, ‘ventilator weaning’, ‘nurse’, ‘protocol’ and ‘guideline’. The filter was developed in English, Dutch, German and Polish. Only English studies met eligibility criteria. Due to the need of additional evidence on sedation, a second search was conducted in the same databases as previously using just English terms: ‘adult’, ‘sedation’ and ‘mechanical ventilation’. The studies from Europe, North America, Australia and New Zealand were further screened for relevant evidence.

A developed 32-items instrument was tested for content validity (Lynn 1986) among 4 independent experts in ICU nursing and research and 1 physician. After 2 rounds, in order to achieve full agreement from 5 experts, some additional changes were made.

The respondents were asked to evaluate their every-day practice on weaning from mechanical ventilation and sedation in the ICU. Therefore closed-ended multiple-choice questions and 4-point Likert scales were used. Some of the questions were designed to assess nurses’ personal perception on the subject.

The questionnaire was divided into 3 sections. Section 1 collected basic demographic data on the target population. Section 2 contained 17 questions on sedation practices, mainly the medication used (muscles relaxants inclusive), availability of a sedation protocol in the unit and adherence to it, adequacy of sedation and nurses’ independence in administration of the medications and daily interruption of sedative infusions (DIS).
Section 3 included 14 items on weaning from mechanical ventilation practices. This section provided data about weaning protocol and adherence to it, the use of weaning modes, spontaneous breathing trial (SBT) and extubation. The last section contained 1 question about a multidisciplinary collaboration in the ICU.

There was a common agreement among the expert panel members that the 32-item questionnaire was already quite exhaustive and could not be extended any further for extra relevant questions.

### 3.2 Data collection and analysis

The questionnaire was distributed among a consecutive sample of 640 attendants of 32\textsuperscript{nd} Annual Congress of Flemish Society of Critical Care Nurses in Ghent, Belgium (December 20, 2014). Only bed-side nurses working in the ICU for adults were included in the statistical analysis. Collected data was entered in SPSS statistics (version 21). Descriptive statistics of all variables were performed. Differences between responses were tested using Chi-square for categorical variables. Statistical significance level was set at p-value of <0,05.

### 3.3 Ethical approval

Ethical approval was obtained from ethics committee at Ghent University Hospital. Furthermore the respondents were informed about the purpose of study and its voluntary character. The survey was anonymous.
4. Results

4.1 Demographic data

423 responses were retrieved (response rate 66,1%) of which 363 were included for further analysis. Finally 342 respondents met eligibility criteria. The majority of included participants were women (74,1%). A high percentage of nurses (88,9%) have a special title in emergency and intensive care, a post-graduate course for Belgian nurses. Only a minority of nurses (8,5%) have a master degree in nursing. A majority of participants are employed in general hospitals (73,1%) rather than in university hospitals (26,9%). Respondents work particularly in general ICUs (66,1%), surgical ICUs (17,8%), medical ICUs (13,2%) and cardio-surgical ICUs (8,2%). Respondents’ ICU nursing experience ranged from less than 1 year (2,6%), up to 5 years (19,0%), up to 10 years (16,7%), to more than 10 years (61,7%). Respondents work in small-sized ICUs (8 or less beds; 24,4%), medium-sized ICUs (9 to 16 beds; 44,9%) or large ICUs (more than 16 beds; 30,7%). The most common nurse-to-patient ratio is 1:2 during early shifts (50,9%) and 1:3 during late shifts (56,4%) and night shifts (53,2%).

4.2 Sedation practices

The respondents were asked to indicate the agents used in their ICU for sedation shorter and longer than 24 hours. To provide sedation for less than 24h, mainly short working agents are being used. Propofol is employed as a single agent infusion (54,7%) or together with remifentanil (45,9%) or sufentanil (8,5%). Propofol alone (19,6%) or with remifentanil (46,8%) is also commonly used for sedation ≥24h.

The use of benzodiazepines is mainly reserved for sedation ≥24h: as a single agent (13,5%) or in combination with analgesic agents, as remifentanil (23,1%), morphine (19,6%), sufentanil (16,7%) or fentanyl (11,7%).
The single use of analgesic agents occurs for remifentanil in 12.3% of the cases for sedation <24h and in 6.7% for sedation ≥24h. Dexmedetomidine seems to be more frequently used for sedation ≥24h (19.3%), sometimes in combination with analgesic agents (with remifentanil: 10.5%). The use of neuromuscular blocking agents tends to be almost exclusively reserved for cases of patient-ventilator dyssynchrony (77.5%). Less common indications for neuromuscular blockers include acute lung injury/acute respiratory distress syndrome (ALI/ARDS) (38.0%), prevention or treatment of shivering in patients with induced therapeutic hypothermia (30.4%), and in case of high intracranial pressure (22.2%). In the majority of the cases sedation is administered in continuous infusion with bolus doses if needed (81.0%).

Nurses indicated changing sedative infusion rate (74.9%) and delivering sedative bolus doses (78.7%) without physician’s order. A majority of nurses (83.5%) indicate that additional analgesic agents are generally administrated if sedation is being withdrawn.

Less than half of the nurses indicated the presence of a sedation protocol in their ICU (43.7%). A sedation protocol appears to be more frequently available in university hospitals compared to general hospitals (72.0% vs. 41.5%, p<0.001).

However, only 8.1% of nurses reported to “always” use the sedation protocol while 53.7% of nurses use it “mostly”. Most of the respondents indicated having a patient-targeted protocol (53.4%). Protocols are mainly developed by ICU physicians (78.5%) and nurses (51.7%), while other disciplines (anaesthetist, physiotherapist, respiratory therapist, pneumologist) are less frequently or not at all (psychologist) involved in the development of the protocol. Nearly 54% of the nurses will not use a protocol if the doctor desires to work without it.

Level of sedation is generally evaluated per 2 hours (56.0%) and with use of a RASS scale (59.1%), Glasgow Coma Scale (47.0%) and The Ramsay Sedation Scale (RSS) (29.1%). However 3.6% of respondents claim not assessing sedation level at all.

Daily interruption of sedation (DIS) is applied variably (never: 27.4%, rarely: 53.5%, mostly 14.4%, always: 2.1%). Usually it is used to evaluate the neurological status of the patient (86.3%), to shorten the duration of mechanical ventilation (44.2%), to wake
up the patient (32,1%) or to prevent the accumulation of the sedatives (29,7%). Nearly 78% of nurses reported not applying DIS at night.

There are numerous barriers reported to perform DIS. Patient’s comfort is the biggest concern for the respondents (49,4%) next to respiratory deterioration (46,6%). Some nurses are afraid of patient’s self-extubation/removal of the drains/catheters (39,8%) and their agitation (35,3%). Other important barriers to perform DIS include a high workload (24,5%) and the fact that this technique is never suggested by the physician (18,5%).

A majority of nurses (65,8%) indicated agitation/confusion/ICU delirium to be a significant problem frequently occurring during reduction of sedative agents. Also patient’s comfort/pain (45,6%), need for physical restraints (34,8%) and patient-ventilator dyssynchrony (33,9%) are the major concerns.

4.3 Weaning practices

Only a minority of nurses reported availability of a weaning protocol (28,5%). Even less respondents (22,3%) declare presence of both weaning and sedation protocol in their ICU. Nurses working in university hospitals reported higher availability of weaning protocols (43,8% vs. 28,6%; p=0,016) compared to respondents from general hospitals. Protocols are paper-based (23,2%) or computer-assisted (5,3%) and in nearly 20% of the cases never used. Approximately one-fifth of the nurses got some information or training about use of the protocol. Some of the respondents are not aware of having a protocol (10,0%).

To assess nurses’ level of autonomy on weaning, respondents were asked to indicate which settings of the ventilator are being changed by them without physician’s prescription (in setting without a protocol). The tree major responses were ventilation mode (68,1%), pressure support (PS) level (65,8%) and respiratory rate (49,1%). A small sample of nurses (8,2%) reported not changing any ventilator settings without a physician’s order. Regarding the ventilator weaning modes, nurses were more likely to indicate usage of Continuous Positive Airway Pressure (CPAP) (76,9%),
BiLevel/BIPAP (73.5%), Pressure Support Ventilation (PSV) (58.9%) and Synchronised Intermittent Mandatory Ventilation (SIMV) (25.7%). The use of Volume Support Ventilation (VSV) is reported by 12.7% of nurses. More sophisticated modes as Automode (16.9%), Adaptive Support Ventilation (ASV) (7.9%), Proportional Assist Ventilation (PAV) (7.6%), SmartCare/PS or Intellivent-ASV (7.0%) are in the minority (Figure 1).

**Figure 1:** Distribution of weaning modes used in the ICU (n).

Further to examine the usual practice concerning weaning from MV (Figure 2), respondents were asked to specify the readiness to wean criteria assessed before starting with spontaneous breathing trial (SBT). These are positive evaluation of respiratory status (82.5%), with maintenance of respiratory capacity (73.4%) and adequate oxygenation (63.2%). For more than a half of respondents (53.8%) the presence of physician’s order is essential to start a SBT.
Figure 2: Criteria taken into consideration before starting with SBT (n).
Spontaneous breathing on T-tube (57.6%) is the most frequently chosen SBT next to CPAP (57.3%) and PSV with minimal pressure support (46.2%). Automatic tube compensation (ATC) was mentioned by 11.7% of nurses and other SBT practices by 3.2%. 7 respondents (2.0%) reported not implementing SBT in their daily practice at all. On average, a SBT is executed 3 times (38.2%), 2 times (27.7%) or once a day (20.9%). Duration of the first SBT is generally between 30-120 minutes (43.9%) or shorter than 30 minutes (44.5%). Only a minority of nurses perform the first SBT for longer than 120 minutes (9.5%) Duration of the first SBT between 30-120 minutes was not associated with the presence or absence of!weaning protocol (p=0.57). There is also no connection found between SBT on T-tube and duration of first SBT (p=0.85). Further, nearly all respondent declared applying SBT during daytime (99.4%) whereas only 37.3% reported to execute SBT at night as well.

Most frequently reported criteria to evaluate the success of the SBT were adequacy of gas exchange (89.3%), breathing pattern (76.1%), patient’s comfort during the trial (55.2%) and stable hemodynamic condition (51.9%). Nurses would terminate SBT if they reported any signs of patient’s exhaustion (89.3%), inadequacy of gas exchange (89.6%) or hemodynamic instability (65.7%). Further almost all respondents find oxygenation to be a vital parameter taken into consideration prior to extubation (94.2%). Two hundred-forty respondents (70.2%) indicate absence of visible signs of exhaustion and 221 respondents (64.6%) hemodynamic status to be the parameters taken into account before removal of the artificial airway. Complete distribution (n) of the parameters considered before extubation are shown in Figure 3.
4.4 Multidisciplinary collaboration in the ICU

When it comes to weaning, nurses are generally satisfied about the cooperation with attending physicians (mostly: 75.5%, always: 7.3%). However to obtain a better view on weaning practices in Flanders, nurses were also asked to indicate persons involved in divers activities around weaning and sedation.

Physicians are most prominently involved in decision making around weaning (90.6%) and sedation (cessation of sedative infusions: 95.9%; reduction of sedative infusions: 94.4%). The second important team players are nurses. The involvement of other disciplines is rather scarce. The distribution of the votes has been pictured in Table 1.
Table 1: Involvement in decision making: distribution of the votes (n)

<table>
<thead>
<tr>
<th>involvement</th>
<th>reduction of sedative infusions</th>
<th>cessation of sedative infusions</th>
<th>implementation of DIS</th>
<th>weaning</th>
<th>starting a SBT</th>
<th>extubation</th>
<th>reintubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>doctor</td>
<td>323 (94,4%)</td>
<td>328 (95,9%)</td>
<td>238 (69,6%)</td>
<td>310 (90,6%)</td>
<td>294 (86%)</td>
<td>322 (94,2%)</td>
<td>337 (98,5%)</td>
</tr>
<tr>
<td>nurse</td>
<td>276 (80,7%)</td>
<td>225 (65,8%)</td>
<td>149 (43,6%)</td>
<td>263 (76,9%)</td>
<td>240 (70,2%)</td>
<td>262 (76,6%)</td>
<td>240 (70,2%)</td>
</tr>
<tr>
<td>respiratory therapist</td>
<td>1 (0,3%)</td>
<td>4 (1,2%)</td>
<td>3 (0,9%)</td>
<td>6 (1,8%)</td>
<td>5 (1,5%)</td>
<td>3 (0,9%)</td>
<td>3 (0,9%)</td>
</tr>
<tr>
<td>physiotherapists</td>
<td>2 (0,6%)</td>
<td>3 (0,9%)</td>
<td>6 (1,8%)</td>
<td>29 (8,5%)</td>
<td>13 (3,8%)</td>
<td>35 (10,2%)</td>
<td>5 (1,5%)</td>
</tr>
<tr>
<td>other discipline</td>
<td>0 (0%)</td>
<td>1 (0,3%)</td>
<td>1 (0,3%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>per protocol</td>
<td>28 (8,2%)</td>
<td>15 (4,4%)</td>
<td>10 (2,9%)</td>
<td>7 (2,0%)</td>
<td>1 (0,3%)</td>
<td>2 (0,6%)</td>
<td>2 (0,6%)</td>
</tr>
<tr>
<td>not applicable</td>
<td>1 (0,3%)</td>
<td>2 (0,6%)</td>
<td>49 (14,3%)</td>
<td>3 (0,9%)</td>
<td>8 (2,3%)</td>
<td>2 (0,6%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
5. Discussion

Weaning from mechanical ventilation requires careful management of both sedation and mechanical ventilation with incorporation of SBTs (Ely et al. 2001). The existing body of literature and international guidelines recommend inclusion of sedation and weaning protocols in every-day practice to reduce variability of care and to ensure patients’ safety. Especially non-physicians health care professionals (HCP)-led protocols may have an important influence guaranteeing more homogenous practice in sedation (Kollef et al. 1998) and weaning from mechanical ventilation (Ely et al. 2001, Tonnelier et al. 2005), improving patients’ outcome through reduction of duration of MV. This mainly due to the fact that nurses are the most present caregivers next to patient’s bed (Mcgrane and Pandharipande 2012). There should be room available to deviate from protocol if indicated. Practice tailored to individual patient’s demands contributes to successful implementation of the protocols (Anifantaki et al. 2009, Williams et al. 2008, Schweickert and Kress 2008, Caroleo et al. 2007, Blackwood and Wilson-Barnett 2007). It should be emphasized that successful weaning is an effort of all disciplines (Grap et al. 2003), together with patient himself and his family (Rose et al. 2014). However, patient and family empowerment is only prematurely developed in Flemish ICUs.

Availability of protocols in our study differs between university and general hospitals with the presence of weaning and sedation protocols mainly in university hospitals. Tanios et al. (2009) found no difference between university and general hospital in this regard but in the survey response rate was very low (7,1%) and the responders were mainly physicians (69,0%). The overall presence of sedation protocol was also higher (64,0%) (Tanios et al. 2009). The overall number on availability of sedation protocol in our survey is comparable to the other European surveys (Egerod et al. 2013, Randen and Bjørk 2010) and the consistency of use of the protocol seems to lay around 50%, as in the study of Egerod et al (2013). Implementation of a sedation and analgesia protocol as well as it’s utilisation by non-physicians HCPs in the ICU is supported by the international guidelines developed by multidisciplinary and multi-centre task force assembled by The American College of Critical Care Medicine (Barr et al. 2013). Also
recommendations provided in the guidelines developed by the Federación Panamericana e Ibérica de Sociedades de Medicina Crítica y Terapia Intensiva (FEPIMCTI) support this statement (Celis-Rodriguez et al. 2013). Therefore we dare to conclude that there is evidently room for improvement in Flemish ICU practice.

As it comes to weaning from MV protocol, its presence is considerably low (28,5%) although respondents reported in 80,4% of the cases adherence to it. Respondents working in general hospitals reported availability of weaning protocol in only 28,6% of the cases (43,8% in university hospitals, p=0,016). Even less nurses (22,3%) indicated having both weaning and sedation protocol. Some international literature suggest that organisational and contextual factors, as nurse-to-patient ratio, pre-existing practice and level of multidisciplinary collaboration may affect the every-day practice of sedation and weaning, availability of protocols and its use (Blackwood et al. 2006, Egerod et al. 2013, Jordan et al. 2012). International guidelines recommend implementation of a weaning/discontinuation protocol in the ICUs as well as non-physician HCPs’ participation in its development (MacIntyre et al. 2001, Ely et al. 2001). With the low availability of weaning protocols in Flemish hospitals, we can conclude that those recommendations are not being respected, what may result in suboptimal quality of care.

The results from our survey show some discrepancies. The perceived level of collaboration on sedation and weaning practices is high, with the physician most prominently involved in all decisions. We have noticed however that “multidisciplinary” applies almost exclusively for physicians and nurses with a significant absence of other disciplines, as e.g. physiotherapist. Nurses are also satisfied with cooperation with the physician suggesting the presence of a fair teamwork. These findings may contribute to finding an answer on low availability of protocols. On the other hand nurse-to-patient ratio was found low in comparison to the other European (Egerod et al. 2013, Rose et al. 2011b) and international studies (Rose et al. 2011a). A 1:1 nurse-to-patient ratio was almost not reported in our survey. In the early shift there is a predominance of ratio 1:2 in nearly 51% of the cases followed by ratio 1:3 (38,9%). In the late (56,4%) and night (53,2%) shift we stated ratio of 1:3 being the most present one. Nearly one-fifth of respondents (19,9%) indicated being responsible for 4 patients during the night time. This data rises up some questions about quality of nursing care of the ventilated patients.
In this context the use of protocols would be recommended in order to ensure patients’ safety, even if perceived collaboration seems to be high. However we are not able to provide any other data on organisational/contextual factors, as availability of physician, number of mechanically ventilated patients or actual level of nurses’ autonomy. We agree that there is additional data necessary to detect those factors and consequences of such a low nurse-to-patient ratio.

Regarding adherence to sedation protocols, nurses implied not using it in settings where physicians wish to work outside protocols (53,7%). Half of nurses were involved in development of the protocol what may have had an influence on acceptance of the protocol and adherence to it (Chan et al. 2001).

Performance of DIS also appears to be low despite existing international consensus on its beneficial influence on patients’ outcome. DIS contributes to faster liberation from mechanical ventilation through decreasing use of sedatives, preventing their accumulation, promotion of patient’s awareness and patient’s interaction with the environment (Schweickert et al. 2004, Patel and Kress 2012, Kress et al. 2000, Celis-Rodríguez et al. 2013). It might also be protective from depression and PTSD (Schweickert and Kress 2008, Patel and Kress 2012). DIS and target sedation goals are recommended to be incorporated in a sedation protocol to reduce ICU LOS by shortening duration of MV (Ely et al. 2001). However a recent review on DIS was not able to give any strong conclusions promoting this particular practice. This due to important heterogeneity of the studies (Burry et al. 2014).

Nurses perform DIS in order to neurologically evaluate a patient and shorten duration of MV as suggested in the literature (Kress et al. 2000). When asked about barriers to perform DIS, respondents revealed fear for respiratory deterioration, lack of patient’s comfort and possible removal of devices, as endotracheal tube despite existing evidence on its safety (Kress et al. 2000). Further investigation is necessary to determine if the barriers are induced by personal experiences or gaps in the education. Too high workload (24,5%), insufficient medical supervision (16,1%) and physicians not suggesting DIS (18,5%) were also revealed as barriers to perform DIS. These findings bring up an essential need of better exploration of organisational and context factors.
Analgo-sedation in this study is based particularly on short-acting agents, such as propofol and remifentanil being more frequently used than in other studies (Randen and Bjørk 2010, O’Connor et al. 2010, Egerod et al. 2013). Also dexmedetomidine based sedation was stated in some cases. Employment of neuromuscular blocking agents (NMBA) is reserved mostly for patient-ventilator dyssynchrony and ALI/ARDS. All those strategies follow international recommendations from the literature (Fraser et al. 2013, Celis-Rodríguez et al. 2013, Hogarth and Hall 2004, Gehlbach and Kress 2002, Futier et al. 2012, Greenberg and Vender 2013, Barr et al. 2013). Sedatives are frequently administered as continue infusion with bolus doses if necessary bringing possibility to overdose the drugs (Kress and Hall 2006). However in settings with a high use of short working agents, the deleterious impact might be limited. To monitor level of sedation, respondents use mostly a valid RASS scale (Hogarth and Hall 2004) doing it regularly (every hour or two), having possible positive influence on faster obtainment of sedation goal (Mcgrane and Pandharipande 2012). The use of RASS (and SAS) scale is also recommended by the international guidelines as being the most appropriate to evaluate the level of sedation (Barr et al. 2013).

In nurses’ practice on weaning we have also found some discrepancies between availability of a weaning protocol and existing every-day practice, as in sedation practices. Despite absence of a protocol in majority of the cases (71,5%), we recognised some practice as described in evidence-based studies. Readiness to wean preceding a SBT is mainly assessed by positive evaluation of respiratory status (82,5%), preserved respiratory capacity (73,4%), adequate oxygenation (63,2%), stable cardio-vascular status (52,3%) and limited sedatives use with no influence on patient’s consciousness (52,3%). Those criteria, inter alia, are supported by numerous authors (Boles et al. 2007, Williams et al. 2008, Burns et al. 2010, Caroleo et al. 2007) and are described in international recommendations as well (MacIntyre et al. 2001, Boles et al. 2007). We have not examined if the assessment was regularly performed, what is crucial in order to prevent any delays in withdrawal of MV (MacIntyre 2004). There is however lack of uniformity in these recommendations (Rose and Nelson 2006) and diversity of approaches to assess readiness to wean is high. The same uncertainty can be addressed toward the best way to perform SBT. Respondents have pointed out T-tube (57,6%), CPAP (57,3%) and PSV with low PS (46,2%) to be the most applicable in their daily
practice. These are the major approaches recommended by the international literature (Rose and Nelson 2006, Ely et al. 2001, Boles et al. 2007) and some guidelines (MacIntyre et al. 2001, Ely et al. 2001) Some authors recommend duration of the first SBT for at least 30 minutes (Boles et al. 2007, McConville and Kress 2012) up to 120 minutes (MacIntyre 2004, Ely et al. 2001, Haas and Loik 2012) in order to consider discontinuation of MV. This at least 1 time per day (Boles et al. 2007). International recommendations (The American College of Chest Physicians together with The American Association for Respiratory Care and the American College of Critical Care Medicine) are clear on this behalf: the tolerance of SBT lasting between 30 and 120 minutes should lead to consideration of patient’s extubation (grade A) (MacIntyre et al. 2001).

In our survey, 43.9% of respondents declared duration of SBT between 30-120 minutes (not associated with availability of weaning protocol, p=0.57). Nearly the same amount (44.5%) indicated performing first SBT for less than 30 minutes. Those first minutes are crucial in order to recognise the first signs of ventilatory muscle fatigue and should be monitored carefully. Therefore a SBT lasting for at least 30 minutes is recommended by international institutions in order to assess properly if a patient is capable of breathing spontaneously. However, a SBT should not exceed 120 minutes due to increased risk of ventilatory muscle fatigue, induced by the trail itself (MacIntyre et al. 2001). Also in this case the level of knowledge, nurse-to-patient ratio and presence of physician should be further explored in order to determine the cause of too short and too long SB trial.

Nurses perform SBT mostly 3 times per day (38.2%) and during the daytime (99.4%). Hansen et al. (2008) has found in his study that weaning activities are lowest during the night shifts and they depend inter alia (i.a). on availability of physician’s prescription (Hansen et al. 2008). More than half of respondents in our study (53.8%) also indicated physician’s order being an important factor before commencing the first SBT, what possibly indicates that nurses may not act that autonomously as they presume.

When asked about weaning modes, respondents indicated CPAP (76.9%) and BiLevel/BIPAP (73.5%) being the most popular in their ICUs. Surprisingly ¼ of nurses admitted using an old SIMV mode to wean patients despite existence of evidence discouraging use of this particular approach (Boles et al. 2007) due to increased work of
breathing (Caroleo et al. 2007). However some of the authors suggest more careful interpretation of these findings (Blackwood et al. 2006). The use of automated closed-loop systems possibly reducing duration of weaning is low in our study (SmartCare/PS or Intellivent-ASV: 7,0%). The benefits of automated closed loop systems remain rather unclear (Rose et al. 2013, Burns et al. 2014). More data on this subject is necessary.

Nurses’ perspective on their independence in weaning seems to be incoherent. Nurses indicate to independently change ventilation mode (68,1%), pressure support (65,8%) and respiratory rate (49,1%). These findings contrast with international survey of Rose et al. (2011), where FiO₂ level (decrease: 68,0%, increase: 67,0%) was the most frequently manipulated, followed by PS (increase and decrease: 55,0% each) and titration of respiratory rate (50,0%) (Rose et al. 2011b). In our survey was surprisingly ventilation mode being most frequently changed, raising question on how nurses accomplish optimal ventilation with no adjustment of other settings. Changing ventilator mode requires cognitive exercise on manipulating and choosing the most optimal settings in order to guarantee patient’s improvement. More data on this subject is necessary in order to gain more complete insights in nurses’ knowledge, argumentation and actions in front of a ventilator.

SBT is a major diagnostic test providing information on patient’s readiness to be extubated (Boles et al. 2007). Success or failure of SBT depends on several criteria. In the international literature we find numerous recommendations to follow (Haas and Loik 2012, Ramachandran et al. 2005, Ely et al. 2001, Caroleo et al. 2007) and Flemish nurses include majority of them with variable frequency. To determine if patient passed a SBT, majority of our respondents evaluate respiratory parameters (adequacy of gas exchange: 89,3% and breathing pattern: 76,1%). Inadequate gas exchange (89,6%) and patient’s exhaustion (89,3%) result in premature discontinuation of the trial. Oxygenation, as expected, is an important predominant of extubation (94,2%). Less than half of nurses include evaluation of cough reflex although ability to protect the airways is crucial in maintaining spontaneous breathing and preventing extubation failure according to international recommendations (Haas and Loik 2012, Boles et al. 2007, MacIntyre et al. 2001).
5.1 Limitations

There are couple of limitations to this study that are needed to be mentioned. Due to self-reporting nature of the study we are not able to ensure lack of response set bias. Furthermore the survey was rather long what may have contributed to lower response rate and losing some important data on ICU sedation and weaning practice.

Generalizability of the study is burdened due to convenient sample of participants. Nurses who have participated in the study are all nurses working in Flemish hospitals. Therefore caution is warranted to extrapolate these results to other geographic regions that might differ from Flanders in how nursing education and care is organized.

Furthermore, this study might suffer from selection bias as respondents in the study are probably more interested in additional training on recent insights in intensive care, what would explain their presence during 32nd Annual Congress of the Flemish Society of Critical Care Nurses and their voluntarily contribution to the study.

Finally, important issues such as ICU delirium and pain protocols have not been studied in this survey, resulting in limited information in this regard.

5.2 Recommendations for further studies

To gain deeper insight into the reality of weaning from mechanical ventilation, additional studies on this subject should be performed. We recommend dividing sections about sedation and weaning into two different surveys. This practice would support gaining additional information about perceived barriers, nurses’ attitudes and ICU context/culture. Furthermore nurses’ level of knowledge on the subject is worth exploring to determine the cause of variation in the practice in Flanders.
6. Conclusion

There appears to be a considerable discrepancy between recommendations and sedation/weaning practice. Less than half of nurses have sedation and weaning protocols available. Organisational and context factors need further deep and careful exploration in order to reveal a total picture of practices among nurses. This data demonstrate room for quality improvement initiatives.
References


Annex 1: Questionnaire

Weaning op IZ - praktijkpeiling

Deze vragenlijst bestaat uit 

Deel 1: Demografische vragen

Uw geslacht: □ man □ vrouw

In welke functie bent u momenteel tewerkgesteld?
□ art
□ verpleegkundige
□ middenkader
□ fysiotherapeut/kinesiolog/ergotherapeut
□ docent
□ student
□ ik werk momenteel niet

Welke diploma’s heeft u in uw bezit? (meerdere antwoorden mogelijk)
□ graduatuur in de verpleegkunde (A2)
□ bachelor in de verpleegkunde (A1)
□ bijzonder beroepstitel in intensieve zorgen en spoedgevallenzorg
□ master in de verpleegkunde of gelijktijdende
□ master in de geneeskunde
□ ander diploma

Hoeveel jaren werkvaring heeft u op een intensievezorgafdeling?
□ geen, want ik ben een student
□ geen, want ik werk niet op IZ afdeling (ik ben verpleegkundige spoed/OK, leerkraacht onderwijs...)
□ < 1 jaar
□ 1 – 5 jaar
□ 6 – 10 jaar
□ ≥10 jaar

In welk type ziekenhuis bent u tewerkgesteld?
□ universitair □ algemeen ziekenhuis □ ik werk niet in een ziekenhuis

Op welke afdeling(en) bent u tewerkgesteld?
□ algemene intensievezorgafdeling
□ medische intensievezorgafdeling
□ chirurgische intensievezorgafdeling
□ pediatrische intensievezorgafdeling
□ neonatale intensievezorgafdeling
□ cardio-chirurgische intensievezorgafdeling
□ brandwondencentrum
□ andere

Hoeveel intensievezorgen bedden heeft de afdeling van het ziekenhuis waar u werkt? (geef een inschatting)
□ ________ IZ-banden □ niet van toepassing

Voor hoeveel patiënten bent u gemiddeld verantwoordelijk tijdens:
□ vroege shift: □ 1 □ 2 □ 3 □ meer (vul in) □ niet van toepassing
□ late shift: □ 1 □ 2 □ 3 □ meer (vul in) □ niet van toepassing
□ nachtshift: □ 1 □ 2 □ 3 □ meer (vul in) □ niet van toepassing
Deel II: Praktijkgerichte vragen

Deze vragen hebben betrekking op de praktijk op uw afdeling(en) en/of peilen naar uw persoonlijke perceptie. Er zijn telkens meerdere antwoorden mogelijk tenzij anders aangegeven.

A. Sedatie

1. Welke middelen gebruikt men voor kortdurende sedatie (<24u)?
   □ alleen morfine
   □ alleen fentanyl
   □ alleen sufentanil (Sufenta®)
   □ alleen remifentanil (Ultiva®)
   □ benzodiazepines (bv. Dormicum®)+morfine
   □ benzodiazepines (bv. Dormicum®)+fentanyl
   □ benzodiazepines (bv. Dormicum®)+sufentanil (Sufenta®)
   □ benzodiazepines (bv. Dormicum®)+remifentanil (Ultiva®)
   □ alleen benzodiazepines (bv. Dormicum®)
   □ alleen propofol (Diprivan®/Propolipid®)
   □ propofol (Diprivan®/Propolipid®)+morfine
   □ propofol (Diprivan®/Propolipid®)+fentanyl
   □ propofol (Diprivan®/Propolipid®)+sufentanil (Sufenta®)
   □ propofol (Diprivan®/Propolipid®)+remifentanil (Ultiva®)
   □ alleen dexmedetomidine (Dexdor®)
   □ dexmedetomidine (Dexdor®)+morfine
   □ dexmedetomidine (Dexdor®)+fentanyl
   □ dexmedetomidine (Dexdor®)+sufentanil (Sufenta®)
   □ dexmedetomidine (Dexdor®)+remifentanil (Ultiva®)
   □ andere (specificeer):..........................

2. Wat zijn de indicaties op uw afdeling voor het toedienen van spierverslappers, exclusief bij intubatie?
   □ acute lung injury (ALI)/ acute respiratory distress syndrome (ARDS)
   □ patiënt-ventilator dysynchronie (moeilijk te ventileren patiënt)
   □ status asthmaticus
   □ routinematig bij sedatie
   □ hoge intracraniële druk
   □ intra-abdominale hypertensie
   □ preventie/behandeling van shivering bij therapeutische hypothermie
   □ niet van toepassing (er worden geen spierverslappers gebruikt)

3. Wat doet u zonder voorschrift van de arts?
   □ opstarten van sedatieinflux
   □ perfusiesnelheid van het sedatium aanpassen
   □ sedatiebolus geven
   □ sedatieinflux stopzetten
   □ sedatie onderbreken
   □ geen van bovenstaande

4. Hoe wordt intraveneuze sedatie op uw afdeling toegediend?
   □ enkel in continu infus
   □ enkel intermittente bolus
   □ continu infus aangevuld met bolus indien nodig
   □ andere

5. Wordt tijdens het afbouwen van sedatie aanvullend pijnstilling voorzien? (met geen of minimaal sедерend effect)
   □ nooit
   □ duidelijk
   □ meestal
   □ altijd

6. Is er een sedatieprotocol aanwezig op uw afdeling?
   □ ja
   □ neen (ga naar vraag 11)
   □ ik weet het niet (ga naar vraag 11)

7. Wordt het sedatieprotocol consequent toegepast? (slechts 1 antwoord mogelijk)
   □ nooit
   □ duidelijk
   □ meestal
   □ altijd

8. Welke disciplines werden betrokken bij het ontwikkelen van het sedatieprotocol?
   □ arts intensivist
   □ fysiotherapeut/kinesiologist
   □ verpleegkundige
   □ pnumoloon
   □ anesthesioloog
   □ respiratory therapist
   □ psycholoog
   □ ik weet het niet
9. Welk soort sedatieprotocol wordt gebruikt op uw afdeling?
☐ patiënt gerichte (patient-targeted) sedatie protocol
☐ routinematig stoppen van de sedatie (daily interruption of sedative infusions DIS)
☐ een combinatie van bovenstaande
☐ ik weet het niet

10. Ik gebruik het sedatieprotocol NET: ☐
☐ als patiënt kort geseënd moet worden (<24 uren)
☐ als de artsen buiten protocol wensen te werken
☐ uit bezorgdheid om sedatie te hoog te doseren
☐ bij gebrek aan een voorschrift van de arts
☐ uit bezorgdheid om sedatie te laag te doseren
☐ indien ik geen uitleg over sedatieprotocol gekregen heb
☐ bij te hoge werkdruk
☐ als het moeilijk te vinden is
☐ bij tekort aan verpleegkundigen
☐ ik gebruik het altijd

11. Hoe frequent beoordeelt u de adequaatheid van de sedatie gedurende de shift (naast op klinische indicaties)?
☐ elk uur
☐ 2/uren
☐ 6/uren
☐ wordt niet beoordeeld (ga naar vraag 13)

12. Welk van onderstaande instrumenten gebruikt u om de adequaatheid van sedatie te beoordelen?
☐ The Richmond Agitation Sedation Scale (RASS)
☐ Glasgow Coma Scale (GCS)
☐ Numeric Rating Scale (NRS)
☐ Riker Sedation-Agitation Scale (SAS)
☐ Adaptation to the intensive Care Environment (ATICE)
☐ The Ramsay Sedation Scale (RSS)
☐ Bispectral Index (BIS)
☐ Critical Care Pain Observation Tool
☐ Bispectral Index (BIS) + een schaal
☐ andere
☐ Nursing Instrument for the Communication of Sedation (NICS)
☐ geen

**Routinematig stoppen van de sedatie (daily interruption of sedative infusions DIS)**

13. Hoe frequent wordt DIS toegepast op uw afdeling? (slechts 1 antwoord mogelijk)
☐ nooit (ga naar vraag 17)
☐ zelden
☐ meestal
☐ altijd
☐ ik weet het niet

14. Wat zijn de redenen om DIS uit te voeren?
☐ spontane spierbewegingen faciliteren
☐ duur van mechanische ventilatie verkorten
☐ patiënt snel laten ontwaken
☐ preventie van posttraumatische stressstoornis (PTSD)
☐ neurologische evaluatie
☐ betere communicatie met de patiënt
☐ reductie van de nodig aan vasopressoren
☐ preventie van opstapeling van sedativa
☐ ik weet het niet

15. Wanneer wordt DIS NIET toegepast?
☐ overdag
☐ 5 nachten
☐ in het weekend

16. Wat zijn voor u de drie belangrijkste barrières om DIS uit te voeren?
☐ slechte ervaringen met DIS
☐ slechte ervaringen met DIS bij de collega(s)
☐ comfortabel voor de patiënt
☐ angst bij de patiënt
☐ niemand doet het
☐ geen meerwaarde
☐ onvoldoende kennis
☐ verhoogde kans op agitatie
☐ ontostexubatie, het verwijderen van drain/katheters...
☐ kunnen een gevaarlijke dieet steelt dit nooit voor
☐ moeilijk van voederen
☐ moeilijk te controleren techniek
☐ te hoge werkdruk
☐ het staat niet in het sedatieprotocol
☐ ik voor altijd DIS uit

17. Duid de drie meest voorkomende problemen aan, die u erken in uw dagelijkse praktijk bij het afbouwen van sedatie.
☐ respiratoire achteruitgang
☐ hemodynamische instabiliteit
☐ haringstoomzorgen
☐ vasoconstrictorproblemen tussen patiënt en ventilator
☐ neurologische achteruitgang
☐ agitatie/verwardheid ICU delirium
☐ bijwerkingen aan te luchtweg/ziektes
☐ groter nood aan fixatie
☐ visueel contact bij de patiënt en/of pijn
☐ andere

38
B. Weaning (ventilatie afbouw)

18. Is er een weaning protocol beschikbaar? (slechts 1 antwoord mogelijk)
- ja
- enkel computer gestuurd (via beademingstoestel)
- neen
- ik weet het niet

19. Heeft u bijscholing/training/informatie gekregen over het gebruik van het weaningprotocol? (slechts 1 antwoord mogelijk)
- ja
- niet van toepassing/geen weaningprotocol beschikbaar
- neen
- ik weet het niet meer

20. Bij welke patiënten maakt u gebruik van het weaningprotocol?
- bij alle geventilieerde patiënten
- bij falen van weaning zonder protocol
- geen protocol beschikbaar
- indien mechanische ventilatie ≥24u
- nooit

21. Hoe frequent bent u tevreden over samenwerking met andere disciplines bij weaning? (slechts 1 antwoord mogelijk)
   Met de arts:
   - nooit
   - zelden
   - meestal
   - altijd
   Met de kinectherapeut:
   - nooit
   - zelden
   - meestal
   - altijd

22. Indien geen protocol gehanteerd wordt, welke instellingen van het beademingstoestel verandert u zonder voorschrift?
- fraction of inspired oxygen (FiO2)
- pressure support (PS)
- ademhalingsfrequentie
- positive end-expiratory pressure (PEEP)
- tidal volume (TV)
- andere
- beademingsmodus
- pressure limit (Pmax)
- geen


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Spontaneous Breathing Trial (SBT, spontane ademhalingsproef)

24. Met welke criteria houdt men rekening bij het starten van SBT?
- positieve evolutie van respiratoire toestand
- vermogen om ademhalingsarbeid te verrichten
- adequate saturatie (bv. 90% bij FiO₂ <50%)
- PaO₂/FiO₂ >150-200mmHg
- PEEP≥5 cmH₂O
- tidal volume (TV) [voldoende hoog, bv. > 5ml/kg]
- stabiele cardiovasculaire toestand
- geen vasopressie/inotropica nodig
- stabiele hemoglobine/hematocriet
- stabiele neurologische toestand
- GCS (voldoende hoog, bv. ≥8)
- volledig stopzetten van sedatie
- minimale sedatie aanwezig (zonder invloed op het bewustzijn)
- afwezigheid van agitatie/angst
- geen elektrolytenstoornissen
- afwezigheid van infectie/koorts
- aanwezig interstitieel
- geen anemie of vasculaire sonde
- aanwezigheid van naspastische sonde
- comfort van de patiënt/afwezigheid van pijn
- afwezigheid van zweten
- een andere
- ik weet het niet

4
25. Welk soort SBT wordt doorgaans toegepast?
- spontane ademhaling aan T-stuk
- continuous positive airway pressure (CPAP)
- pressure support ventilation (PSV) met lage PS
- automatic tube compensation (ATC)
- andere
- niet van toepassing, er wordt geen SBT toegepast

26. Hoelang duurt de eerste SBT doorgaans? (slechts 1 antwoord mogelijk)
- 0 - 15 minuten
- 16 - 30 minuten
- 31 - 60 minuten
- 61 - 90 minuten
- >90 Minuten
- niet van toepassing, er wordt geen SBT toegepast

27. Hoe vaak wordt SBT maximum herhaald? (slechts 1 antwoord mogelijk)
- 1x/dag
- 2x/dag
- meer dan 3x/dag
- niet van toepassing, er wordt geen SBT toegepast

28. Wanneer wordt SBT NIET toegepast?
- overdag
- 's nachts
- in het weekend

29. Met welke parameters houdt u rekening bij het bepalen of een SBT al dan niet geslaagd is?
- adequaatheid van gasuitwisseling
- bewustzijnsgraad
- agitatie/angst
- comfort van de patiënt
- hemodynamische stabiliteit
- braakneiging

30. Wanneer wordt een SBT vroegtijdig gestopt? In het geval van:
- inadequaat gasuitwisselingsproces
- bewustzijnsniveau
- agitatie/angst
- verminderd bewustzijn
- zichtbare uitputting
- andere

C. Extubatie

31. Met welke parameters houdt men rekening op uw afdeling om de patiënt te extuberen?
- oxygenatie (saturation, PaO₂, ...
- ademhalingsfrequentie
- aanwezigheid van hoestreflex
- duur van SBT
- comfort van de patiënt
- andere
- adequate neurologische toestand
- ik weet het niet

D. Samenwerking op de werkvloer

32. Kruis aan wie er betrokken is bij de beslissing tot:

<table>
<thead>
<tr>
<th>Arts</th>
<th>Verpleegkundige</th>
<th>Respiratory therapist</th>
<th>Kinesitherapeut</th>
<th>Andere discipline</th>
<th>Per protocol</th>
<th>Niet van toepassing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afbouw sedatieinflus</td>
<td>Stoppen sedatieinflus</td>
<td>Toepassen DIS</td>
<td>Weaning</td>
<td>Starten met SBT</td>
<td>Extubatie</td>
<td>Herintubatie</td>
</tr>
</tbody>
</table>