Introduction

Assessment and treatment of pain, agitation and delirium are integral parts of the complex management of critically ill patients. Although research studies on pain, delirium and sedation in general ICUs have flourished, little is known about current practices in Burn Units. Hence, there is a need to describe the practice of sedation, analgesia and delirium management in Burn ICUs to determine the impact of guidelines on burn specialists’ practice patterns. The purpose of this review is to describe the assessment and management of delirium, pain and sedation in Burn ICUs, and to address whether management of these issues is compatible with internationally accepted recommendations. This approach will be useful in determining the impact of guidelines on physicians’ practice patterns and in developing the appropriate educational programs as well as future guidelines for the management of sedation and analgesia in Burn ICUs.

Pain, analgesia

Recognition and management of pain is challenging in intensive care units (ICUs) because of the many confounding factors that exist in this setting. It is well known that the short- and long-term consequences of inadequate pain relief are associated with increased morbidity and mortality. Adverse physiological response to pain has been reported to be related to unstable hemodynamic status, alterations in immune system function, hyperglycemia, and increased release of catecholamine, cortisol and antidiuretic hormones. Additionally, uncontrolled pain is implicated in a variety of detrimental psychological effects including delirium, posttraumatic stress disorder, disorientation and depression, which in turn may affect morbidity and length of stay, having a profound negative impact on socio-economic health. Therapeutic barriers to adequate pain relief in ICU patients include knowledge deficits, low prioritization, and failure to assess pain or evaluate the effect of the applied treatment regimen.

SUMMARY. Assessment and treatment of pain, agitation and delirium are integral parts of the management of critically ill patients. The purpose of this review is to describe how pain, delirium and agitation are managed in general intensive care units and in burn units, and to address whether management of these issues is compatible with internationally accepted recommendations. A substantial gap exists between the conception of the guidelines, clinical practice and physicians’ statements regarding pain, sedation and delirium management. Specific training programs might be required to increase the implementation rate of guidelines and best practices on sedation, pain and delirium assessment and management in burn units.

Keywords: sedation, analgesia, delirium, burns

RÉSUMÉ. L’évaluation et le traitement de la douleur, de l’agitation et du délire font partie intégrante de la prise en charge des patients de réanimation. Cette revue a pour but de décrire la prise en charge de ces paramètres en réanimation générale et en centre de brûlés et de discuter si cette prise en charge correspond aux recommandations internationales. Il existe des différences notables entre ces recommandations, la pratique courante et le point de vue des médecins concernant la prise en charge de la douleur, de l’agitation et de la confusion. Des programmes de formation spécifiques pourraient être utiles pour améliorer la concordance entre la vraie vie et les recommandations dans ces situations.

Mots-clés: sédation, analgésie, délire, brûlure
Pain assessment

Pain assessment is essential for appropriate treatment, especially when a comprehensive pain management protocol is followed. Although the quality of available evidence is moderate, it is strongly recommended that routine pain assessments are performed in all ICU patients, as the benefits strongly outweigh the possible impact on workload. Recent recommendations emphasize that pain in ICU patients should be assessed routinely and repeatedly in an efficient and reproducible manner (Table I). Additionally, it has been shown that implement-

Table I - Management of pain, agitation and delirium in adult patients in the Intensive Care Unit: recommendations*

<table>
<thead>
<tr>
<th>Section, field/topic of recommendations</th>
<th>Recommendation, statement</th>
<th>¹Quality of evidence</th>
<th>²Strength recommendation</th>
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<tbody>
<tr>
<td>Analgesia, pain</td>
<td>a. Pain assessment</td>
<td>B</td>
<td>+1</td>
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<td></td>
<td>Pain should be routinely monitored in all adult ICU patients.</td>
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<td></td>
<td>The Behavioural Pain Scale (BPS) and the Critical-Care Pain Observation Tool (CPOT) are the most valid and reliable behaviourial pain scales for monitoring pain in medical, postoperative, or trauma adult ICU patients who are unable to self-report and in whom motor function is intact and behaviours are observable.</td>
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<td></td>
<td>b. Pain treatment</td>
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<td></td>
<td>Pre-emptive analgesic therapy and/or non pharmacologic interventions should be administered to alleviate pain for all types of invasive and potentially painful procedures in adult ICU patients.</td>
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<td></td>
<td>Intraavenous (IV) opioids is suggested as the first-line drug class of choice to treat non-neuropathic pain in critically ill patients.</td>
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<tr>
<td></td>
<td>All available IV opioids, when titrated to similar pain intensity endpoints, are equally effective.</td>
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<td>The use of non-opioid analgesics is suggested to decrease the amount of opioids administered (or to eliminate the need for IV opioids altogether) and to decrease opioid-related side effects.</td>
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<tr>
<td>Sedation</td>
<td>a. Monitoring of depth of sedation</td>
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<td></td>
<td>The Richmond Agitation-Sedation Scale (RASS) and Sedation-Agitation Scale (SAS) are the most valid and reliable sedation assessment tools for measuring quality and depth of sedation in adult ICU patients.</td>
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<td></td>
<td>b. Depth of sedation</td>
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<td></td>
<td>Maintaining light levels of sedation in adult ICU patients is associated with improved clinical outcomes (e.g., shorter duration of mechanical ventilation and a shorter ICU length of stay).</td>
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<td>c. Choice of sedatives</td>
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<td>Sedation strategies using non-benzodiazepine sedatives (either propofol or dexmedetomidine) may be preferred over sedation with benzodiazepines (either midazolam or lorazepam) to improve clinical outcomes in mechanically ventilated adult ICU patients</td>
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<tr>
<td>Delirium</td>
<td>a. Detecting and monitoring delirium</td>
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<td></td>
<td>Routine monitoring of delirium in adult ICU patients is recommended.</td>
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<td></td>
<td>The Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) are considered the most valid and reliable delirium monitoring tools in adult ICU patients.</td>
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<td>b. Delirium risk factors</td>
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<td></td>
<td>The following risk factors are positively and significantly associated with the development of delirium in the ICU: pre-existing dementia, history of hypertension and/or alcoholism, and a high severity of illness at admission.</td>
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<td>Benzodiazepine use may be a risk factor for the development of delirium in adult ICU patients.</td>
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<td>In mechanically ventilated adult ICU patients at risk of developing delirium, dexmedetomidine infusions administered for sedation may be associated with a lower prevalence of delirium compared to benzodiazepine infusions.</td>
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<td>c. Delirium prevention</td>
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<td>0</td>
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<td></td>
<td>There is no recommendation for using a combined non-pharmacologic and pharmacologic delirium prevention protocol in adult ICU patients, as this has not been shown to reduce the incidence of delirium.</td>
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<td>d. Delirium treatment</td>
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<td>In adult ICU patients with delirium unrelated to alcohol or benzodiazepine withdrawal, continuous IV infusions of dexmedetomidine rather than benzodiazepine infusions should be administered for sedation to reduce the duration of delirium.</td>
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</table>

⁴ Quality of evidence for each statement and recommendation was ranked as high (A), moderate (B), or low/very low (C).
⁵ Strength of recommendations was ranked as strong (1) or weak (2), and either in favour of (+) or against (−) intervention.
ing behavioural pain scales improves both ICU pain management and clinical outcome parameters, including optimal use of analgesic and sedative agents and shorter durations of mechanical ventilation and length of ICU stay.\(^9,10\) Pain scales such as the Behavioural Pain Scale and the Critical Care Pain Observation Tool provide structured and repeatable assessments and are currently considered the best available methods for pain assessment in an ICU setting.\(^{11,12}\)

Previous publications indicate increasing awareness of critical care specialists concerning pain assessment. According to these data, the implementation rates for pain monitoring varies from 21% in general ICUs to up to 60% in European burn centers.\(^{13,14}\) Among the various pain monitoring tools, the Visual Analogue Scale has been validated as a sensitive and effective method in burn patients.\(^{15}\) However, this method requires both adequate cooperation and consciousness of the patient - something that is not always feasible. Tools based on behavioural observation (Abbey pain scale) have also been validated in burn patients who are unable to self-report pain.\(^{16}\) Results from recent publications show inadequate pain assessment in sedated ICU patients.\(^{1,4}\) In a survey by Payen et al., 70% of the ICUs did not use any assessment tool specifically developed for assessing pain in sedated patients.\(^{11}\) According to the survey of Trupcovic et al.,\(^{14}\) a regular assessment of analgesia in burn centres is practiced mainly by using the Visual Analogue Scale and the Numeric Rating Scale. It is important to mention that both of these scales are not suitable for patients who are unable to communicate verbally as they are not designed for use on sedated patients. Therefore, sedated burn patients may be exposed to a higher risk of suffering from insufficient analgesia due to the inappropriate use of pain assessment tools.

**Pain management**

Although burn ICU patients undergo many painful procedures (dressing changes, catheter manipulation, secretion suctioning, mobilization), the practice of analgesic management during procedural pain has not been addressed adequately in the literature. Pain and sedation management for burn-dressing change are the most popular drugs used routinely in burn patients to provide structured and repeatable assessments.

Clinical trials show insufficient pain management for ICU patients who are exposed to painful procedures. In a multicentre study comprised of 5,957 adult patients from 169 centres, less than 20% of patients received opioids before and/or during painful procedures, while 63% received no analgesics.\(^{17}\) Moreover, most patients remained intentionally not medicated, even though pain intensity increased during the procedure; when used, analgesic doses were low, and combination therapy was infrequent. A prospective, observational study in 44 ICUs in France revealed that procedural pain was specifically managed in less than 25% of patients.\(^{18}\) According to these data, the proportion of patients with pain significantly increased during painful procedures, reflecting the lack of analgesia when the patients were subjected to noxious stimuli. Moreover, the authors warned that satisfactory basic levels of analgesia by continuous infusion of opioids did not guarantee adequate analgesia during painful procedures.

The use of patient-controlled analgesia (PCA) during painful procedures allows the patient to actively participate in the pain management program. Studies comparing PCA with other routes of opioid administration have reached mixed conclusions as to the benefit and patient satisfaction.\(^{19}\) The use of patient-controlled sedation and analgesia with propofol and alfentanil for dressing changes has been shown to be safe and effective in burn patients.\(^{20}\) The patients preferred the use of the PCA method despite the fact that the mean pain rating (Visual Analogue Scale) was higher in the patient-controlled sedation group.

The management of procedural pain continues to challenge burn specialists, and this is highlighted by the lack of consensus on therapeutic strategy.\(^{16}\) Recent recommendations on the management of pain in adult patients in Intensive Care Units\(^{1}\) suggest the use of preemptive analgesia and nonpharmacologic interventions for all types of invasive and potentially painful procedures to alleviate pain (grade of recommendation +2C, Table I). The guidelines recommend intravenous (IV) opioids to be considered as the first-line drugs of choice to treat non-neuropathic pain in critically ill patients (grade of recommendation +1C, Table I).\(^{4}\) All available IV opioids when titrated to similar pain intensity endpoints are considered to be equally effective. Intravenously used opioids (fentanyl and morphine) are the most popular drugs used routinely in burn patients to alleviate pain.\(^{16,17}\) Although intravenous opioids are safe and effective in the management of pain in burn patients, the oral route of opioid administration is also frequently used. Oral or transmucosal administration of opioids has been studied in burn patients and appears to have an advantage in patients without intravenous access when rapid onset of a potent analgesic is indicated.\(^{21}\)

Oxycodone, a new semisynthetic opioid, is an effective alternative option for patients experiencing moderate to severe pain, especially in procedural pain relief. Oxycodone has superior bioavailability than morphine; it is considered to be useful for the treatment of moderate background pain presented in burn patients. A recent survey of the American Burn Association Burn Centres showed that Oxycodone was the most commonly selected oral opioid premedication for patients undergoing burn dressing change.\(^{22}\) Sharar et al. in a placebo-controlled, double-blind study,\(^{23}\) comparing oral transmucosal fentanyl citrate and oral oxycodone, concluded that both medications offer effective analgesia in the setting of pediatric outpatient wound care.

Several other types of pain-modulating non-opioid medications can be used adjunctively, decreasing the overall dose of opioids and both the incidence and severity of opioid-related side effects according to the guidelines.\(^{4}\) Ketamine and clonidine have been mentioned as the most popular adjunctive pain medications.\(^{16,24}\)

**Non-pharmacological approach to pain management**

Although a multimodal approach to pain management in ICU patients has been recommended,\(^4\) there are a limited number of studies focusing on the effectiveness of nonpharmacological interventions in burn patients. Complementary
of medications in the ICU setting vary widely worldwide.28-30

The use of virtual reality systems, sound and video devices in pediatric burn patients is associated with lower procedural pain scores.26 Results from the study by Faber et al.27 suggest that the repeated use of immersive virtual reality therapy in adult and pediatric patients with severe burn injury was effective in controlling pain during burn wound debridement and wound dressing changes. These findings are encouraging considering the potential evolution of virtual reality into a powerful analgesic technique without pharmacological side effects.

However, a recently published systematic review which assessed the quality of evidence regarding pain management in burn patients revealed poor methodological quality of the published manuscripts on this field.24 A variety of analgesic agents were studied in this review, including dexmedetomidine and ketamine. Pregabalin was found to be the only alternative agent to the traditional opioid analgesia in burn patients. Nevertheless, the authors of this review concluded that no clear recommendation can be made for clinical practice due to the low quality of readily available evidence.

Key points

- Pain in ICU patients is common and poorly treated.
- Uncontrolled pain has a plethora of negative consequences both on patient health and on the health system.
- Pain should be assessed regularly, throughout patient stay and during specific procedures using validated pain scales.
- Both opioids and non-opioids could be used effectively in pain management.
- Non-pharmacological approaches seem to be valuable in burn patient care.

Sedation

Practice patterns regarding sedation monitoring and type of medications in the ICU setting vary widely worldwide.28-30 Evidence from available data consistently supports the use of the minimum possible level of sedation. Strategies using specific scoring systems with goal-oriented sedation have been recommended by clinical practice guidelines to provide optimal patient comfort in the ICU setting whilst minimizing the adverse effects of sedatives.4,28

Sedation assessment

References indicate that practices of sedation and pain assessment have been disregarded for the majority of ICU patients, suggesting that the impact of clinical trials and guidelines on physicians’ practice patterns is quite low.18,31 According to the survey by Luetz et al.,31 there was a reported use of validated screening tools for assessing sedation depth in 77% of the cases. However, the study revealed that only 43% of the patients were monitored regarding their sedation depth in actual practice. Data from the study by Trupkovic et al.14 show that sedation scores were used in 58% of European burn centres, a rate that was higher than that reported in non-burn European ICUs. Interestingly, the Glasgow Coma Scale was preferred for sedation assessment in most burn centres over the Ramsay Sedation Scale, despite the fact that this scale is not appropriate for sedation estimation. Interestingly, the guidelines recommended Richmond Agitation-Sedation Scale was applied in only 7% of burn centres. These data emphasize the need for structured training programs to increase the implementation rate of best practices in clinical setting.

The use of protocol-driven management of sedation has been shown to result in better outcomes for mechanically ventilated patients in intensive care than standard approaches.28,32 The current evidence reveals that light sedation should be preferred as long as there are no specific clinical indications for a deep level of sedation.4 A large multicentre study by Payen et al.33 demonstrates a remarkable gap between the targeted level of sedation and that which was obtained. Regardless of the sedation instrument used (Ramsay Scale, Sedation-Agitation Scale, Richmond Agitation-Sedation Scale), a large proportion of patients were in a deep state of sedation with no major changes made in their sedative dosages during the first week of ICU stay. Although causal relations between level of sedation and patient outcomes are difficult to determine, many studies suggest that the excessive use of sedatives and analgesics could account, in part, for the increased requirements of vasoactive agents in burn patients with hemodynamic compromises.18,33 Neglecting a regular assessment of sedation to achieve the desired sedation level may put patients at risk of receiving inappropriate dosages of sedatives with concomitant negative effects on organ functions.3

Sedation medications

The choice of certain medications for sedation could be influenced by many factors, including the severity of the patient’s illness, the foreseeable duration of mechanical ventilation and the habits and resources of each centre. Recent recommendations suggest that the choice of a sedative agent in an ICU setting should be driven by: the specific indications and sedation goals for each patient; the specific pharmacokinetic and pharmacodynamic characteristics of the drug in a particular patient, including the side effect profile; and the overall costs associated with the use of a particular sedative.4 According to these recommendations sedation strategies using non benzodiazepine sedatives (either propofol or dexmedetomidine) should be preferred over sedation with benzodiazepines (either midazolam or lorazepam) aiming to improve clinical outcomes in mechanically ventilated ICU patients (grade of recommendation +2B, Table I). However, the current literature reports modest differences in outcomes with benzodiazepine-based vs. non benzodiazepine-based sedation.1,34,35 Despite the apparent advantages in using either propofol or dexmedetomidine over benzodiazepines for ICU sedation, benzodiazepines remain an important alternative for sedation of ICU patients, especially for treating anxiety, seizures and alcohol withdrawal syndrome. Benzodiazepines are also important when deep sedation, amnesia or a combination therapy is required to reduce the use of other sedative agents. If the desirable goal is the minimization of the depth and duration of sedation, the use of a short-acting agent with an effect that can be rapidly adjusted,
such as propofol, offers advantages over longer acting agents or agents with active metabolites.\(^1\) Propofol, although it has not been shown to reduce mortality in comparison with benzodiazepines, may result in a reduction of intensive care unit length of stay.\(^36\)

**Use of dexmedetomidine for sedation**

Dexmedetomidine, a highly selective \(\alpha_2\)-adrenoceptor agonist, has certain advantages over benzodiazepines since it produces analgesia while causing less respiratory depression. Dexmedetomidine provides a qualitatively different type of sedation which allows patients to be more interactive and potentially communicate their needs more effectively.\(^37,38\) Dexmedetomidine is suitable for short- and longer-term sedation in an intensive care setting.\(^39\) As compared with lorazepam and midazolam, dexmedetomidine resulted in less delirium and a shorter duration of mechanical ventilation.\(^38,40\) However, there was no difference between dexmedetomidine and benzodiazepines in lengths of ICU or hospital stay. At comparable sedation levels, dexmedetomidine-treated patients experienced less delirium than patients receiving midazolam, propofol or remifentanil and had more delirium-free and coma-free days than patients receiving lorazepam.\(^41\) Dexmedetomidine has an acceptable tolerability profile; hypotension, hypertension and bradycardia are the most commonly reported adverse reactions.\(^39,41\) A systematic review on the use of dexmedetomidine in burn patients identified only four prospective randomized studies on the use of dexmedetomidine in this specific category of patients.\(^42\) This meta-analysis included a total of 266 patients with burn injuries who were evaluated for analgesia and sedation levels as well as for hemodynamic changes. The main results suggest that dexmedetomidine may be an efficient adjunct to analgesic treatment during dressing changes. Even though there are only a small number of clinical trials available, the meta-analysis shows evidence for more effective sedation as well as for prevention of hypertension when using dexmedetomidine as an adjunct during burn procedures. However, there were no differences in analgesia scores in comparison with other therapeutic approaches.

Further studies are warranted to evaluate the effectiveness and safety of dexmedetomidine use for sedation of patients with burns and to confirm whether this particular agent improves outcomes in comparison to other commonly used sedative and analgesic drugs in the burn ICU population.

**Concomitant use of neuromuscular blocking agents**

Neuromuscular blocking agents (NMBAs) are widely used in burn ICUs to optimize mechanical ventilation and oxygenation. A survey by Trupkovic et al.\(^43\) reveals that half of the responding intensive care units use neuromuscular blocking agents in their everyday practice. However, the use of NMBAs in ICUs remains controversial because of possible side effects.\(^43\) Additionally, burn patients may develop resistance to agents in their everyday practice. However, the use of NMBAs tolerability profile; hypotension, hypertension and bradycardia are the most commonly reported adverse reactions.\(^39,41\) A systematic review on the use of dexmedetomidine in burn patients identified only four prospective randomized studies on the use of dexmedetomidine in this specific category of patients.\(^42\) This meta-analysis included a total of 266 patients with burn injuries who were evaluated for analgesia and sedation levels as well as for hemodynamic changes. The main results suggest that dexmedetomidine may be an efficient adjunct to analgesic treatment during dressing changes. Even though there are only a small number of clinical trials available, the meta-analysis shows evidence for more effective sedation as well as for prevention of hypertension when using dexmedetomidine as an adjunct during burn procedures. However, there were no differences in analgesia scores in comparison with other therapeutic approaches.

Further studies are warranted to evaluate the effectiveness and safety of dexmedetomidine use for sedation of patients with burns and to confirm whether this particular agent improves outcomes in comparison to other commonly used sedative and analgesic drugs in the burn ICU population.

**Key points:**

- Sedation needs to be evaluated regularly using appropriate scales.
- The duration and level of sedation should be as short and low as possible.
- Short acting, easily reversible sedation medications should be preferred.
- Dexmedetomidine may be valuable in sedation and analgesia with cooperative burn patients.
- The excessive use of neuromuscular blocking agents should be avoided.

**Delirium**

Development of delirium is an independent predictor of poor outcomes in medical intensive care unit (ICU) patients. Delirium may be considered as an acute disease-induced syndrome developed in patients with sepsis, multiple organ dysfunction or failure, metabolic alterations, hypo- or hyperthermia. Iatrogenic factors including exposure to certain medications, or environmental factors such as prolonged physical isolation, restraints or immobilization, perturbation of sleep and wakefulness patterns may also contribute to the development of delirium in the ICU patient population.\(^4\) Four baseline risk factors are associated with the development of delirium in the ICU: pre-existing dementia, history of hypertension and/or alcoholism, and a high severity of illness at admission (Table I). Timely management of the potentially modifiable conditions is essential to reduce the incidence, severity and duration of delirium.

**Delirium assessment**

Monitoring critically ill patients for delirium with valid and reliable delirium assessment tools enables clinicians to detect and treat delirium earlier, and thus, possibly improve outcomes. Indeed, there is evidence that even when urged to report delirium, ICU physicians recognize less than one third of delirious critically ill patients when they are not using a specific instrument to aid their diagnosis.\(^44\)

Guidelines on sedation, delirium and analgesia management in ICU patients\(^4\) recommend routine monitoring for delirium in adult ICU patients (grade of recommendations +1B, Table I). Based on moderate evidence, these guidelines issue a strong recommendation that ICU patients at moderate to high risk for delirium (patients with a baseline history of alcoholism, cognitive impairment or hypertension; patients with severe sepsis or shock; patients on mechanical ventilation receiving sedative and opioid medications) should be monitored for the development of delirium at least once per nursing shift by using a valid and reliable delirium assessment tool. The Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) have been considered as the most valid and reliable delirium monitoring tools in adult ICU patients (grade of recommendations A).\(^3\)

Delirium seems to be a frequent phenomenon in burn patients; the prevalence of delirium in mechanically ventilated burn ICU patients is as high as 77% when assessed using the Confusion Assessment Method for the Intensive Care Unit.\(^45\) Delirium often remains undiagnosed because delirium monitoring is often dismissed as being too time-consuming.\(^46-49\) Another important reason for delirium underestimation in the ICU environment is that it frequently presents in hypoactive...
rather than hyperactive form. Moreover, hypoactive delirium has a tendency to be missed without the use of a specific delirium assessment tool. A study by Spronk et al. performed in a mixed medical-surgical ICU revealed that delirium was severely under-recognized by intensivists and ICU nurses in daily care; days with delirium were poorly recognized by doctors (sensitivity 28.0%; specificity 100%) and ICU nurses (sensitivity 34.8%; specificity 98.3%) when using only clinical criteria. However, in contrast with the previous data, recognition of delirium in this study did not differ between hypoactive and hyperactive status of the patients. The authors concluded that structural screening for delirium by a validated diagnostic instrument should be a part of routine daily critical care. In accordance with the previously published data in a general ICU setting, a survey conducted on analgesia and sedation practices in the burn population revealed that only an extremely low percentage of burn clinicians (5%) screen routinely critically ill burn patients for the presence of delirium.

A systematic review and meta-analysis of publications evaluating five ICU delirium screening tools found that the CAM-ICU and ICDS&C were the most sensitive and specific tools for detecting delirium. According to the data of Ely et al., testing the Confusion Assessment Method for ICU Patients (CAM-ICU) in adult medical and coronary ICUs, delirium occurred in 83.3% of patients during their ICU stay: delirium was even present in 39.5% of alert or easily aroused patients and persisted in 10.4% of patients at hospital discharge. Data from a recently published survey revealed that forty-four percent (n=44) of participating ICUs used a validated delirium screening tool; the most frequently used score was the Confusion Assessment Method for the ICU (CAM-ICU) (n=37, 84%) followed by the Intensive Care Delirium Screening Checklist (ICDS&C) (n=3, 7%). Interestingly, the second part of this study, in which the responders were asked to enter patient specific data, revealed that only 27% of the patients were in fact monitored by physicians with a validated delirium screening tool.

**Delirium prevention and treatment**

Delirium prevention strategies can be classified into three categories: non-pharmacological (e.g., early mobilization), pharmacological, and combined pharmacological/non-pharmacological approaches. Interestingly, the recent guidelines, also based on low evidence, provide no recommendation for the use of a combined non-pharmacological and pharmacological delirium prevention protocol in adult ICU patients, as this has not been shown to reduce the incidence of delirium (grade of recommendation 0, C). Currently, practices and perceptions surrounding treatment of delirium by critical care specialists are heterogeneous. A survey by Luetz et al. reported that 98% of the ICUs stated treating delirious patients with specific pharmacological agents; surprisingly, even ICUs that had not implemented some kind of delirium monitoring tool stated prescribing medications for symptoms that could supposedly be related to delirium. Antipsychotics and benzodiazepines are frequently recommended for delirium treatment, despite a lack of rigorous evidence to support their use. The survey by Luetz et al. revealed that antipsychotics were the most frequently used specific pharmacological agents in delirious patients (99%); however, a relatively high percentage of the ICUs (82%, n=81) referred to also using benzodiazepines as a part of their treatment regime, despite the increasing evidence that benzodiazepines have been implicated in the development of delirium. According to the current literature, the use of midazolam and lorazepam has been considered as an independent and potentially modifiable risk factor for the transition to delirium. In burn patients, exposure to benzodiazepines has been shown to be an independent risk factor for delirium, whereas opioids seem to reduce the risk of developing delirium, possibly through proper pain management. Consequently, judicious use of benzodiazepines alongside other positive aforementioned implications may also decrease the overall incidence of delirium in burn ICU patients.

Dexmedetomidine appears to be particularly effective in decreasing the risk of delirium compared with benzodiazepines in mechanically ventilated ICU patients. According to the results of a randomized controlled trial evaluating the effect of sedation with dexmedetomidine and lorazepam in mechanically ventilated ICU patients, the use of dexmedetomidine reduces the duration of delirium and coma in comparison with lorazepam (median days without delirium or coma, 7.0 vs. 3.0; p = .01). The study showed that the cost of care and the 28-day mortality rate were similar between groups on both sedation regimens. A study by Kundra et al. compares analgesic efficacy and side effects of oral dexmedetomidine and ketamine in adults for burn wound dressing. Oral ketamine produced significantly better pain relief than dexmedetomidine but was associated with delirium. The use of dexmedetomidine administered intranasally seems to be effective in reducing preoperative anxiety and the emergence of delirium in children undergoing reconstructive surgery.

The scarcity of data evaluating the effect of dexmedetomidine necessitates well-designed clinical trials to establish the optimal sedation practices that could potentially decrease the risk of delirium in burn ICU patients.

**Key points:**
- Delirium is often overlooked resulting in negative consequences.
- Appropriate assessment tools should be used in delirium estimation.
- The use of benzodiazepines has been considered as an independent risk factor for delirium.
- The use of dexmedetomidine may prove useful in delirium prevention.

**The role of teamwork in sedation, analgesia and delirium management**

Sedation, analgesia and delirium treatment in burn patients is a unique and complex challenge for all specialists. Optimal care of the burn patient requires a multidisciplinary approach with collaboration among the team members. Nurses with a special interest in burn care form an integral part of the burn team. The role of nursing staff has expanded over the last few decades to include nurses specialized in burn care who coordinate all patient care activities in burn centres. The implementation of specific protocols for nurse-monitored sedation and analgesia is also considered an effective and safe method of pain relief for burn dressing changes. The treatment of burn patients presents many challenges where the skills and experience of anesthesiology are crucial. Burn patients may present a number of complex anesthetic is-
sues including airway management, ventilation, circulatory support, sedation and analgesia. The involvement of a dedicated anesthesiologist in a burn centre facilitates the optimal care of the patients. The contribution of pain specialists as part of a multidisciplinary approach could be a valuable addition to the care of burn patients, especially those with comorbidities, drug dependence, or previous failure with traditional sedation and/or analgesia treatment. The involvement of pain specialists allows the development of local guidelines for pain management, better coordination of pain control and continuous education of all staff on this topic.

**Conclusions**

Current literature reveals a substantial gap between guidelines and clinical practice regarding pain, sedation and delirium assessment and management in the ICU setting. Further studies will be necessary to assess and evaluate strategies toward delirium, sedation, pain assessment and treatment in burn patients. Efforts should be directed to elaborate specific guidelines and protocols for burn patients to facilitate the regular use of sedation, delirium and pain scales, to enhance management of procedural pain, and to ensure the proper use of sedatives and analgesics.

**BIBLIOGRAPHY**


