Impact of a pain protocol including hypnosis in major burns

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1. Introduction

Pain is a major issue after burns even when large doses of opioids are prescribed. The study focused on the impact of a pain protocol using hypnosis on pain intensity, anxiety, clinical course, and costs.

Methods: All patients admitted to the ICU, aged >18 years, with an ICU stay >24 h, accepting to try hypnosis, and treated according to standardized pain protocol were included. Pain was scaled on the Visual Analog Scale (VAS) (mean of daily multiple recordings), and basal and procedural opioid doses were recorded. Clinical outcome and economical data were retrieved from hospital charts and information system, respectively. Treated patients were matched with controls for sex, age, and the burned surface area.

Findings: Forty patients were admitted from 2006 to 2007: 17 met exclusion criteria, leaving 23 patients, who were matched with 23 historical controls. Altogether patients were 36 ± 14 years old and burned 27 ± 15%BSA. The first hypnosis session was performed after a median of 9 days. The protocol resulted in the early delivery of higher opioid doses/24 h (p < 0.0001) followed by a later reduction with lower pain scores (p < 0.0001), less procedural related anxiety, less procedures under anaesthesia, reduced total grafting requirements (p = 0.014), and lower hospital costs per patient.

Conclusion: A pain protocol including hypnosis reduced pain intensity, improved opioid efficiency, reduced anxiety, improved wound outcome while reducing costs. The protocol guided use of opioids improved patient care without side effects, while hypnosis had significant psychological benefits.

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2. Patients and methods

2.1. Setting

The burn ICU of a University teaching hospital (CHUV) in Lausanne between 2002 and 2007. The 4 burn beds are included in the 32 bed multidisciplinary ICU facility.

The ICU is organised as follows: nurses are in charge of pain evaluation and report it in the computerized information system. Opioids are delivered according to the doses prescribed by the ICU physicians in charge of medical care, using prescription target (e.g. target = VAS < 4, morphine 3 mg/h plus 2 mg morphine reserve qd 1 h). Psychiatrists assess every patient as soon as recovery allows verbal communication: they do not prescribe drugs. Surgeons are in charge of the wound treatments (dressings, hydrotherapy, debridements and grafting). Twice weekly meetings of the complete team with the senior burn specialists (MMB, WR) focus on treatment coordination: pain treatment is specifically addressed. Overall patient management was conducted according to ICU protocols for resuscitation, feeding, metabolic management [18], and antibiotherapy.

2.2. Patients

The study was conducted between 2002 and 2007, with the patient’s oral consent and the Institutional Ethics Committee’s approval. The inclusion criteria were: age >18 years, ICU stay >24 h, and agreement to try hypnosis. The “early” exclusion criteria were ICU admission more than 24 h after injury, life expectancy <48 h, or patient refusal. Delirium developing during ICU stay, or active delusional psychosis, if identified before hypnosis was attempted, were “late” exclusion criteria. A psychiatrist (registrar expertise level) assessed the patient before hypnosis, in a structured clinical interview. Delirium was categorized according to psychomotor behavior: hypoactive delirium characterized by decreased responsiveness, withdrawal, and apathy, or hyperactive delirium characterized by agitation, restlessness, and emotional lability [19].

The intervention patients were enrolled prospectively between May 2006 and April 2007. The matched controls were admitted between 2002 and 2006: their data were prospectively collected into the ICU’s computerized data base (MetaVision®, iMDsoft, Tel Aviv, Israel). Matching of patients was based on sex, age, and burned body surface (% body surface area burned = BSA). The derived burns’ scores were calculated: the Ryan score including age, burn size and inhalation injury [20], and the abbreviated burn injury index [21]. The severity of the physiological alterations during the first 24 h in the ICU was summed by the Simplified Acute Physiology Score (SAPS II) [22]. Physiological variables were recorded according to the standardized nursing techniques of the ICU. The observations were limited to 40 days after injury.

2.3. Intervention

2.3.1. Pain management

During the first days after injury, pain treatment was based on standardized opioid prescription aiming at a pain score VAS < 4 (see definition below). Pain assessment and therapy were systematically addressed by physicians and nurses during clinical round. During both periods, the nurses were in charge of delivering opioids based on a combination of continuous infusion plus bolus reserves. Pain assessment was carried out by nurses most of the time, and recorded in the system. The staff was globally stable during the study period. The differences in pain management between the 2 periods are summarized in Table 1.
Opioid rotation consists in changing to another opioid, in the event that pain is not controlled, or is associated with oversedation, or the patient presents signs of toxicity such as delirium, agitation, or myoclonus [23]. In that case, an equivalent opioid dose is calculated, and half this equivalent dose of the second opioid is then prescribed with reserve doses to enable adaptation to VAS < 4 by the nurse. Opioids used were morphine, fentanyl, hydromorphone, methadone and oxycodone. For painful procedures (dressing and hydrotherapy), opioid and sedative delivery was standardized to fentanyl and propofol, and was administered by the anaesthesiologist. Pain therapy recording was the same over the two periods (pain and sedation scores, as well as the opioids and sedatives used in the ICU), with the addition of the ESAS score (see below) and of hypnosis sessions in the intervention group. Burn specific procedures have been customized since 2000 (Fig. 1).

2.3.2. Hypnosis

Hypnosis was proposed to the patients as soon as possible, i.e. on admission or as soon as they were extubated and mentally alert. A learning time was required until patients could achieve a trance level and an adequate level of comfort: during this preparation period the painful procedures were carried out under anaesthesia or analgesia and sedation. Hypnosis was administered by an ICU nurse who had completed 3 years of training, under supervision of a psychiatrist. There was no blinding of any of the participants to the ongoing procedure, nor to the medications.

Hypnotic induction and specific suggestions and details during the course of induction varied according to the nurse’s observation of the patient’s behaviour, and on her judgement of the patient’s needs. In 76% of cases induction used the cenesthesic approach (patient attention focused on any body sensation), while in cases of acute pain or anxiety (34%), induction was carried out on the actual symptom.

Typically, there are five stages in classical hypnosis: setting the stage, slowing of breathing and relaxation, suggestion for deepening of relaxation and hypnosis, suggestion for pain control, and alerting [12]. An adequate level is reflected by slow breathing and patient’s description of being in a “safe place” [24]. Hypnosis level was assessed by the hypnosis nurse (MD), based on possibility to carry out the procedure.

2.4. Measurements and outcome variables

Physiological variables (heart rate, blood pressure) were recorded before, during and after the painful procedures.

The Visual Analog Scale (VAS) is a self-rating method using a 10-cm device to assess the level of pain which presents as a ruler or a thermometer (0, no pain; 10, worst pain ever) [25,26]: it has been shown to be a useful instrument for measuring pain in burned patients. It was administered and recorded at least 4 times per day to record basal pain, and repeated up to 12 times in case of acute pain, whether related to a painful procedure such as a dressing change or not (see below ESAS for procedural pain evaluation). Maximum pain was recorded, as well as pain at the end of procedure. A mean VAS score for every day in the ICU was recorded.

| Table 1 – Comparison of pain management during the two study periods. |
|-----------------------------|-----------------------------|-----------------------------|
| Variable                    | Historical                  | Intervention                |
| VAS scoring                 | Yes                         | Yes                         |
| VAS target                  | Not specified               | VAS < 4                     |
| Opioids                     | Morphine, fentanyl, methadone| Morphine, fentanyl, methadone, hydromorphone, oxycodone |
| Opioid rotation             | Not mentioned               | Encouraged                  |
| Reserve opioids             | Yes                         | Yes                         |
| Systematic pain discussion  | No                          | Yes                         |
| during the round            | Customized computer page    | No                          |
| Customized computer page    | Yes                         | Yes                         |

Fig. 1 – Dedicated sedation and pain monitoring screen in the computerized system showing the pain score (VAS), sedation score (SAS = Sedation Agitation Score [36]), and the current doses of opioids and sedatives along with the procedure carried out during the day (GA = general anaesthesia), and hypnosis session.
documented. We used the VAS and not a burn specific scale [27] as our patients are treated in a mixed ICU: including different assessment tools would increase confusion among nurses.

The Edmonton Symptom Assessment Scale (ESAS) is a 9-item patient-rated symptom VAS developed for use in assessing symptoms of patients receiving palliative care which has been validated in cancer populations. The nine symptoms are: pain, activity, nausea, depression, anxiety, drowsiness, lack of appetite, well-being, and shortness of breath on a 10-cm scale [28]. The ESAS was used before and after any hypnosis session or any painful procedure under hypnosis in the intervention group, to assess patient’s related symptoms.

Opioid requirements. The different opioids were converted into morphine equivalents using a web-based dose converter to enable comparison of requirements [29]: the first 40 days after injury are included in the analysis as 85% of patients were discharged from the ICU. The computer system summed up all doses of opioids delivered to the patients. The basal “non-procedural” 24 h opioid requirements (which was the sum of continuously delivered opioids and of reserve boluses) and the procedural opioid delivery doses were recorded separately: they were summed to determine the total 24-h opioid dose.

Psychological management. Systematic psychiatric assessment belonged to the protocol, and the number of consultations was recorded. A questionnaire was developed and applied at the end of the ICU stay to address patient’s procedural perception (i.e. for dressings and hydrotherapy) and memories at the end of the hospital stay with the following questions: was the procedure agreeable (y/n), comfortable (y/n), how was comfort after procedure (1–10), maximum intensity of pain (tolerable, strong, and unbearable), anxiety (y/n), confusion (y/n).

Wound management was standardized. Hydrotherapy was carried out in a dedicated room before the first surgical session and after post-surgery day 5. Dressings were carried out either in the patients’ room or in an operating room. Early scar excision was started within 72–96 h, by 10–15% BSA steps, 1–3 times weekly. Wound healing was assessed by comparing the total surface requiring surgery and the sum of the surface effectively grafted during the successive sessions. We recorded the number of procedures carried out under anaesthesia, as well as the duration of each procedure.

Table 2 – Patient characteristics.

<table>
<thead>
<tr>
<th>Description</th>
<th>Historical (n = 23/718 days)</th>
<th>Intervention (n = 23/663 days)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N patients and observation days</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>16 M/7 F</td>
<td>14 M/9 F</td>
<td>ns</td>
</tr>
<tr>
<td>BMI 24 ± 5, 23.3 [15.5–37.3]</td>
<td>24 ± 5, 24.2 [15.7–40.2]</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Inhalation injury 9/23 (39%)</td>
<td>12/23 (52%)</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Surgical %BSA 15 ± 13, 12 [0–45]</td>
<td>14 ± 14, 10 [0–51]</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Ryans score 0.7 ± 0.6, 1 [0–2]</td>
<td>0.9 ± 0.7, 1 [0–2]</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>ABSI 7 ± 2, 7 [3–10]</td>
<td>7 ± 2, 8 [3–10]</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Proportion of surgical burn grafted (%)</td>
<td>158 ± 85, 119 [100–421]</td>
<td>99 ± 46, 100 [100–167]</td>
<td>0.014</td>
</tr>
<tr>
<td>Length of mechanical ventilation (days)</td>
<td>8 ± 10, 4 [0–34]</td>
<td>6 ± 6, 5 [0–15]</td>
<td>ns</td>
</tr>
<tr>
<td>Length of ICU stay (days) 28 ± 29, 21 [2–140]</td>
<td>21 ± 19, 16 [1–79]</td>
<td>ns</td>
<td></td>
</tr>
</tbody>
</table>

Data in mean ± S.D., medians [ranges]. BMI: body mass index; ABSI: abbreviated burn severity index; SAPS: Simplified Acute Physiology Score.

Economic assessment. Cost data were retrieved from the analytic accounting system, which singled out the direct cost for one ICU day (€1740) and a standard hospital ward (€440) as well as the cost of 1 anaesthesia session of 70 min for dressing change (€500). The wages of the hypnosis nurse amounted to €74,660 for a full time employment (FTE) in the ICU and €69,325 in the standard ward.

Statistics. Data were prospectively recorded in the computerized information system. Data are provided as mean ± S.D., median and range. Comparison of baseline continuous variables between groups was carried out with one-way ANOVA, and non-parametric variables with χ² tests (e.g. opioid rotation), or Wilcoxon test (VAS levels). Two-way ANOVA was used to analyse evolution of opioid dose delivery over time. The assessor was MMB, who received blinded files that had been constituted by MD. MMB was blinded to the grouping at the time of statistical outwork: the code was broken thereafter. Significance was considered at p level <0.05, while trends were considered up to p = 0.20. Statistical package was JMP® Version 5.5., SAS Institute Inc., Cary, NC, USA.

3. Results

During the study period, 40 patients were admitted (Fig. 2). Seventeen patients met exclusion criteria: 15 patients had early exclusion criteria, while 2 elderly patients developed delirium and were unable to enter hypnosis sessions. The 23
was institutionalized, and one refused to participate. Four patients were lost to follow-up (four moved to another country, one groups. All the patients were discharged alive: six patients second degree burns not requiring surgery was similar in both groups. The proportion of patients with age, gender ratio, burned body surface, inhalation injury were analyzed during 1381 days including 939 ICU treatment days. The mean lengths of ICU and hospital stays were not significantly shorter in the intervention group. Intestinal complications. The mean lengths of ICU and painful procedures between groups. The times to first bowel movement (5 [2–11] days in historical controls versus 4 [1–8] days in intervention group) were unchanged as they generally occurred before hypnosis treatment could be introduced. Importantly, the larger doses of opioids were not associated with more intestinal complications. The mean lengths of ICU and hospital stays were not significantly shorter in the intervention group.

Hypnosis. The first session could be carried out on a median of 9 days after injury (range 0–20 days), eight patients having their first session on admission day. A median of three sessions of training per patient were required to enable facing painful procedures. A hypnotic trance level was achieved after a median of 15 min.

Pain intensity. The mean VAS daily score was significantly reduced in the intervention group from 3.7 ± 2.5 ± 1.2 ± 1.5 points (p < 0.0001); drowsiness was reduced from 3.9 ± 2.85 to 2.7 ± 2.3 points (p < 0.014); pain (VAS) was reduced from 2.5 ± 2.6 to 0.9 ± 1.4 points, p < 0.0001; nausea and lack of appetite were unchanged. The amount of psychiatric inter-ventions was lower in the intervention group with 2 ± 5 versus 6 ± 8 (p = 0.07).

Opioid requirements. During the first 10 days, mean daily opioid doses were significantly higher in the intervention group compared with historical controls (p < 0.0001). Within the intervention group the overall opioid delivery was higher in those patients who could not benefit from early hypnosis (n = 15) compared with those benefiting from hypnosis on admission, without any detectable side effects (Fig. 4). Thereafter, the doses of opioids required for pain control were significantly reduced. Between days 10 and 15 (gap in Fig. 4), the doses of opioids declined in both groups and in most patients, as the result of pain decreasing after the first surgeries and wound healing. This decrease of opioid delivery

**Table 3 – Opioid and sedative requirements for the painful procedures.**

<table>
<thead>
<tr>
<th></th>
<th>Historical (n = 23)</th>
<th>Intervention (n = 23)</th>
<th>p (^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypnosis sessions</td>
<td>–</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Time to first session (day)</td>
<td>– 8 ± 7, 9 [0–20]</td>
<td>8 ± 7, 9 [0–20]</td>
<td></td>
</tr>
<tr>
<td>Procedures in the ICU (n)</td>
<td>150</td>
<td>171</td>
<td>ns</td>
</tr>
<tr>
<td>With anaesthesia</td>
<td>142 (95%)</td>
<td>127 (74%)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Duration (min)</td>
<td>140 ± 72, 120 [25–425]</td>
<td>127 ± 76, 75 [35–405]</td>
<td>0.053</td>
</tr>
<tr>
<td>Fentanyl requirement (mg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before hypnosis</td>
<td>565 ± 340, 500</td>
<td>470 ± 240, 500</td>
<td>ns</td>
</tr>
<tr>
<td>With hypnosis</td>
<td>– 80 ± 65, 75</td>
<td>80 ± 65, 75</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Propofol requirement (mg)</td>
<td>380 ± 340, 240</td>
<td>0</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>ESAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before hypnosis</td>
<td>– 22 ± 15, 20 [0–62]</td>
<td>22 ± 15, 20 [0–62]</td>
<td></td>
</tr>
<tr>
<td>After hypnosis</td>
<td>– 13 ± 11, 8 [0–48]</td>
<td>13 ± 11, 8 [0–48]</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>


\(^{1}\) Refers to a difference “within” the hypnosis group: i.e. before and after the hypnosis session.

**Fig. 3 – Daily VAS pain score during the first 40 days: there was a significant reduction of mean VAS score in the intervention group.**
was very small in the eight intervention patients having benefited from early hypnosis sessions, as their opioid requirements were low from the start. After day 15, the mean daily non-procedural and procedural opioid doses remained significantly lower in the intervention group (p = 0.001). Procedural opioid and sedative requirements were similar in both groups before hypnosis introduction. In the intervention group, the procedural opioid (fentanyl) and sedative (propofol) requirements were strongly reduced after introduction of hypnosis (p < 0.0001) (Table 3).

Opioid rotation was carried out in 13 patients, once per patient as a median (0.8 ± 0.7 rotations, range 0–2) in the intervention group, versus in only 5 patients in the historical group (0.2 ± 0.4 rotations, range: 0; p = 0.004; p = 0.018 for the number of patients benefiting from rotation in both periods). The first opioid rotation was carried out between days 3 and 14 (mean after 7.8 ± 3.4 days). Recorded reasons for opioid rotation were increasing doses of opioids (doses >140 mg morphine per day) with unsatisfactory analgesia (i.e. a VAS > 4), or oversedation.

Patient questionnaires were available in 21/23 patients in the hypnosis and 19/23 in the historical patients: procedures were perceived as agreeable in 12/21 in hypnosis versus 0/18 in control (p < 0.0001), the patients felt comfortable in 19/21 in hypnosis versus 1/18 in control (p < 0.0001), the patients experienced a fair comfort after the procedure in 13/21 in hypnosis versus 0/18 in control (p < 0.001), maximum intensity of pain was considered unbearable 0/21 in hypnosis versus 7/18 in control (p = 0.001), while the procedure was anxiety generating in 0/21 in hypnosis versus 15/18 in control (p = 0.02). The number of psychiatric consultations during the ICU stay was reduced from 5.6 to 2.1 per patient (p = 0.07).

4. Discussion

The present study shows that a protocol in pain management including hypnosis reduced patient anxiety and exposure to pain, increased early opioid delivery, and decreased general anaesthesia requirements, hospital length of stay and costs.

In pain management, larger doses of opioids were delivered in response to increasing VAS scores during the first days after admission, followed by significantly lower doses after the introduction of hypnosis. The patients’ pain intensity assessment according to the VAS was lower throughout in the Intervention group, reflecting the combined benefit of more liberal and adequate opioid delivery and hypnosis. The better pain control was associated with improved clinical course as reflected by lower surgical grafting requirements, lower number of procedures under anaesthesia, and less frequent interventions of the psychiatric team.

This is to our knowledge the first hypnosis study conducted in an ICU in which attending physicians frequently have a limited training in the treatment of severe pain. A target of VAS < 4, and the daily scores are easily visualized on the computer system, with the simultaneous visualization of the total daily opioid dose facilitated analgesic prescription and adaptation. Pain level change has become “measurable and quantifiable” based on this visualization of the variables required for pain control (Fig. 1). This has reduced subjectivity, and enabled immediate decisions about analgesia and sedation by the multidisciplinary team (intensive care, anaesthesia, plastic surgery, psychiatry). The awareness of the pain issue resulted in a significant increase of the doses of opioids delivered during the first 10–15 days after admission to the ICU. These higher doses did not increase the incidence of side effects, probably due to the introduction of systematic monitoring and of opioid rotation: the latter was used as a
median once in the Intervention group. This can be considered a success, and reflects awareness to potential side effects of high doses of opioids [23].

Hypnosis is a state of consciousness highly accessible to suggestions. Both intensity and unpleasantness of the noxious stimuli are reduced by suggestions during the hypnotic state [30,31]. Although the neural mechanisms remain unclear, recent studies support the involvements of the anterior cingulate cortex and primary somatosensory cortex (S1) in affective and sensory aspects of pain perception, respectively. Pain, and particularly burns, causes stress with intense physiological responses, including sympathetic activation with catecholamine release, release of stress hormones, alteration of immune function, and behavioural changes [32,33]. The factors modulating the different components of this response are many, and despite a clear cut reduction of pain levels and opioid requirements, we could not detect any significant change of either heart rate or blood pressure [18], in accordance with previous research showing that physiological parameters are not good outcome markers in pain assessment [8].

Anxiety before the procedures was frequently recorded in the historical controls: we therefore attempted to quantify this symptom. The ESAS was chosen for assessment of anxiety as a result of the collaboration with the palliative care team: it provides a 10-point scale for each symptom. The intervention patients expressed less anxiety before the procedures, considering even the hydrotherapies as agreeable – this strongly contrasted with the experience of the control patients, whose anxiety before the procedures was enormous despite anaesthesia: clearly the acute stress disorder was reduced. Obviously, hypnosis had a strong impact. The present study will be followed by a prolonged psychiatric follow-up investigating the impact on depression and symptoms of post-traumatic stress disorders which is reported in 29% of burn patients 1 year after the accident [34].

Wound healing was improved in the intervention group as reflected by the lower grafting requirements. This may be accounted for by lower stress levels as shown in a study 47 reflected by the lower grafting requirements. This may be accounted for by lower stress levels as shown in a study 47, including a grant from the Institutional Quality Improvement Commission (CHUV), and a grant from the Fondation pour la Recherche en Soins Intensifs – Lausanne.

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Conflict of interest statement

None to declare.
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