Comparison between the Comfort and Hartwig sedation scales in pediatric patients undergoing mechanical lung ventilation

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INTRODUCTION

One of the most important goals in the treatment within pediatric intensive care units (PICUs) is the management of pain and distress in children receiving artificial ventilation. Controlled studies have demonstrated reduced morbidity and mortality rates in patients when adequate analgesia is provided. To maintain low levels of stress, pain and fear, these patients require special attention from nursing staff and parents, but additional pharmacological treatment is also necessary. Therefore PICU staff routinely attempt to control distress by administering sedatives and analgesics, and/or managing the social and physical environment. However, to determine the effect of sedation, many sedation-score scales have been developed in order to reduce the subjective impressions, which lead to wide individual variation in evaluation among the clinical staff.

The Comfort scale is based around eight behavioral and physiological parameters developed from literature reviews and surveys among experienced PICU nurses. This empirical scale is a reliable and valid method for assessing children’s distress and it is non-intrusive, multidimensional, suitable for
continuous observation, and it may include variables that remain variable in the face of the continuously changing state of the patient's disease.

The Hartwig scale is a less complex sedation score based on five behavioral criteria. This is another empirical scale developed from surveys among experienced PICU nurses. It was devised to quantify the effect of sedation during routine procedures such as tracheal aspiration and its validity and reliability in the clinical assessment of the degree of sedation in patient populations has already been demonstrated.

We performed a prospective trial comparing these two sedation scales in pediatric patients undergoing mechanical ventilation.

**METHODS**

**Study population.** The study was conducted during an 11-month period from March 1995 to January 1996 in the PICU at Hospital do Servidor Público Municipal (HSPM) in São Paulo, Brazil. To evaluate agreement between these two sedation scales we performed simultaneous and independent ratings conducted by specialist pediatric intensive care physicians using the American Comfort scale (Fig 1) and the European Hartwig scale (Fig 2) in pediatric patients undergoing mechanical ventilation.

**Inclusion criteria.** a) age < 18 years; b) mechanically ventilated patients receiving intermittent mandatory ventilation or continuous positive airway pressure; c) patients with endotracheal intubation or with a tracheostomy in place. Each patient was sedated by the managing physician using opiates, benzodiazepines, barbiturates, or a combination of these medications. All patients had continuous cardiorespiratory monitoring, and blood pressure monitoring via an inserted arterial catheter.

**Exclusion criteria.** a) head injury; b) ischemic encephalopathy; c) stroke; d) mental dysfunction; e) multiple trauma within 72 hours of the study; f) abnormalities of muscle function;

**Figure 1.** The COMFORT scale is a one point was given for the highest and 5 points for the lowest rate of sedation (range from 8 to 40 points). We considered sedation as excessive in the range 8 to 16, adequate (17 to 26) or insufficient (27 to 40).

**Figure 2.** The Hartwig scale is a one point was given for the highest and 5 points for the lowest rate of sedation (ranging from 8 to 25 points). We considered sedation as excessive in the range 8 to 14, adequate (15 to 18) or insufficient (19 to 25).
g) neuromuscular blockage; h) chronic cough. The exclusion criteria were selected to ensure that normal neurologic responses were being assessed, thus avoiding misunderstanding of items assessed by these two sedation scales (such as muscle tone or response to the ventilator), and to reduce the likelihood of distress due to uncontrolled pain.

Data collection and definitions. Each study consisted of a 3-minute period of intensive observation of the patient in his or her pediatric ICU bed. After each observation, evaluations using Comfort scoring (ranging from 8 to 40) and Hartwig scoring (ranging from 8 to 25) were done by the specialist. We graded the sedation given by Comfort scores as follows: adequate (17 to 26 points), excessive (8 to 16 points) and insufficient (27 to 40 points). Using the Hartwig scores, the corresponding sedation grades were: adequate (15 to 18 points), excessive (8 to 14 points) and insufficient (19 to 25 points).

Statistical methods. We used the agreement rate (kappa) with unitized distribution, and p < 0.01 was considered significant.

RESULTS

This study comprised 30 observations in 18 mechanically ventilated pediatric patients aged 16 days to 5 years (mean: 16.45 months, SD 17.27; see Table 1) and the reason for PICU admission were: cardiac disease - 1 case (5.5%); neurologic disease - 1 case (5.5%); infectious disease - 7 cases (39%); respiratory disease - 9 cases (50%). The analysis of the degree of sedation in our patients obtained by applying the Comfort and Hartwig scales showed almost the same results among those with adequate sedation (Table 2).

On the Comfort scale, the mean scores for adequate, insufficient and excessive sedation were: 20.28 (SD 2.78), 27.5 (SD 0.70), and 15.1 (SD 1.10), respectively. On the Hartwig scale, the average scores for adequate, insufficient and excessive sedation were: 16.35 (SD 0.77), 20.85 (SD 1.57), and 13 (SD 0.89), respectively. The analysis of agreement between Comfort and Hartwig scores is presented in the table 2.

DISCUSSION

In recent years the administration of sedative and analgesic agents has been widely studied and such agents have been applied in the control of stress in critically ill patients, especially children. Sedation and analgesia are known to be powerful instruments providing comfort and reducing complications. The utilization of these drugs has been frequently based on subjective personal evaluation without a valid objective method of measuring the distress.

Although a number of reliable and valid

### Table 1 - Age of PICU patient at the time of observation

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants (newborn to 12 months)</td>
<td>1</td>
<td>5.5%</td>
</tr>
<tr>
<td>Toddler (from 13 to 23 months)</td>
<td>12</td>
<td>66.7%</td>
</tr>
<tr>
<td>Preschool (from 24 to 71 months)</td>
<td>5</td>
<td>27.8%</td>
</tr>
</tbody>
</table>

### Table 2 - Quality of sedation and analysis of agreement between Comfort and Hartwig scores

<table>
<thead>
<tr>
<th>Hartwig grade</th>
<th>Comfort grade</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over-sedated</td>
<td>Adequately sedated</td>
</tr>
<tr>
<td>O versedated</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Adequately sedated</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Insufficiently sedated</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>total</td>
<td>10 (33.4%)</td>
<td>18 (60.9%)</td>
</tr>
</tbody>
</table>

Observed agreement rate: 63%; p = 0.006; Expected agreement rate: 44%; Kappa coefficient: 0.345238; z = 2
methods have been developed to provide observers with a rating of behavioral and physiological indices for children's distress during hospitalization in PICUs, these scales have specific characteristics that may be questioned. Some scales have been developed from the observation of reactions during painful procedures. These scales appear inadequate for continuous observation because of the stress factor during the nociceptive stimulation procedure. In addition, other objective scales are inapplicable in pediatric intensive care units because they do not evaluate neonatal or critically ill patients.

In order to get more experience in the application of objective sedation scales and to try to validate a less complex scale with fewer variables, we made a comparison between two distinct methods.

The Comfort scale has previously been shown to be reliable and has been validated as a descriptor of behavioral and physiological distress with good results. However, its application is not easy because of the great number of variables (eight), thus rendering it not very practical. In addition to this, its applicability is questionable when used in a routine manner.

The Hartwig scale measures only behavioral variables, and therefore has an advantage because of its facility of application. The need for endotracheal aspiration is questionable due to the painfulness of this procedure, thus affecting the goal of our study on sedation. Nevertheless, this fact is minimized as it is a routine procedure done in artificially ventilated patients. Both scales were designed to be age-independent and used at any time to assess the adequacy of sedation at that point in time. For this reason repeated observations of the same patient were not excluded.

We noted that there was a low standard deviation for the means considered for the degrees of sedation on both sedation scales. When the results were analyzed, the agreement rate observed was 63%, and it was statistically significant because there was little difference between the scores in spite of the fact that we had a low n in our sample.

**CONCLUSION**

There was no statistical difference when the Comfort and Hartwig scales were applied in mechanically ventilated children, therefore allowing their use in daily clinical practice.

**REFERENCES**


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RESUMO

Contexto: É elevado o número de crianças hospitalizadas que não recebem uma sedação adequada, devido a avaliação e ao uso inadequado desses agentes. Nos últimos anos aumentou a preocupação e os conhecimentos a respeito da sedação e analgesia, de tal modo que é inaceitável hoje em dia termos uma criança sem correta avaliação de seu estado de dor e ansiedade. Objetivo: Comparar o uso de duas escalas de sedação (COMFORT e HARTWIG) em pacientes pediátricos em ventilação pulmonar mecânica. Tipo de estudo: Estudo prospectivo. Local: Unidade de cuidados intensivos pediátricos de hospital terciário. Participantes: Realizadas 30 observações, simultâneas e independentes, em 18 pacientes, por médicos especializados. Teste diagnóstico: Após observação de três minutos, aplicou-se critérios objetivos (escalas de COMFORT e HARTWIG) para avaliar a sedação. Variável estudada: Taxa de concordância (Coeficiente Kappa) onde p < 0,01 foi considerado significante. Resultados: Escala COMFORT (média e desvio padrão) para adequadamente sedado, inadequadamente sedado e muito sedado foi 20,28 ± 2,78, 27,5 ± 0,70 e 15,1 ± 1,10 respectivamente. Para a escala de HARTWIG: 16,35 ± 0,77, 20,85 ± 1,57 e 13,0 ± 0,89. Taxa de concordância observada 63% (p = 0,006), esperada de 44% com o coeficiente kappa = 0,345238 (z = 2,49). Conclusões: Em nosso estudo, não houve diferença significativa na aplicabilidade entre as escalas de COMFORT e HARTWIG em assegurar o nível de sedação em crianças submetidas a ventilação pulmonar mecânica.