Continuous rate infusion of butorphanol after colic surgery may decrease pain, stress, and weight loss during hospitalization. If clinicians look only for the "classic" signs of abdominal pain in horses (e.g., pawing, rolling, stretching, increased heart rate), more subtle signs that are more reliable indicators of postoperative pain may be missed. Authors' addresses: Department of Veterinary Clinical Sciences (Sellon) and Department of Veterinary Comparative Anatomy and Physiology (Ulibarri), College of Veterinary Medicine, Washington State University, Pullman, WA 99164; and Department of Animal Health and Resource Management (Roberts) and Department of Clinical Sciences (Blikslager), College of Veterinary Medicine, North Carolina State University, Raleigh, NC 27606. © 2002 AAEP.

1. Introduction

Most equine veterinarians are adept at identification of behavioral and physiological indicators of abdominal pain (colic) in horses. Behaviors such as pawing, rolling, and flank gestures are universally recognized as indicators of pain. A failure of these types of pain behaviors to resolve with prudent analgesic therapy is often an indicator of the need for exploratory celiotomy to identify and correct the cause of the pain. After abdominal surgery, pain may continue as a result of smooth muscle spasm; ischemia; inflammation; and tension, stretching, or twisting of viscera, peritoneum, or mesentery. Most equine clinicians administer only flunixin meglumine (a nonsteroidal anti-inflammatory drug) as a postoperative analgesic after colic surgery. They monitor horses for the classic signs of abdominal pain (pawing, rolling, flank gestures, etc.) and for increases in heart rate as indicators of pain. In other domestic animal species, an increase in heart rate is not a reliable indicator of pain after abdominal surgery, and behavioral signs of pain in these animals are more subtle than previously thought.¹⁻⁴ In a preliminary study, we determined that horses undergoing surgery have significantly higher plasma cortisol concentrations and heart rates and significantly different behavior compared with normal horses or horses anesthetized for non-painful procedures.⁵ We hypothesized that decreased locomotion, postural changes, and decreased responsiveness to human interactions are the most reliable indicators of postoperative pain in horses undergoing colic surgery and that continuous rate intravenous infusion (CRI) of butorphanol⁶ to horses in the

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first 24 h after colic surgery would ameliorate the pain associated with recovery from exploratory celiotomy.

2. Materials and Methods

Thirty-one horses undergoing exploratory surgery for diagnosis and treatment of abdominal pain were included in a randomized, blinded study of the effects of butorphanol administered by CRI in postoperative horses. Informed owner consent was obtained before inclusion of any horse in the study. All horses received flunixin meglumine at 1.1 mg/kg IV 12 h after surgery. Horses in the Treatment group (n = 16) received butorphanol at approximately 13 μg/kg/h IV diluted in lactated Ringer’s solution (LRS) beginning immediately after surgery. Control horses (n = 15) received LRS without butorphanol. Physiological parameters, including heart rate, respiratory rate, and plasma cortisol concentrations, were determined at 0, 2, 4, 8, 12, 16, 20, and 24 h after surgery. A visual pain score (VPS) was calculated after the observer assigns a numeric score to each behavior category based on a descriptive definition of the horse’s behavior category. The VPS is calculated as the sum of the scores assigned for each behavior category. The 24-h VPS is calculated as a sum of the VPS from each time point in the first 24 h after surgery.

Variables were considered significant when p < 0.05.

3. Results

There were no significant differences between the Treatment and Control groups with respect to age, gender, type of lesion, duration of anesthesia, or type and quantity of drugs administered while under anesthesia. Clinical pathological parameters indicative of severity of endotoxemia and cardiovascular status before surgery (packed cell volume (PCV), white blood cell count, neutrophil count, and serum glucose, creatinine, and albumin concentrations) did not differ significantly between groups. One horse in the Treatment group was discharged from the hospital early at the owner’s request. One horse in the Treatment group and three horses in the Control group died or were euthanized because of complications after surgery.

Heart rate and respiratory rate did not differ between the two groups of horses at any time point. Plasma cortisol concentration was significantly decreased in Treatment horses compared with Control horses at 2, 4, 8, 12, and 24 h. Treatment horses lost significantly less weight during hospitalization than did Control horses. Treatment horses lost 2.75 ± 2.89% of their body weight compared with 6.05 ± 3.20% for Control horses. There was a trend for Treatment horses to have a shorter duration of hospitalization than Control horses (8.7 ± 2.7 and 11.2 ± 4.1 days, respectively), but this did not reach significance (p = 0.07). Treatment horses had a median final bill that was approximately $1000 less than Control horses, but this difference was not significant (p = 0.11). The total 24-h VPS was significantly different for Treatment horses than for Control horses.

Table 1. The Visual Pain Scale (VPS)

<table>
<thead>
<tr>
<th>Behavior Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross pain behaviors*</td>
<td>None</td>
<td>Occasional</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Head position</td>
<td>Above withers</td>
<td>At withers, slightly back, little movement</td>
<td>Below withers</td>
<td></td>
</tr>
<tr>
<td>Ear position</td>
<td>Forward, frequent movement</td>
<td>Standing in middle, facing stall door</td>
<td>Standing in middle, facing back of stall</td>
<td></td>
</tr>
<tr>
<td>Location in stall</td>
<td>At door watching environment</td>
<td>Standing in middle, facing stall door</td>
<td>Standing in middle, facing sides of stall</td>
<td></td>
</tr>
<tr>
<td>Spontaneous locomotion</td>
<td>Moves freely</td>
<td>Occasional steps</td>
<td>No movement</td>
<td></td>
</tr>
<tr>
<td>Response to open door</td>
<td>Moves to door</td>
<td>Looks at door</td>
<td>No response</td>
<td></td>
</tr>
<tr>
<td>Response to approach</td>
<td>Move to observer, ears forward</td>
<td>Looks at observer, ears forward</td>
<td>Does not move, ears back</td>
<td></td>
</tr>
<tr>
<td>Lifting feet</td>
<td>Freely lift feet when asked</td>
<td>Lift feet after mild encouragement</td>
<td>Extremely unwilling to lift feet</td>
<td></td>
</tr>
<tr>
<td>Response to grain</td>
<td>Moves to door and reaches for grain</td>
<td>Lift feet when encouraged</td>
<td>No response</td>
<td></td>
</tr>
</tbody>
</table>

*Gross pain behaviors include pawing, sweating, looking at the flank, curling the upper lip, and lying down/standing up repeatedly.

VPS is calculated after the observer assigns a numeric score to each behavior category based on a descriptive definition of the horse’s behavior as specified in each column. The VPS is the sum of the scores assigned for each behavior category. The 24-h VPS is calculated as a sum of the VPS from each time point in the first 24 h after surgery.
Control horses, with Treatment horses scoring lower (closer to scores of normal, non-painful horses). Elapsed time for the first passage of feces after surgery was longer in Treatment horses than for Control horses (median time 10 h versus median time 4 h, respectively), although this difference did not reach significance ($p = 0.059$).

4. Discussion

Administration of butorphanol by CRI to horses for 24 h after colic surgery improved recovery characteristics of those horses compared with horses that received only standard doses of flunixin meglumine. These results are similar to findings reported in studies of postoperative analgesia in other species. Clinicians frequently refer to heart rate as an indicator of postoperative pain; however, heart rate did not differ between treated and control horses. This may be attributable to the influence of various other factors on cardiovascular status in postoperative patients (e.g., endotoxemia, hydration status, inflammation). Behavioral parameters that differed between Treatment and Control groups included postural and socialization behaviors. Control horses were more likely to stand quietly in the stall and were less responsive to human interventions compared with Treatment horses. This behavior was a more consistent indicator of postoperative pain than the traditional abdominal pain behaviors such as pawing, rolling, flank gestures, etc. Administration of butorphanol as an adjunctive analgesic agent may benefit the recovery and well-being of horses undergoing colic surgery.

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References and Footnotes


b Torbugesic; Fort Dodge Animal Health, Fort Dodge, IA 66225.