Cardiac arrest complicating neostigmine use for bowel opening in a critically ill patient

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Clinical record

A 16-year-old woman with cerebral palsy underwent an elective scoliosis repair. She had previously undergone several orthopaedic procedures without complication.

The surgical procedure and anaesthesia were uncomplicated. The patient was extubated at the end of the procedure and transferred to the intensive care unit for postoperative management, as planned. The early postoperative course was complicated by respiratory failure requiring intubation and ventilation. Bilateral pleural effusions were drained, and a pneumothorax was treated.

Regular paracetamol and large doses of morphine and tramadol were administered to control pain. During the first 7 days in the ICU, the patient’s bowels did not open despite management with docusate (Coloxyl), sennosides a and b (senna), Kiwi Crush digestive enhancer, glycerol (glycerine) suppositories and phosphate enemas. There was no clinical evidence of mechanical bowel obstruction. Neostigmine was administered intravenously to achieve bowel opening. This was commenced at a dose of 2.5 mg to be administered over 1 hour. Routine monitoring with electrocardiography, pulse oximetry and invasive arterial blood pressure was in use.

After 40 minutes of neostigmine administration, there was a progressive bradycardia, followed by asystole. Closed chest cardiac massage was performed for less than 1 minute before spontaneous return of circulation. No medications were given for management of the cardiac arrest, and the neostigmine infusion was discontinued. The patient’s condition remained stable after the cardiac arrest, with no further arrhythmia or haemodynamic instability.

The patient was extubated 11 days after the operation. After a period of rehabilitation, she made an uncomplicated recovery and achieved a satisfactory functional result from her surgery.

Table 1. Previous reports of bradycardia following neostigmine use among critically ill patients

<table>
<thead>
<tr>
<th>Study</th>
<th>Condition</th>
<th>Dose*</th>
<th>No. of patients</th>
<th>No. with bradycardia (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>van der Spoel et al, 2001</td>
<td>CIRCI</td>
<td>0.4–0.8 mg/hour for 24 hours</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>Abeyta et al, 2001</td>
<td>ACPO</td>
<td>2 mg “bolus”</td>
<td>10</td>
<td>1 (10%)</td>
</tr>
<tr>
<td>Loftus et al, 2002</td>
<td>ACPO</td>
<td>2 mg over 3–5 min</td>
<td>18</td>
<td>2 (11%)</td>
</tr>
<tr>
<td>Sgouros et al, 2006</td>
<td>ACPO</td>
<td>2 mg over 3–5 min</td>
<td>30</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>Turégano-Fuentes et al, 1997</td>
<td>ACPO</td>
<td>2.5 mg over 60 min</td>
<td>16</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>Mehta et al, 2006</td>
<td>ACPO</td>
<td>2 mg over 15 min</td>
<td>19</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>Trevisani et al, 2000</td>
<td>ACPO</td>
<td>2.5 mg over 2–3 min</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>Paran et al, 2000</td>
<td>ACPO</td>
<td>2.5 mg over 1 hour</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Hutchinson &amp; Griffiths, 1992</td>
<td>ACPO</td>
<td>2.5 mg over 1 min</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Rosman et al, 2008</td>
<td>Spinal cord injury</td>
<td>2 mg IM (with 0.4 mg glycopyrrolate)</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Rubiales et al, 2006</td>
<td>Constipation in advanced cancer</td>
<td>0.25–1.25 mg SC every 8 hours</td>
<td>8</td>
<td>0</td>
</tr>
</tbody>
</table>

Total: 187 patients, 8 (4%) had bradycardia.

ACPO = acute colonic pseudo-obstruction. CIRCI = critical illness-related colonic ileus. IM = intramuscular. SC = subcutaneous. * Intravenous unless otherwise indicated.

ABSTRACT

Absence of bowel opening is common among critically ill patients. Neostigmine can be used to achieve stool passage after other treatments have been ineffective. Here, we report a case of cardiac arrest complicating neostigmine use in a 16-year-old woman with cerebral palsy who was being treated in the intensive care unit after orthopaedic surgery. Bradycardia is a recognised complication of neostigmine administration; however, cardiac arrest has not been reported previously.
Discusssion

Neostigmine is a cholinesterase inhibitor that acts by increasing the concentration of acetylcholine at the neuromuscular junction, increasing gut contractions.

Neostigmine use to achieve stool passage, after other treatments have been ineffective, has been described for critically ill patients.1,2 Neostigmine is a treatment with a well-established role in the management of acute colonic pseudo-obstruction in non-ICU settings.3-10 Its use has also been described for bowel management in patients with autonomic neuropathy,11 spinal cord injury,12 advanced cancer13 and severe constipation.14 A double-blind, placebo-controlled trial examined neostigmine use for promoting defecation in critical illness-related colonic ileus.1 Here, critical illness-related colonic ileus was defined as non-passage of stools among critically ill patients with absent colonic prokinetic movements, a normally functioning upper gastrointestinal tract and no evidence of mechanical obstruction.

A variety of dosing regimens for relief of acute colonic pseudo-obstruction or critical illness-related colonic ileus are described. Adverse events associated with neostigmine use include abdominal cramps, excessive salivation, bronchospasm, sweating, nausea and vomiting, hypotension and bradycardia. The reported incidence of bradycardia ranges from zero to 11%.1,3-13 Dosing regimens and incidence of bradycardia are summarised in Table 1. Cardiac arrest has not previously been reported.

Coadministration of atropine appears not to block the muscarinic effect of neostigmine on bowel activity.15 When compared, glycopyrrolate and atropine showed similarly low efficacy in preventing neostigmine-induced colonic activity.16 This raises the question of whether coadministration of glycopyrrolate or atropine could reduce the risk of bradycardia during neostigmine administration without reducing its ability to achieve bowel opening for critically ill patients.17,18 The incidence of significant bradyarrhythmia when administering neostigmine means that cardiac monitoring is essential, and that atropine or glycopyrrolate should be immediately available for treatment of bradyarrhythmia.

Conclusion

We have reported the rare event of cardiac arrest complicating neostigmine use to achieve bowel opening in a critically ill young woman in the ICU. The dosing regimen was comparable with those described elsewhere (Table 1). Although cardiac arrest itself has not previously been described in this circumstance, symptomatic bradycardia has been reported. Further work is required to determine whether there is a role for routine administration of atropine or glycopyrrolate with neostigmine.

Competing interests

None declared.

References