transcranial Doppler (TCD), near-infrared spectroscopy (NIRS) with calculation of tissue oxygen index (TOI) and bispectral index (BIS) EEG. Four hours after admission, pupils became dilated and fixed and repeat computed tomography (CT) showed progression of the ICH deemed unsurvivable by the medical team (Fig. 1). Sedation was stopped and palliation and withdrawal of treatment was discussed with family.

Twenty-six hours after ictus, TCD showed bilateral diastolic reversal of flow in all basal cerebral arteries, including the basilar artery. Simultaneously, the unprocessed EEG obtained on the BIS monitor was isoelectric. In patients with abolished brain stem reflexes, these TCD and BIS findings would independently be considered to be ‘confirmatory’ of death with a reported specificity of 100%. NIRS also demonstrated a marked reduction in cortical oxygenation. Despite confirmation of cerebral circulatory arrest and cortical electrical silence, the patient was still making active respiratory efforts with flexor motor posturing.

Six hours later, multimodal monitoring documented a Cushing reflex characterized by hypertension (290/120 mm Hg) and bradycardia (Fig. 1). During that time, TCD signals remained unchanged and EEG remained isoelectric, while NIRS seemed to indicate a bilateral increase in frontal cerebral oxygenation with a reduction in right-to-left asymmetry. The patient continued to breathe spontaneously with flexor motor response. Organ support was withdrawn and the patient died shortly after.

This unusual case highlights three important points. The first is of a physiological nature. Cushing reflex has previously been interpreted as a homeostatic baroreflex which can restore cerebral blood flow (CBF) during episodes of intracranial hypertension. In this case, extreme hypertension did not result in any improvement in cerebral circulation, arguing against this interpretation and supporting the view that the Cushing reflex can be a paroxysmal pre-mortal phenomenon. The second significant observation is that NIRS monitoring can be potentially misleading during extreme haemodynamic events. Importantly, NIRS estimates blood flow at a depth of ~0.5 – 1 cm in the frontal cortex, making extrapolation to global CBF potentially erroneous. Thirdly, in the context of the absence of cerebral electrical activity and persistent cerebral circulatory arrest, the observed increase in TOI during the Cushing reflex could be interpreted as the accumulation of oxygenated blood due to obstructed venous outflow or reduced metabolic activity due to widespread cerebral ischaemia. In the absence of EEG and TCD monitors, the increase in TOI observed during extreme hypertension could have been misinterpreted as a partial restoration of CBF.

In the UK, the diagnosis of brain death in adult patients remains based on comprehensive clinical examination, the exclusion of potential confounders (including a sufficient time of observation), and confirmation of complete loss of brain stem function. The final and most important observation in this case is that ultrasonographic and EEG evidence of cerebral circulatory arrest and cortical electrical silence can coexist with active motor responses and preserved respiratory drive for many hours.

**Declaration of interest**

None declared.

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**Bladder control increases the incidence of urinary retention after epidural analgesia after paediatric orthopaedic surgery**

Editor—Epidural analgesia is an important tool in the management of acute postoperative pain in the paediatric population albeit not devoid of complications, including postoperative urinary retention (POUR). The incidence of POUR in children is reported between 17% and 70%. As nosocomial urinary infection, although less common in children than in adults, increases after catheterization, we do not routinely use urinary catheters.

We retrospectively compared the incidence of POUR in two populations of children, toilet-trained or not, following similar types of pelvic surgery, open reduction and acetabuloplasty for DDH (Group 1) and shelf operations (Group 2). This
study included 92 cases operated in our department from January 2005 to February 2011. There were significant differences in the sex distribution, age, and weight between the study groups, as to be expected due to the index diagnoses (Table 1). Two epidural infusion regimens were given, depending on anaesthetist preference. Regimen 1 was bupivacaine 0.125% and regimen 2 bupivacaine 0.15% with fentanyl 2 μg both to a maximum rate of 0.33 or 0.5 mg kg⁻¹ h⁻¹ of bupivacaine dose.

All children underwent successful epidural placement obtaining effective pain relief. However, almost one in four children complicated their immediate postoperative course with urinary retention. POUR was defined as the absence of spontaneous bladder emptying 12 h after the recorded surgical time. Once diagnosed, an indwelling catheter was inserted. It was removed the same day that the epidural perfusion was taken down, 48 h after the index procedure. Toilet-trained children had an increased incidence of POUR compared with those who did not control their bladder (43.18% vs 6.25%). Age and weight differences were also statistically significant regarding the development of POUR, but this is most likely related to the inherent characteristics of the groups studied. Conversely, gender, side, or drug used in the epidural regimen made no difference (Table 1).

Importantly, none of these children developed urinary, epidural, or surgical site infection as a complication.

Other authors have reported an increased incidence of POUR in toilet-trained children albeit not offering an explanation for their findings. Although epidural opioids have been associated with a higher rate of urinary retention, this study did not find such difference. Pelvic orthopaedic surgery is particularly affected by this complication due to nerve sharing levels of pain, epidural, and bladder function. Infants have a primitive excitatory somato-bladder reflex that becomes progressively weaker in the post-natal period. It is eventually replaced by an inhibitory perineal-to-bladder reflex and the adult form of reflex voiding. This somato-bladder reflex mechanism may be spared by the epidural analgesia justifying our findings. Consequently, toilet-trained children who have much larger bladders and mature urinary reflexes are more susceptible to POUR, although psychological reasons may play an important part as well.

The initial reluctance to routinely catheterize patients due to increased risk of bacteraemia has to be balanced against the ultimate need for a catheter, associated with increased patient discomfort and less than aseptic conditions during catheterization in the ward. Additionally, this study found no infectious complications after the use of indwelling urinary catheters in those children who required it. POUR is highly likely in the toilet-trained population after pelvic orthopaedic surgery and continuous epidural analgesia.

### Table 1 Patient and study data. Values are mean (range) for age, and mean (sd) for weight

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1</th>
<th>Group 2</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of surgery</td>
<td>Open reduction + acetabuloplasty</td>
<td>Shelf osteotomy</td>
<td></td>
</tr>
<tr>
<td>Bladder control</td>
<td>No</td>
<td>Yes</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Sex (M/F)</td>
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<td>25/19</td>
<td></td>
</tr>
<tr>
<td>Age (months)</td>
<td>18.71 (4.6–61.2)</td>
<td>56.34 (10.2–108.4)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>10.72 (2.24)</td>
<td>29.1 (11.15)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Side (R/L)</td>
<td>21/27</td>
<td>21/23</td>
<td>0.43</td>
</tr>
<tr>
<td>Epidural drugs (I/II)</td>
<td>31/17</td>
<td>28/16</td>
<td>0.54</td>
</tr>
<tr>
<td>POUR (N/Y)</td>
<td>45/3</td>
<td>25/19</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

### Harlequin syndrome after extrapleural bupivacaine infusion

Editor—We present a case of harlequin syndrome after the use of an extrapleural bupivacaine infusion post-thoracotomy.

A 76-yr-old man presented for thoracotomy and open resection of adenocarcinoma of the right upper lobe. Anaesthesia was induced with fentanyl 1.5 μg kg⁻¹, propofol 2 mg kg⁻¹, and rocuronium 600 μg kg⁻¹. A 37 Fr left-sided Broncho-Cath® endobronchial tube (Covidien-Nellcor, Boulder, CO, USA) was sited and checked before isolation of...