

# Swimming pool filter-induced transrectal evisceration in children: Australian experience

Neil R Price, S V Soundappan, Anthony L Sparnon and Danny T Cass

## Clinical records

### Patient 1

A 6-year-old boy briefly sat on an uncovered drain site in a home swimming pool. He extracted himself but his intestines could be seen prolapsing from his anus. On transfer to tertiary care from the local hospital, severe hypovolaemic shock was noted. He received aggressive fluid resuscitation and blood transfusion before undergoing an emergency laparotomy. This found a shearing injury, with complete disruption of the mesenteric vessels and a massive haemoperitoneum, but no active bleeding. A 4 cm anterior rectosigmoid tear was noted, through which 110 cm of small intestine had herniated out via the anus. This length was non-viable. The patient was left with 55 cm of small intestine, with an intact ileocaecal valve. The rest of the colon was normal, and there was no injury to the perineum. Primary closure of the rectal perforation was performed, and both ends of the small bowel were exteriorised. After the operation, the patient was managed with total parenteral nutrition, and loperamide to slow stoma output. Six weeks later, he underwent closure of the stoma. The boy's long-term growth, diet and continence are normal, although his bowel motions remain loose.

### Patient 2

A 4-year-old girl sat on a home swimming pool skimmer box and was unable to get up again. Her father broke the seal around her buttocks, and evisceration was immediately apparent. She was taken to the emergency department at a major regional centre, where she was intubated and transferred to tertiary care. A laparotomy found that 75% of the small bowel had prolapsed through a rectal perforation just above the peritoneal reflection. There was a large mesenteric tear, with avulsion of the superior mesenteric vessels. There were 120 cm of jejunum proximally and 90 cm of ileum distally that were viable. The rectal perforation just above the peritoneal reflection was repaired.

Over the next 4 days, two laparotomies were performed and non-viable bowel resected on both occasions. The patient was left with 140 cm of small bowel, an intact ileocaecal valve, and a loop sigmoid colostomy. Oral intake commenced on the 11th day, and parenteral nutrition ceased after 16 days. She was discharged after 21 days. The colostomy was closed after 14 weeks, and the girl was well at 6-month follow-up, with normal continence.

### Patient 3

A 3-year-old boy sat down on an uncovered skimmer box when he balked while preparing to jump into a pool at a motel. He was initially taken to a small regional hospital then transferred to tertiary care. At laparotomy, the small bowel, from 20 cm distal to the duodenojejunal flexure to the ileocaecal valve, was found to have been eviscerated. There was a 20 cm section of jejunum proximally that had its mesentery stripped off; this was resected and the ends stapled. The rectal perforation just above the peritoneal reflection was repaired. At a second-look laparotomy 2 days later, a further 5 cm of the distal bowel was found to be frankly necrotic, and was resected. The remaining distal bowel had marginal viability, as assessed by intraoperative pulse oximetry, but was left in situ to maximise bowel length (170 cm of small bowel). Postoperative management was complex: epoprostenol (prostacyclin) and dopamine were commenced to promote bowel perfusion. A third laparotomy showed improved perfusion and continuity was restored. The patient had a difficult postoperative course, with prolonged parenteral nutrition, sepsis and an enterocutaneous fistula. The fistula closed spontaneously, enteral feeding was established and he was discharged after a 3-month hospital stay. At 1-year follow-up, the boy was active, tolerating a full diet, continent by day, and above the 90th percentile for weight and height. His wound had healed well except for two slightly keloid areas. ♦

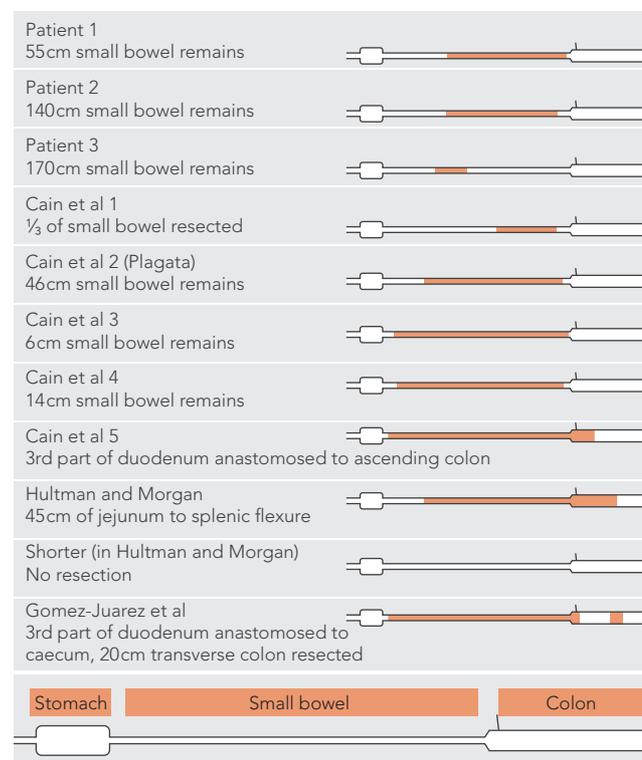
The causes of these evisceration injuries are well described in the literature. Vortex-style drains can create a powerful vacuum when occluded.<sup>1</sup> In addition to the transanal route, direct evisceration through the perineum has been described.<sup>2</sup> Other non-suction-related causes of transanal evisceration have also been described — in adults, it is usually associated with increased abdominal pressure or blunt trauma. This is a rare occurrence in adults, with only 53 reported cases.<sup>3</sup> Non-suction-related transanal evisceration in children has only recently been described in relation to accidental and self-inflicted rectal trauma.<sup>4,5</sup> The potential for penetrating trauma to cause evisceration should be considered by the astute clinician if the history or physical findings are not consistent. Associated perineal oedema and petechiae are well described with suction injuries. Entrapment in deeper water has also resulted in drowning.<sup>6</sup>

There can be a spectrum of injury associated with this mechanism, and treatment should be tailored accordingly. At the mild end of the spectrum, prolapse of the rectum can occur, which can be treated with simple reduction.<sup>7</sup> True transanal evisceration always requires operative repair and often multiple procedures.<sup>1</sup> In

the patients described here, the bowel was difficult to reduce and required gentle pressure from below with guidance via laparotomy from above. The injury to the bowel in all cases was due to the traction on the mesentery and subsequent damage to the mesenteric vessels. This is in contrast to reported cases of evisceration from penetrating injury, where the eviscerated bowel was viable and otherwise intact.<sup>4,5</sup> Patients 2 and 3 illustrate the importance of second-look laparotomy in the evaluation of bowel of questionable viability, as has been highlighted in the literature.<sup>1,6</sup> Bowel that is initially of dubious viability can later be found to have survived, thus preserving length and avoiding complications of short bowel. The use of pulse oximetry to aid in determination of bowel viability has previously been described<sup>8</sup> and was helpful in avoiding massive resection in our third patient. Prostacyclin analogues have been shown to have a beneficial effect on splanchnic perfusion in animal models and in human studies.<sup>9</sup>

There is considerable morbidity associated with this condition. The most minor form of injury can be a transient rectal mucosal prolapse with no perforation, but, even at this end of the spectrum, there is considerable psychological impact.<sup>7</sup> At the most serious

**1 Length of bowel resected\* in our three patients and eight other cases<sup>1,2,6</sup> of transrectal evisceration**



\* Length of bowel resected is represented by shaded area.

**2 "Potty" style skimmer box**



This is the location at which Patient 3 was injured. The brown structure to the left is the cover that is intended to sit over the skimmer box.

**Lessons from practice**

- Evisceration injuries caused by the suction of swimming pool drains are rare but potentially catastrophic events.
- Delayed resection can minimise the chance of short bowel syndrome in evisceration injuries.
- Although current engineering standards are adequate to prevent these kinds of injuries, education of pool owners and ultimately enforcement of legislation are required to ensure that standards are enacted.

end of the injury spectrum, short bowel syndrome can occur, with an ongoing requirement for parenteral nutrition, and potentially even death following small bowel transplant.<sup>1,2,6</sup> A 2007 review of published cases found that nine of 13 patients were dependent on parenteral nutrition.<sup>10</sup> The lengths of bowel lost through these injuries are graphically represented in Box 1. By comparison, our patients had good outcomes, with no ongoing requirement for parenteral nutrition.

There is growing literature suggesting that suction drains are not necessary for pool cleaning, and that more effective, safer alternatives are available.<sup>11,12</sup> If a suction drain is newly installed or is already in place, protective, or antivortex, covers have been advocated to minimise the suction risk.<sup>1</sup> Although these covers will prevent direct suction injuries, hair or digits could still be trapped, and the covers only offer protection when fitted correctly and not removed. Two of our patients' injuries occurred because the covers had been temporarily removed. In addition to the inherent danger of the pool suction drain, the arrangement of the drain in two of our cases made it even more inviting for a young child to sit on when uncovered (Box 2). Changing the shape, size and configuration of the aperture may therefore also prevent injury. Other potential remedies are adding an automatic cut-off switch so that the filter cannot function if the cover is off, or an override system that cuts off the filter if the intake appears to be occluded, thus limiting the peak negative pressure that can be generated.

The role of legislation with regard to education also needs to be considered. There has been a voluntary standard for swimming pool

drains in Australia since 1980, and this was updated in 2003. This document mandates that any access hole greater than 150 mm in diameter be separated from the pool edge by a solid permanent beam of at least 100 mm width and be covered by a vented lid.<sup>13</sup> The ongoing incidence of these injuries shows that this approach alone has failed to protect children. The "four Es" of injury prevention — education, engineering, enforcement and economics — have previously been described.<sup>14</sup> Rather than a voluntary standard, legislation is needed to mandate the safety of swimming pool fittings, as has been the case with pool fencing.<sup>15</sup> Enforcement of such legislation is also required to effect change.<sup>16</sup> Finally, public education has been shown to be effective in injury prevention in other areas.<sup>17</sup> These suction injuries are rare but potentially catastrophic. It is important to publicly highlight the danger of these injuries and effect change before more children are maimed.

**Competing interests**

None identified.

**Author details**

Neil R Price, MB ChB, FRACS(Paed), Surgical Registrar<sup>1</sup>  
 S V Soundappan, MS(GenSurg), MCh(PaedSurg), FRACS(Paed),  
 General and Trauma Surgeon<sup>1</sup>

Anthony L Sparnon, FRACS, General Surgeon<sup>2</sup>  
 Danny T Cass, FRACS, General and Trauma Surgeon<sup>1</sup>

<sup>1</sup> Children's Hospital at Westmead, Sydney, NSW.

<sup>2</sup> Women's and Children's Hospital, Adelaide, SA.

Correspondence: neilp@chw.edu.au

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(Received 14 Sep 2009, accepted 10 Feb 2010)

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