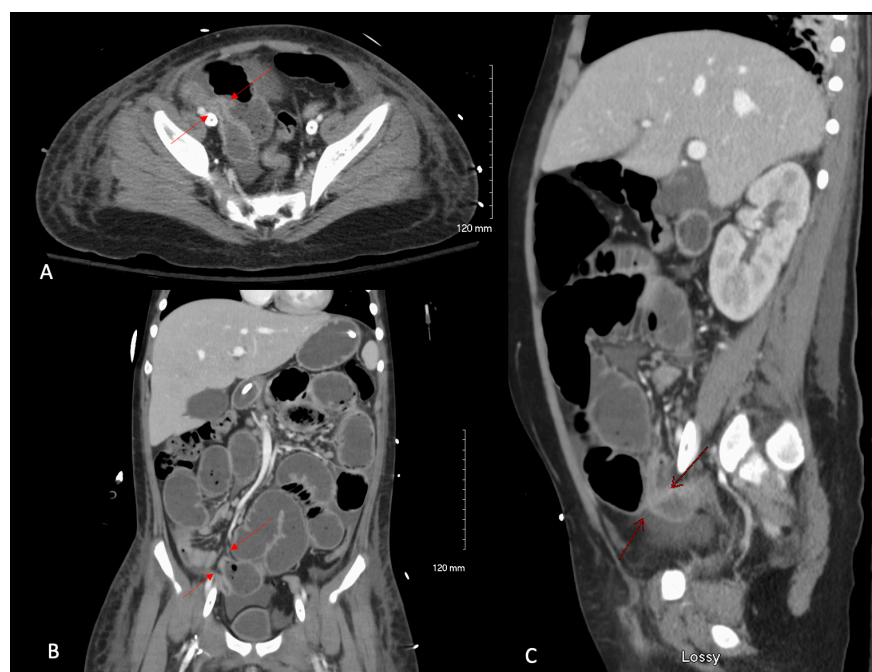


Abdominal massage alleviates a high-grade small bowel obstruction in a pediatric polytrauma patient: a case report and review of the literature

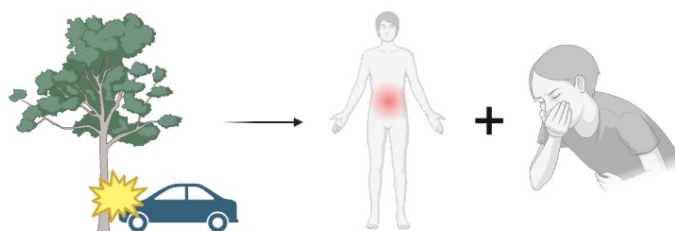
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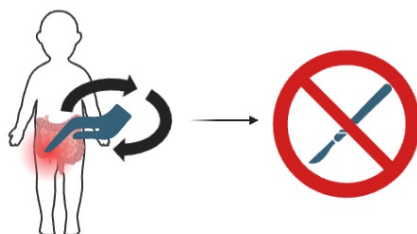
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Blunt abdominal trauma may lead to small bowel obstruction secondary to serosal injury and scar formation



Abdominal massage performed several times daily may mitigate surgical intervention in a critically ill child

Abdominal massage alleviates a high-grade small bowel obstruction in a pediatric polytrauma patient: a case report and review of the literature

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Written consent for this case report was obtained by the mother as the patient is a minor.

Critical Clinical Message (32/50 words): In selected and clinically suitable patients, abdominal massage may alleviate high-grade small bowel obstruction. This is a case report of such a case in a pediatric polytrauma patient without abdominal surgical history.

Introduction:

Intestinal injury occurs in approximately three percent of blunt abdominal traumas (1). Diagnosing intestinal injury in blunt abdominal traumas is challenging and requires a high index of suspicion, cross-sectional imaging at the time of presentation, and often serial abdominal examinations. Despite that, missed intestinal injuries or delays in diagnosis are still common. Computed tomography (CT) imaging, though the most sensitive and specific for intestinal trauma, still has a 15% false negative rate for intestinal injury in blunt trauma patients (2). Blunt abdominal trauma may result in scar tissue formation leading to eventual adhesive disease. This phenomenon has been reported in cases where patients with no abdominal surgical history underwent laparoscopy for small bowel obstruction after blunt abdominal trauma and were found to have adhesive disease (3,4). Blunt abdominal traumas can also cause bowel-wall ischemia or hematoma, which can progress to strictures.

The management of small bowel obstruction varies across institutions; however, it should be guided by the patient's clinical condition. Patients who have peritonitis or evidence of perforation should be treated with surgical intervention. Most small bowel obstructions, however, will resolve with non-operative management. Those that persist after a period, usually 48-72 hours, of bowel rest, nasogastric decompression, and intravenous hydration will likely require operative intervention to address the cause (5). In situations where there is no concern for compromised bowel, surgical intervention might be delayed if the patients are critically ill or require ongoing resuscitation. Here we present what we believe to be the first case of pediatric blunt abdominal trauma who developed a high-grade small bowel obstruction and was successfully managed non-operatively with bowel rest, gastric decompression, and manual mechanical abdominal therapy.

Case Report:

The patient is a previously healthy 6-year-old male with no prior surgical history who presented as a critical polytrauma following a motor vehicle collision (MVC). The vehicle was on fire, and the patient was trapped within the vehicle. He was intubated at the scene due to an altered mental status. Upon presentation to the trauma bay, he was noted to have 25% total body surface area full-thickness burns to his head, neck, anterior/posterior trunk, bilateral upper extremities, and bilateral lower extremities. Initial workup included CT scans of the head, neck, and face, and X-rays of the chest and pelvis, all of which were negative for injuries. Laboratory showed a leukocytosis of $28.8\text{k}/\mu\text{L}$ and elevated potassium of 5.8 mmol/L . His abdominal labs were generally within normal limits, with only a mildly elevated AST of 57 units/L . Without obvious signs of abdominal trauma, seat belt signs, or concerning abdominal laboratory values, cross-sectional imaging of the abdomen/pelvis were not performed per institutional trauma guidelines.

The patient was started on nasojejunal tube feed on hospital day 1, which he tolerated well. On hospital day 4, the patient developed ARDS in the setting of volume overload secondary to burn resuscitation and inhalational injury. His high ventilatory requirement necessitated venovenous extracorporeal membrane oxygenation (ECMO) cannulation. On hospital day 8, the patient developed high-volume stool output and abdominal distention, which prompted holding the nasojejunal tube feeds. Abdominal distention continued to progress. An abdominal X-ray was obtained, and the findings suggested an ileus or small bowel obstruction. An orogastric (OG) tube was placed while the patient was intubated and on ECMO with significant bilious output. As a result, a CT scan of the abdomen and pelvis was obtained and demonstrated diffuse distention (3.5 cm in diameter) of the proximal small bowel with a focal narrowing of the distal ileum and a decompressed terminal ileum and colon, suggesting a high-grade small bowel obstruction (Figure 1). The working hypothesis is that this obstruction was due to an unrecognized serosal injury secondary to his MVC.

Since the patient was on ECMO, and his intestines were not compromised, we opted for non-operative management of his small bowel obstruction. Management included gastric decompression via an OG tube, mechanical abdominal massage, and daily lactate levels to assess for bowel compromise. The mechanical abdominal massage, or “mechanical therapy,” involved hand-massage of the entire abdomen with a focus on the right lower quadrant, overlying the area of concern on the CT scan every nursing shift for at least 5 minutes. After five days of mechanical therapy, six days after the patient first developed obstructive symptoms, a small bowel contrast challenge with Gastrografin was performed. The result showed contrast in the colon, extending into the rectum with a non-obstructive bowel gas pattern at the 10-hour mark – indicating full resolution of the small bowel obstruction (Figure 2). The patient remained on ECMO until hospital day 12, when he was decannulated. He was treated for his severe burn and discharged on hospital day 76. His small bowel obstruction did not recur, and he did not require abdominal surgery.

Discussion:

To our knowledge, this is the first reported case of using abdominal massage to alleviate high-grade small bowel obstruction in a pediatric polytrauma patient. Previously published reports demonstrated the efficacy of mechanical therapy in critically ill patients, but none have used it as a therapeutic intervention. In studies of premature neonates in the neonatal intensive care unit, abdominal massage has been found to decrease gastric residual volume, lower the frequency of vomiting, reduce abdominal girth, and increase defecation frequency (6,7). In the adult population, randomized controlled trial data demonstrated that ICU patients had decreased gastric residual volume and decreased abdominal circumference after 20-minute massages twice a day for three days (8,9). This intervention has also

been used in post-operative patients with success. Abdominal massage reduced post-operative ileus and decreased pain in patients with recent colectomies (10). Manual abdominal therapy clearly has efficacy in stimulating gastrointestinal activity in critically ill patients and should be utilized more frequently.

Despite the previously mentioned studies demonstrating efficacy as a preventative measure to manage gastric residual volume, decrease abdominal circumference, and hasten recovery in post-colectomy patients, there are no known circumstances of abdominal massage being used as a therapeutic measure to manage a high-grade small bowel obstruction. In a rodent model, Bove et al. created localized trauma to the cecum and abdominal wall overlying the cecum. One group of rodents underwent daily massage until the necropsy, and a second group underwent massage only once immediately before the necropsy. They found a decrease in adhesive disease in the daily massage group and evidence of adhesion disruption in the group that underwent massage immediately prior to necropsy, thus offering a mechanism to the benefit of abdominal massage in adhesive small bowel disease (11,12).

Our patient likely had a mechanical small bowel obstruction secondary to a likely serosal injury from the high-energy mechanism leading to adhesion formation and subsequent mechanical obstruction or stricture from circumferential injury. Generally, mechanical small bowel obstruction is managed non-operatively with gastric decompression, bowel rest, and hydration for up to 3 days before operative management is recommended (5). However, due to the patient's critically ill status from his severe burns and being on ECMO, we decided to pursue the non-operative intervention with orogastric gastric decompression, bowel rest, and mechanical therapy. To aid our limited clinical assessment of his abdomen, lactate levels were trended, and hemodynamic stability was closely monitored. Over the course of 5 days, we continued to manage the small bowel obstruction non-operatively at least three times daily with abdominal massage as there was no concern for bowel ischemia. Surgery was still being considered if the patient had signs of bowel compromise or the bowel obstruction persisted after he was weaned off ECMO. Once his abdominal distention improved, a contrast study showed a resolution of his small bowel obstruction.

The successful non-operative management of this case suggests that abdominal massage may be added to existing modalities such as gastric decompression, bowel rest, intravenous hydration, and Gastrografin challenge. Future studies can be conducted to assess the effectiveness of adding abdominal massage to the non-operative management of small bowel obstruction.

Conclusions:

We report the first case of a high-grade small bowel obstruction in a pediatric trauma patient that resolved with manual abdominal therapy. Mechanical therapy could be considered a viable alternative option in the management of small bowel obstruction in patients who might not be appropriate surgical candidates. It could also be considered an additional therapy along with bowel rest and gastric decompression in the standard non-operative management protocol for small bowel obstructions in patients who do not have a contraindication to mechanical massage.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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Conflict of Interest Disclosure

The authors have no conflicts of interest to declare.

Ethics Approval Statement

The authors have no ethical conflicts to disclose as patient data was blinded and no identifying information was provided.

Patient Consent Statement

Written consent for this case report was obtained by the mother as the patient is a minor.

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