



Urokinase thrombolysis as a rescue treatment for midgut volvulus ischemia



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ABSTRACT

Midgut volvulus in infants may lead to extreme short bowel syndrome. Strategies to avoid post-ischemia bowel loss have been proposed, involving thrombolysis prior to a definitive surgical treatment. Haemorrhagic risks in these patients may withhold from this approach. Herein we describe the use of urokinase systemic infusion after an unsatisfactory second look laparotomy, performed in a term baby with midgut volvulus. Continuous infusion of urokinase was given for seventeen hours prior to a third laparotomy. A total of 25 cm of small bowel were finally kept in place. Twelve months after the 1st laparotomy the patient was on oral feeding 125 calories/Kg/day. This case showed the possible rescue role of a fibrinolytic agent against persistent ischemia after the second look laparotomy for neonatal volvulus.

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Midgut ischemia due to volvulus is associated to high risk of developing the short bowel syndrome. Modern neonatal surgery focuses on any surgical and medical effort to maximize the chances of preserving each fraction of bowel potentially viable. Delaying decision to resect ischemic bowel, to a second or third explorative laparotomy and avoiding stomas are accepted rules [1]. Mechanical and chemical thrombolysis has been anecdotally reported [2,3]. We herein describe the case of a newborn baby treated with systemic infusion of urokinase after an unsatisfactory second-look laparotomy for severe intestinal ischemia due to midgut volvulus.

1. Case report

1.1. Presentation

A female infant was born after 38 weeks' gestation; birth weight 3250 g via emergent caesarean section due to abnormal cardiotocography. Antenatal ultrasound showed dilated loop of bowel. At birth, distended abdomen and bilious gastric aspirate was noticed. Abdominal X-ray showed a gasless abdomen [Fig. 1].

The baby was taken to the operating room for emergency surgery.

1.2. Treatment

At laparotomy, a 720-degree midgut volvulus was found with obvious transmural ischemia of the whole small bowel [Fig. 2].

No significant improvement was seen after derotation. A Ladd procedure was performed, spontaneous tear sutured, and a second look laparotomy was planned within 24 h. At the exploratory surgery, persistent necrosis was found with uncertain viability of just 8 cm of jejunum and 6 cm of ileum. No resection was performed and rescue thrombolysis was advocated. Color Doppler ultrasound confirmed absent flow into the superior mesenteric artery. No signs of intra-abdominal or intracranial bleeding were found at the ultrasound at this stage. Urokinase systemic infusion was administered 6 h after the second look, at a rate of 4000 IU/kg/h after a bolus of 4000 IU/kg, for a total of 17 h. The third-look laparotomy, performed 60 h after the 1st, revealed an evident improvement with 15 cm of jejunum and 10 of terminal ileum clearly viable. Resection of necrotic/ischemic bowel was performed and jejuno-ileal anastomosis fashioned [Fig. 3].

Postoperative *trans*-cranial ultrasounds did not show signs of intra-cranial bleeding. The patient did not require red blood cells transfusion since the second laparotomy.

1.3. Outcome

Enteral feeding was started (12 ml/kg/day) on postoperative day

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Abbreviations

cm	Centimeters
h	Hour
hrs	Hours
IU	International Units
Kcal	Kilocalories
kg	Kilograms
PN	Parenteral nutrition
TPA	Tissue plasminogen activator
TPN	Total parenteral nutrition

11, with mother-expressed milk. After 3 days, minimal enteral feeding was gradually increased (10–20 ml/kg twice a week) if no sign of intolerance were detected accordingly to our enteral protocol in neonatal short bowel syndrome. At 3 months of life TPN was cycled (20 h per day) and infusion time gradually reduced. She did start complementary oral feeding at 6 months. When PN infusion was reduced to 12 h, the weaning protocol provided discontinuation one day per week every three weeks. Twelve months from the first operation the patient was on oral feeding for 125 kcal/kg/day and the home PN was stopped. At that point she was 8.7 kg of weight (25th centile), 74 cm of height (50th centile), head circumference 45 cm (50th centile). At the physical examination, no signs of abdominal distension were noticed.

2. Discussion

A newborn baby found at the emergency laparotomy to suffer from midgut volvulus, with uncertain viability diffuse to the whole length of the small bowel, has been traditionally treated with derotation and wait policy. Demarked areas of necrosis were resected at a second-look laparotomy performed not later than 48 h after the first [4,5]. This approach would give time to the blood flow to spontaneously restore after the removal of mechanical obstruction. The modern neonatal intensive care, and enteral and parenteral nutrition experts focused the research attention towards methods of maximising the absorbing properties of the remaining bowel and preserving liver function [6]. Surgical research aimed in the past decades mainly to possible novel techniques to refashion the residual intestine, to obtain longer contact with nutrients and preventing excessive dilation that can lead to bacterial overgrowth.

Recent studies demonstrated high chances of weaning from parenteral nutrition for most patient survived to malformative or acquired shortening of the small bowel up to length of 25 cm. Shorter bowels are still a challenge for clinicians. Patients and family might have to face all-life lasting detriment due to medicalization. Furthermore, the duration of the weaning process is variable accordingly to the residual bowel length, having 46% chances of being on PN at 5 years if remaining bowel is 25 cm long or more [7].

On the base of these evidences surgeons must consider paramount saving each possible centimetre of bowel, when treating these patients. The severity of necrosis seen at the first laparotomy, in the case herein described, led us to an early second look. This prudent approach lies on the evidences of the possible catastrophic effect reported after reperfusion of ischemic bowels [8].

Recent encouraging anecdotic experiences have been published regarding the use of thrombolysis in neonate suffering from bowel ischemia. Almost entirely recovered bowel from ischemia has been reported. The authors applied their institutions' protocol for

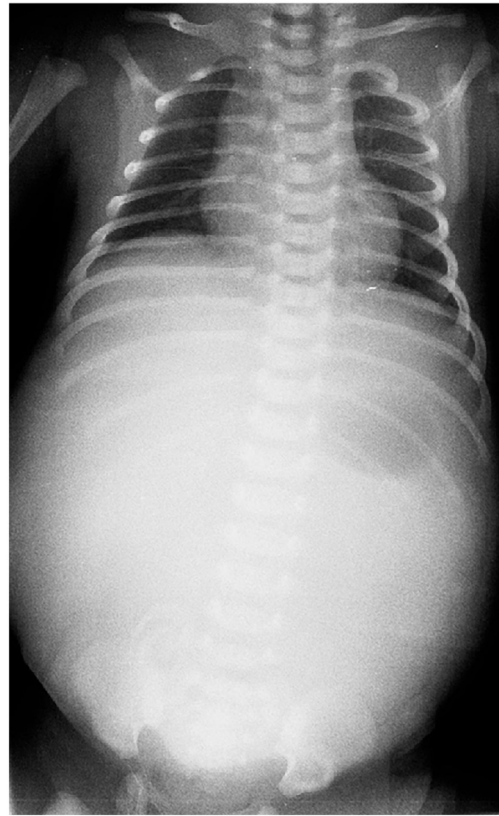


Fig. 1. Plain abdominal X-ray at birth shows gasless abdomen.



Fig. 2. Profound Ischemic small bowel found at the first laparotomy.

extreme limb ischemia. Analogously we followed our usual approach for ischemic limbs in neonate due to thromboembolisms.

The partial recovery of the bowel in our case could be referred to a less effective thrombolytic agent compared to the tissue plasminogen activator (TPA). However, we believe that the degree of damage seen at the emergency laparotomy was too profound to expect any improvement. Furthermore, urokinase carries less risk of bleeding and easier management, since plasma infusion is not required [2].

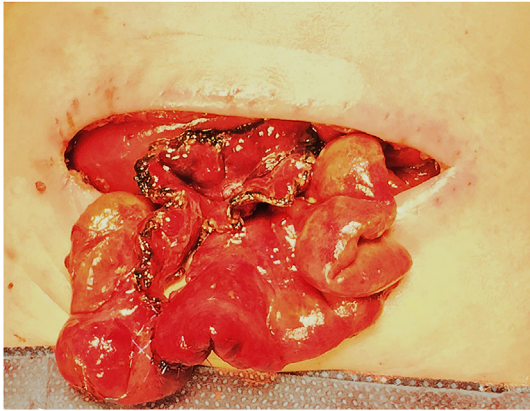


Fig. 3. Spared small bowel after resection of not-viable intestine at the third-look laparotomy.

We found noteworthy that the patient reached the nutrition autonomy in 12 months. In fact, the combination of staged surgical correction and thrombolysis, saved a total length of small bowel of 25 cm. It would be expected a flatter weaning curve according to the literature [7]. This may suggest a role of the thrombolysis in preserving the compensation capability in the spared bowel.

Another consideration deserves the antenatal finding of dilated loops of bowel. One third of foetuses with such a feature can carry surgical causes and malrotation and volvulus should be taken in consideration [9]. However, there are no evidences in the medical literature, which would suggest a preterm induction of delivery without signs of foetal suffering. The awareness of an antenatal condition in our case contributed to a fast path from the labour ward to the operative room.

3. Conclusions

This case report adds to a sparse literature some aspects. In particular, this is the first case where systemic urokinase has been used to mitigate the ischemic effects of neonatal midgut volvulus. The ischemic damage was too profound to expect a complete recovery, but the savaged bowel showed such an adaptation property, to wean the patient from PN in a year time. Similarly to what Messaoudi et al. reported, we commenced the systemic infusion of thrombolytic agent after the second unsatisfactory explorative laparotomy, confirming that the treatment can be still effective 36 h after the derotation.

This experience may further suggest being prepared to consider

thrombolysis if a neonate presents with an antenatal and perinatal history of bowel obstruction. Urokinase infusion may be a valid option carrying less risks compared with TPA.

Rare condition such as neonatal total bowel ischemia may found clinician unprepared in acute setting to face ethical implication. Protocols and detailed information for consenting parents should be readily available in tertiary centres. Experts' consensus should produce soon recommendations and consider a register of cases.

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Conflict of interest

The authors have indicated they have no potential conflicts of interest to disclose.

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