

Intestinal obstruction as a result of intra-abdominal hematoma: a complication of low molecular weight heparin in pediatric patients

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ABSTRACT

Introduction. Hematomas are a rare cause of intestinal obstruction. Subcutaneous heparin can bring about direct punctures on small bowel loops, potentially leading to traumatic hematoma and intestinal obstruction.

Case reports. We present three cases of pediatric patients with clinical signs of intestinal obstruction treated with subcutaneous heparin. Two cases had increased acute-phase reactants and radiological signs of intestinal suffering, so surgical treatment was decided upon, with intramural hematoma emerging as an intraoperative finding. The third case was conservatively managed with anticoagulant discontinuation and gut rest, since the patient had an adequate general condition and no findings compatible with ischemia or necrosis were noted in the complementary tests.

Discussion. The administration of subcutaneous heparin may cause intestinal wall hematomas due to its anticoagulating effect and to the risk of inadvertent punctures on small bowel loops.

KEY WORDS: Hematoma; Intestinal obstruction; Low molecular weight heparin (LMWH).

**OBSTRUCCIÓN INTESTINAL POR HEMATOMA
INTRAABDOMINAL: UNA COMPLICACIÓN DE LA HEPARINA DE
BAJO PESO MOLECULAR EN EL PACIENTE PEDIÁTRICO**

RESUMEN

Introducción. Los hematomas son una causa poco frecuente de obstrucción intestinal. La heparina subcutánea tiene riesgo de producir la punción directa de un asa intestinal, provocando un hematoma traumático que genere una obstrucción intestinal.

Casos clínicos. Se describen tres casos de pacientes pediátricos con clínica de obstrucción intestinal en tratamiento con heparina subcutánea. Dos casos presentaron elevación de reactantes de fase aguda y signos radiológicos de sufrimiento intestinal por lo que se optó por tratamiento quirúrgico, con el hallazgo intraoperatorio de

hematoma intramural. El tercer caso fue manejado de manera conservadora con supresión de la anticoagulación y reposo intestinal, dado el adecuado estado general y ausencia de hallazgos compatibles con isquemia o necrosis en las pruebas complementarias.

Comentarios. La administración de heparina subcutánea puede provocar la aparición de hematomas de pared intestinal, tanto por su efecto anticoagulante, como por el riesgo de punción inadvertida de un asa intestinal.

PALABRAS CLAVE: Hematoma intestinal; Obstrucción intestinal; Heparina de bajo peso molecular (HBPM).

INTRODUCTION

6% of intestinal obstructions are caused by intestinal wall hematomas, which can be spontaneous or result from trauma^(1,2). Spontaneous hematomas are associated with the use of anticoagulants and are more frequent, except in patients under 30 years of age, where closed abdominal trauma represents the underlying cause in most cases^(3,4).

Since low molecular weight heparin (LMWH) was approved in the pediatric population, it has gained traction vs. unfractionated heparin as it is easy to administer, it involves fewer complications, and it is associated with blood level stability⁽⁵⁾. However, like other anticoagulants, it has an estimated bleeding risk of 0.6% and 1.8-8% at prophylactic and therapeutic doses, respectively^(5,6). The incidence of intestinal hematomas in pediatrics has grown due to LMWH's anticoagulant effect—which has increased spontaneous hematomas—and to the risk of direct puncture on small bowel loops during subcutaneous administration—which causes traumatic hematomas^(5,7).

Given the little experience available in the management of hematoma-related intestinal obstruction in pediatrics, the diagnostic-therapeutic process extrapolates from clinical recommendations in the adult population, which are based on descriptive studies with little scientific evidence. Conservative management, which involves anticoagulant

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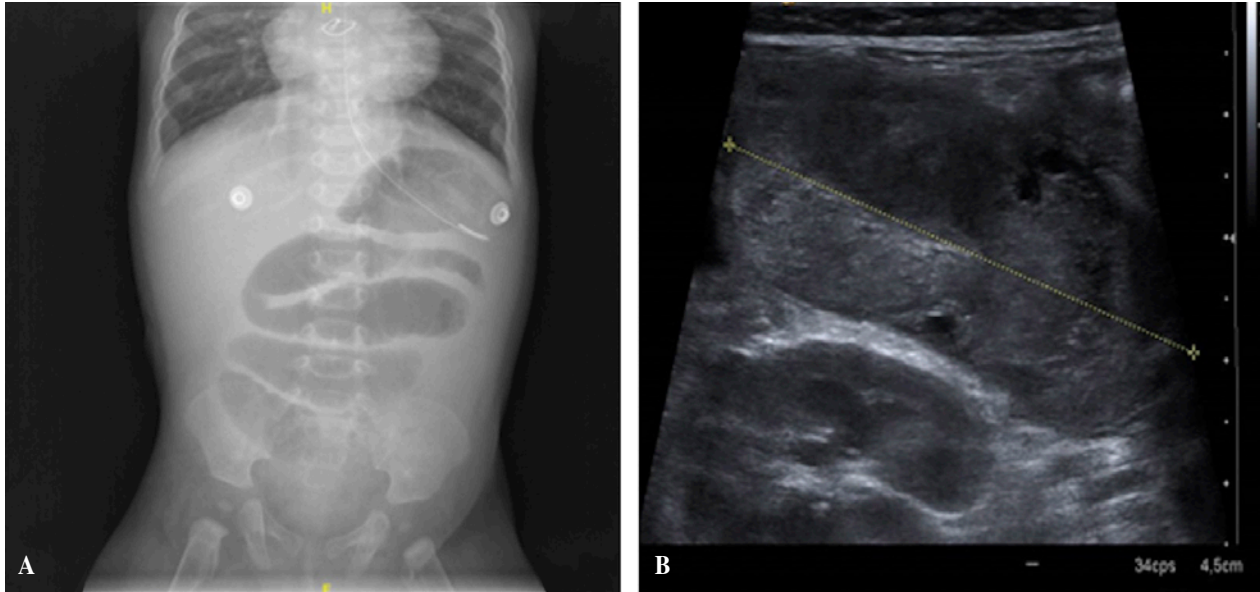


Figure 1. A) Abdominal X-ray: Intestinal obstruction with dilated proximal small bowel loops. B) Ultrasonography: 5cm diameter oval avascular injury at the right flank, with heterogeneous content inside and surrounding hyperemia.

discontinuation and gut rest, is recommended. The results are excellent, with resolution being achieved in 7-10 days on average. Surgical treatment is only advised in patients with suspected intra-abdominal active bleeding, ischemia, or peritonitis^(3,5).

In order to share our experience in the diagnosis and treatment of this pathology, we present three cases of small bowel loop wall hematoma as a result of LMWH subcutaneous administration causing intestinal obstruction in the pediatric population.

CASE REPORTS

Case 1

6-month-old infant with bile vomit and no stools. The patient had undergone Tetralogy of Fallot surgery and was receiving treatment with 8mg/12h subcutaneous (sc.) enoxaparin as a result of postoperative thrombosis. Blood tests showed $23.94 \times 10^3/\mu\text{L}$ (64% neutrophils) leukocytosis and 0.5 mmol/L lactate, whereas imaging tests revealed dilated small bowel loops with vascularization involvement (Fig. 1). A midline laparotomy was performed. It revealed a 7 cm jejunal hematoma completely occluding the lumen and causing loop ischemia. The ischemic segment was resected, and end-to-end anastomosis of the healthy bowel was carried out.

Case 2

9-year-old boy with abdominal pain, admitted following Kawashima procedure as a result of a congenital

cardiopathy. He was receiving prophylactic treatment for deep vein thrombosis (DVT) with 20 mg/12h sc. LMWH. At exploration, he showed pain and guarding following palpation at the right iliac fossa, with hematoma at the LMWH puncture site. Blood tests revealed a decrease in hemoglobin (Hb) levels from 18.9 to 13.4 g/dL and hematocrit levels from 58.3% to 42.2%, 43 mg/L CRP, 1.18 ng/mL PCT, $8.7 \times 10^3/\mu\text{L}$ leukocytes, 83.1% neutrophils, and 1 mmol/L lactate. At ultrasonography, a hemoperitoneum and a thickened small bowel loop wall with adequate vascularization were observed (Fig. 2). Considering the comorbidities and the absence of intestinal suffering signs, a conservative approach with complete fast, nasogastric tube, and anticoagulant discontinuation was decided upon. Progression was favorable, with clinical and blood count improvement. Serial ultrasound controls revealed progressive hemoperitoneum and hematoma reduction—from 11.5 cm to 2.4 cm at discharge—, with full resolution being achieved within one month.

Case 3

5-month-old infant with bile vomit, abdominal distension, and no stools. He had undergone aortic valvuloplasty at birth and prosthetic mitral valve replacement at the age of 3 months, so he was receiving 7 mg/12 h sc. LMWH treatment. Blood tests revealed metabolic alkalosis, with 2.1 mmol/L lactate, $13.74 \times 10^3 \mu\text{L}$ leukocytes (65.6% neutrophils), and 19 mg/L CRP. Imaging tests demonstrated the presence of dilated small bowel loops and an aperistaltic loop in the hypogastrium, with intestinal wall de-structuration (Fig. 3). Given the distorted blood count and the

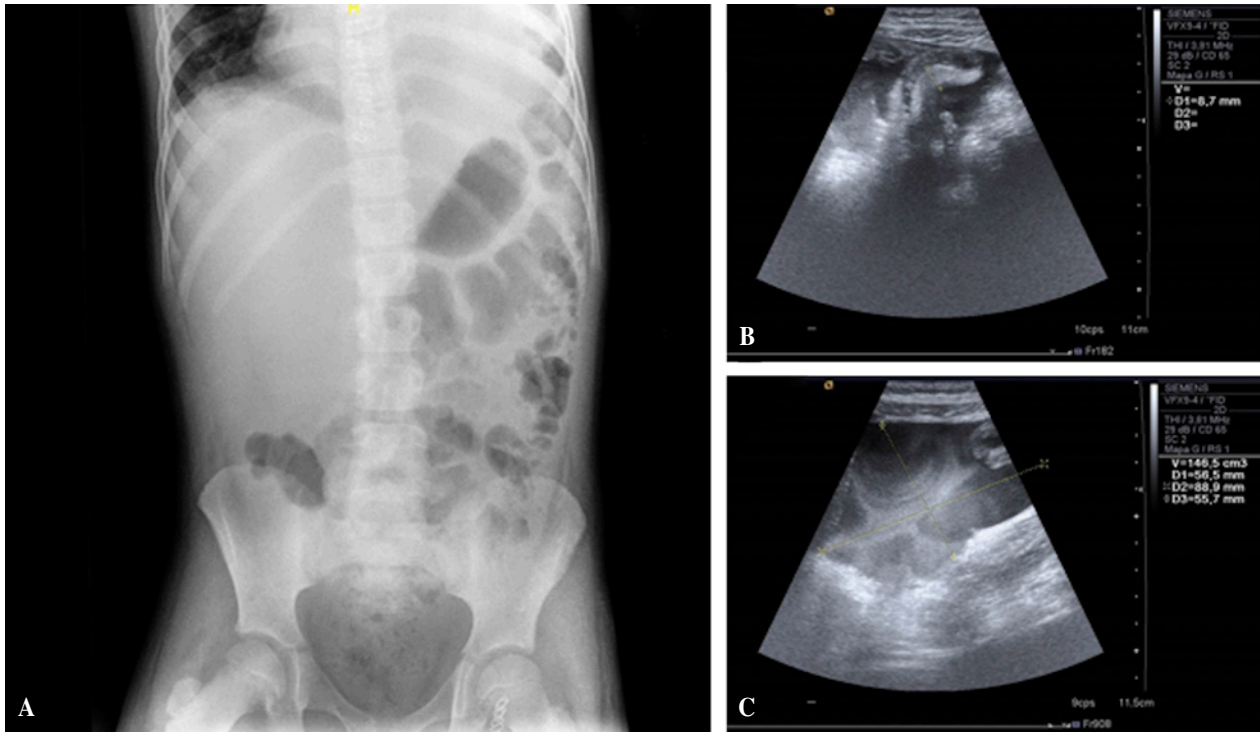


Figure 2. A) Abdominal X-ray: Increased density at the right hemiabdomen, with contralateral displacement of the bowel gas pattern. B) Ultrasonography: Fluctuating free fluid at the right paracolic gutter/peritoneal recess, underlying to the abdominal wall hematoma. C) Small bowel loop with a thickened, echogenic, 8.7mm transverse diameter wall.

ultrasound involvement, surgery was decided upon. A 15 cm intestinal wall hematoma completely occluding the lumen was observed. The loop was resected, and end-to-end anastomosis was carried out. Two hematomas –5 cm and 2 cm in size, respectively– allowing for small bowel content passage were identified and drained without resection.

DISCUSSION

Small bowel intramural hematoma was first described by McLouchlan in 1838^(1,8), but it was not until 1960 that a rise in cases associated with anticoagulation was noted⁽⁸⁻¹⁰⁾. The incidence of intestinal hematoma in adults under anticoagulants is estimated at 1 in 2,500, and an increase in risk with treatment duration has been observed^(1,6,8,9,11). Other procedures such as endoscopic and bone marrow biopsy, as well as coagulopathies and hematological neoplasias, have also been associated with intramural hematoma^(2,6,8,12).

Even though most hematomas described in patients under anticoagulation are considered to be spontaneous or non-traumatic, in our experience, patients who receive subcutaneous heparin have an increased risk of traumatic hematoma as a result of direct puncture on small bowel

loops. This complication can be related to anatomical factors inherent to pediatric patients, such as thinner panniculus adiposus, lack of adapted material to patient age or weight, and technical errors at administration. Subcutaneous devices are an increasingly popular alternative to reduce the number of punctures and the complications associated with subcutaneous administration^(13,14).

Clinical presentation is similar to other causes of intestinal obstruction. Consequently, this cause should be considered in patients with the aforementioned medical history, since it may have therapeutic implications. Blood markers can be within normal ranges at the early stages, with a subsequent increase in acute-phase reactants and lactate⁽⁹⁾. Chen et. al. studied blood markers in pediatric patients with intestinal obstruction as a result of hematoma to find conservative treatment failure predictors. Older age, leukocytosis, high levels of CRP, creatine kinase, fibrinogen, and myoglobin, and decreased troponin I might support surgical approach from baseline^(15,16). In this case series, these variables were not systematically measured, but in the three patients, a rise in acute-phase reactants was found, and in case 3, increased lactate was observed. However, in case 2, the distorted blood count was attributed to the fact the patient had just undergone surgery, since there were no signs of intestinal suffering either clinically or radiologically. In cases 1 and 3, surgical management

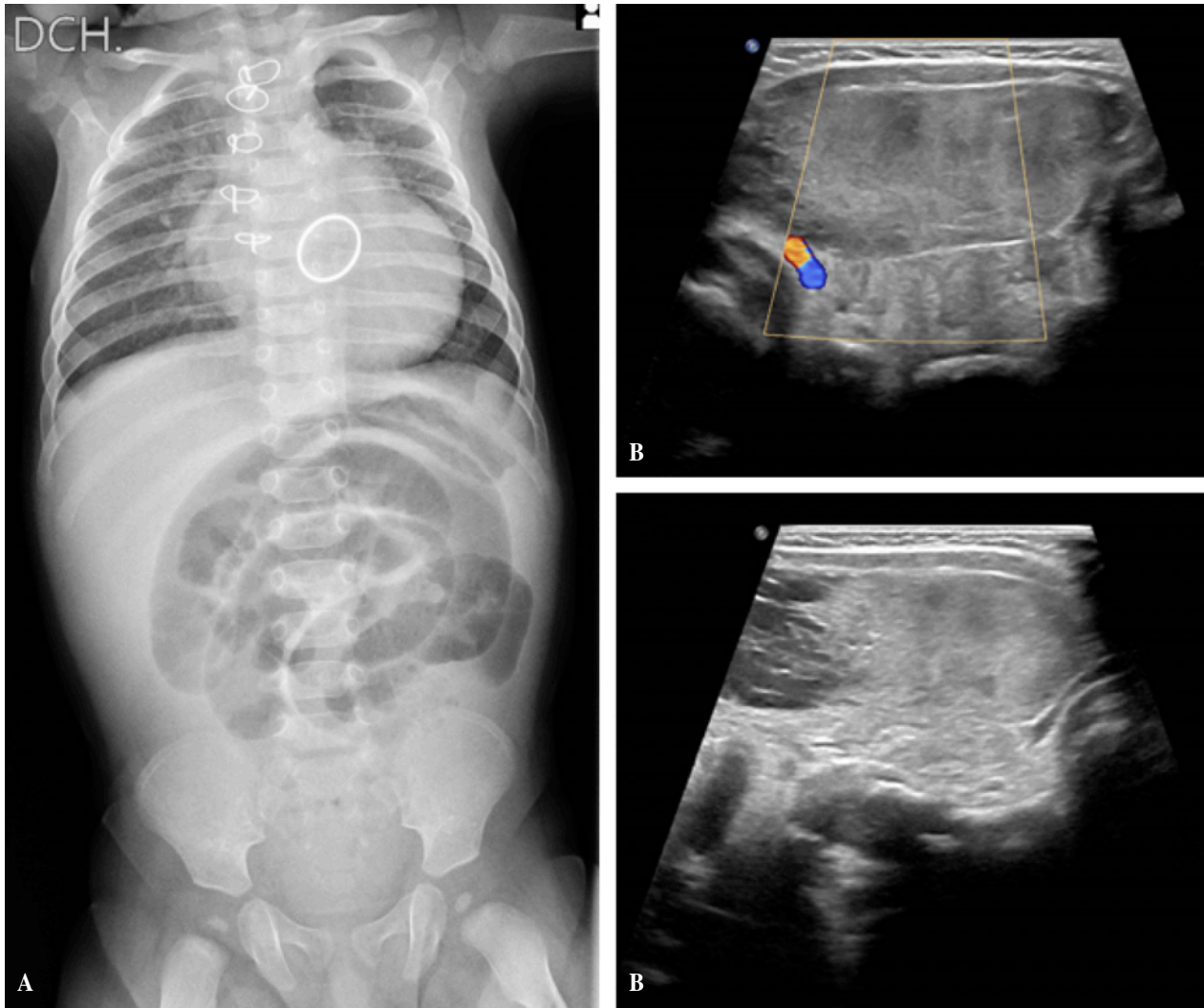


Figure 3. A) Abdominal X-ray: Dilatation of proximal small bowel loops up to 2-3 cm in diameter, with no colonic air. B) Ultrasonography: Aperistaltic loop at the hypogastrium, dilated up to 2 cm, partitioned inside, with echogenic content and signs of intestinal suffering.

was decided upon based not only on the distorted blood count, but also on the patient's general condition and ultrasound findings.

Conservative management – with anticoagulant discontinuation, gastric decompression, parenteral nutrition, and vitamin K or fresh frozen plasma – is the treatment of choice, and surgical treatment will only be considered if treatment fails or acute abdomen is suspected^(3,6,8,17-19). In patients with surgical contraindication, ultrasound-guided drainage and endoscopic balloon dilatation can stand as therapeutic alternatives^(5,16,17). Time to conservative treatment initiation has an impact on treatment success, which means early diagnosis is important. Non-contrast CT-scan is the most sensitive and specific diagnostic method⁽²⁰⁾. In pediatrics, in spite of being less specific at the early stages, ultrasonography is generally regarded as the pri-

mary imaging test. This may be related to the fact the surgical approach is usually employed in the cases published in the pediatric population^(4,19), consistent with our series, where ultimate diagnosis was achieved intraoperatively in cases 1 and 3. In case 2, the fact the hematoma was found at the exact abdominal wall site where heparin puncture had occurred raised suspicions, since the small bowel loop involved was located underlying it. This allowed for early anticoagulant discontinuation and conservative patient management.

In conclusion, subcutaneous heparin can cause intramural hematomas leading to intestinal obstruction, both as a result of trauma and of its anticoagulant effect, especially in the pediatric population. Suspicions should be high as this is a rare clinical entity where early diagnosis has an impact on conservative management success.

REFERENCES

1. Murakami Morishige, P.D, Ortiz de la Peña, JA, Valdovinos, S.T, Zolezzi, A, Castillo, J.R. Hematoma intestinal por warfarina. *Cir Esp.* 2010; 88: 188-205.
2. Sierra, A, Ecochard-Dugelay, E, Bellaïche, M, Tilea, B, Cavé, H, Viala, J. Biopsy-induced duodenal hematoma is not an infrequent complication favored by bone marrow transplantation. *J Pediatr Gastroenterol Nutr.* 2016; 63: 627-32.
3. Mahour GH, Woolley MM, Gans SL, Payne Jr VC. Duodenal hematoma in infancy and childhood. *J Pediatr Surg.* 1971; 6: 153-60.
4. Abbas A, Collins JM, Olden K. Spontaneous intramural small-bowel hematoma: imaging findings and outcome. *AJR.* 2002; 179: 1389-94.
5. López, R, Marañón R, Vázquez P. Una causa inusual de obstrucción intestinal en niños: hematoma intestinal secundario a heparina de bajo peso molecular. *An Pediatr.* 2012; 77: 427-8.
6. Altinkaya N, Parlakgümüs A, Demir S, Alkan Ö, Yildirim T. Small bowel obstruction caused by intramural hematoma secondary to warfarin therapy: A report of two cases. *Turk J Gastroenterol.* 2011; 22: 199-202.
7. Loganathan AK, Singh Bal, H. Intramural duodenal haematoma with mucosal prolapse causing intestinal obstruction. *BMJ Case Rep.* 2019; 12: e228276.
8. Sorbello M, Utiyama E, Parreira J, Birolini D, Rasslan S. Spontaneous intramural small bowel hematoma induced by anticoagulant therapy. Review and case report. *Clinics.* 2007; 62: 785-90.
9. Kang E, Han S, Chun J, Lee H, Chung H, Im J. Clinical features and outcomes in spontaneous intramural small bowel hematoma: cohort study and literature review. *Intest Res.* 2019; 17: 135-43.
10. Abbas A, Collins JM, Olden KW, Kelly K. Spontaneous intramural small-bowel hematoma: Clinical presentation and long term outcomes. *Arch Surg* 2002; 137: 306-10.
11. Schroeder RM, Kohler JE, Mak GZ, Kandel JJ. Bowel obstruction from intramural hematoma in two children treated with low molecular weight heparin: Case report and review of the literature. *J Ped Surg Case Reports.* 2014; 2: 483-5.
12. Sahn B, Anupindi S, Dadhania N, Kelsen J, Nance M, Mamula P. Duodenal hematoma following EGD: Comparison with blunt abdominal trauma-induced duodenal hematoma. *JPGN.* 2015; 60: 69-74.
13. Márquez R, Pino P, Fajuri P, Zúñiga P. Catéter subcutáneo para la administración de heparina de bajo peso molecular en pediatría. *Rev Chil Ped.* 2014; 85: 46-51.
14. Albisetti M, Andrew M. Low molecular weight heparin in children. *Eur J Pediatr.* 2002; 161: 71-7.
15. Chen W, Xiao J, Yan J, Liu R, Yang J, Xiang D, et al. Analysis of the predictors of surgical treatment and intestinal necrosis in children with intestinal obstruction. *J Pediatr Surg.* 2020; 55: 2766-71.
16. Alharbi FM, Abo Amer ZA, Hamamesh KH, Aljubaisi SN. Endoscopic dilatation as a new technique in managing pediatric duodenal hematoma. *Saudi Med J.* 2020; 41: 874-7.
17. Yang JC, Rivard DC, Morello, FP, Ostlie DJ. Successful percutaneous drainage of duodenal hematoma after blunt trauma. *J Pediatr Surg.* 2008; 43: e13-e15.
18. Izquierdo M, Pereda A, Sangüesa C, Lluna J. Hematoma intramural duodenal posbiopsia. *An Pediatr.* 2008; 68: 624-5.
19. Choi B, Koeckert M, Tomita S. Intramural bowel hematoma presenting as small bowel obstruction in a patient on low-molecular-weight heparin. *Case Rep Pediatr.* 2018; 2018: 1-3.
20. Samie AA, Theilmann L. Detection and management of spontaneous intramural small bowel hematoma secondary to anticoagulant therapy. *Expert Rev Gastroenterol Hepatol.* 2012; 6: 553-9.