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Handlebar Hernia: The Need for High Clinical Suspicion

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Background	A male adolescent presented after blunt abdominal trauma from a bicycle handlebar and was found to have a traumatic abdominal wall hernia (TAWH) that was not visualized on initial axial imaging.
Summary	Our patient presented at age 14 after losing control riding his bicycle down a hill and experiencing blunt trauma to his abdomen from the bicycle handlebar. An initial computed tomography (CT) scan revealed a pelvic sidewall hematoma without any disruption of the abdominal wall fascia. Approximately 36 hours after presentation, he was noted to have a bulge in his abdominal wall, only seen after standing and waiting 10 to 15 seconds. He was taken to the operating room and found to have a full-thickness Spigelian abdominal wall hernia, which was repaired primarily. He had no underlying intraabdominal injuries. While traumatic abdominal wall hernias have rarely been previously described, most TAWH are diagnosed via imaging. This case is unique because a CT scan of the abdomen was negative, and the diagnosis was made based on a thorough physical exam.
Conclusion	This case emphasizes the importance of not relying exclusively on imaging to make the diagnosis of TAWH, maintaining a high clinical suspicion, and performing a thorough physical exam.
Key Words	pediatric trauma; traumatic abdominal wall hernia; handlebar hernia

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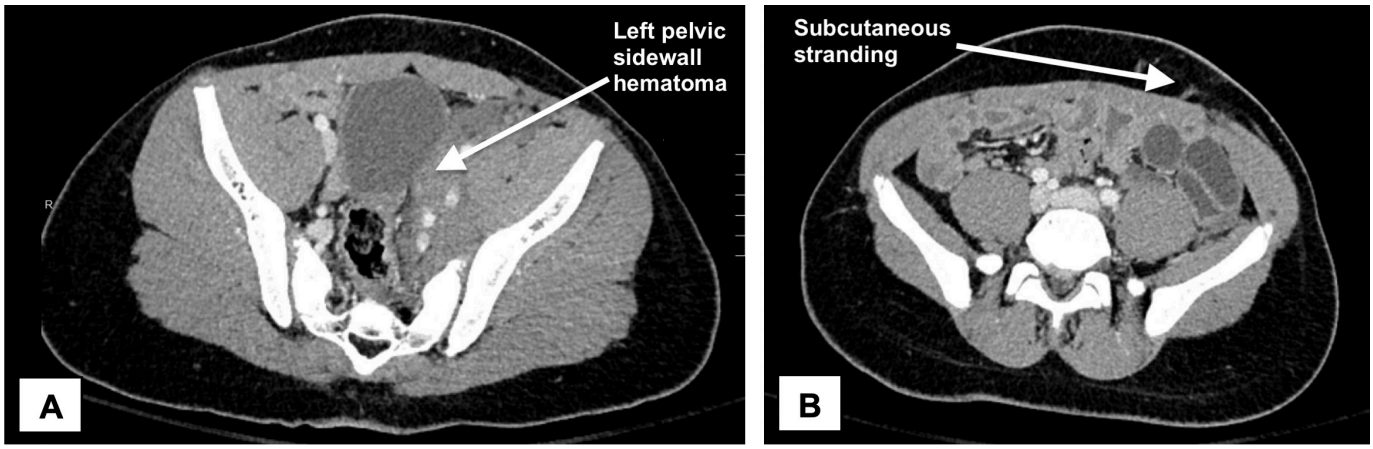
Case Description

An otherwise healthy 14-year-old male presented to the emergency department after a bicycling accident. He was riding his bicycle downhill when he lost control of the handlebars and crashed. His left hemiabdomen impacted the handlebars. He was not wearing a helmet but had no head strike or loss of consciousness. He initially presented to a community hospital where he was evaluated using the Advanced Trauma Life Support® (ATLS®) protocol and, on primary survey, was found to be tachycardic to the low 100s but normotensive. His secondary survey was significant for bruising and pain in the left lower abdomen and the suprapubic region. An extended Focused Assessment with Sonography in Trauma (FAST) exam was negative, and a computed tomography (CT) scan of the abdominal/pelvic area revealed a left pelvic sidewall hematoma (Figure 1A) as well as anterior abdominal wall subcutaneous fat stranding in the left lower quadrant at the site of his bruising (Figure 1B). Initial labs were unremarkable, with a Hgb of 12.9 and Hct of 39.2, but with a urinalysis that revealed 3+ blood. Given the pelvic hematoma and microscopic hematuria, there was a concern for possible bladder injury and that he might need pelvic embolization. He was therefore transferred to a tertiary care center for further management.

After transfer to our institution, a CT cystogram was obtained, which was negative for any evidence of bladder injury. Again, the abdominal wall appeared unremarkable. Later that evening, he was noted to have a bulge in his left lower abdominal wall that was only apparent after standing and observing for 10 to 15 seconds (Figure 2). Fascial edges were not palpable, but the bulge was soft and reducible. Given the clinical concern for abdominal wall hernia and the concern for possible underlying occult intraabdominal injury in the setting of abdominal wall impact significant enough to create an abdominal wall hernia and a pelvic hematoma, the patient was taken to the operating room for a diagnostic laparoscopy.

A diagnostic laparoscopy was performed, with a 12 mm trocar placed at the umbilicus and 5 mm trocars placed in the right lower quadrant and the left subcostal region. The abdominal viscera were inspected, and no occult injuries were identified. The pelvic sidewall hematoma was visualized, and there was a minimal amount of hemoperitoneum in the pelvis. Upon visualization of the left lower abdominal wall, a full-thickness hernia was immediately identified at the left linea semilunaris. The peritoneum and transversalis had defects, and the posterior and anterior rectus sheath had separated from the transversus abdominus aponeurosis, the internal oblique aponeurosis, and the external oblique aponeurosis. Scarpa's fascia and the subcutaneous tissue were directly visualized from the intraperitoneal space (Figure 3). Only some of the abdominal wall layers could be visualized laparoscopically; they had retracted beyond the layer beneath them (i.e., the transversus abdominus and internal oblique were not visualized until we converted to an open approach).

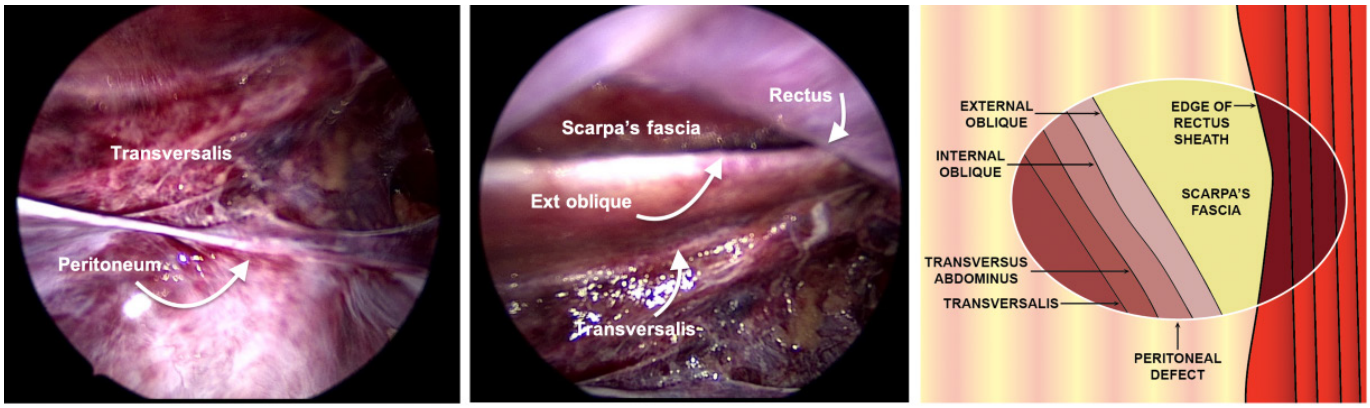
Figure 1. Initial CT Abdomen/Pelvis on Arrival to Emergency Department. Published with Permission



A) Left pelvic sidewall hematoma; and B) subcutaneous fat stranding in left lower quadrant.

Figure 2. Front and Side Views of Patient's Abdomen after Standing for 15 Seconds. Published with Permission

Figure 3. Laparoscopic View of Full-thickness Anterior Abdominal Wall Hernia and Graphic Representation of Laparoscopic View of Abdominal Wall. Published with Permission



Transversus abdominus and internal oblique were not visualized laparoscopically as they had retracted beyond our view.

Attempts were made to close the hernia primarily using intracorporeal suturing, but the fascia of the rectus sheath had retracted so far medially that it was difficult to visualize. Therefore, a left paramedian incision was made just above the fascial defect identified laparoscopically. The layers of the abdominal wall were closed in layers. The patient did well and was discharged home on postoperative day 1. The patient was seen in the clinic two weeks after discharge and was doing very well.

Discussion

Traumatic abdominal wall hernias (TAWHs) are defined as the disruption of the abdominal wall musculature and/or fascia, without skin penetration, associated with blunt trauma. These injuries can be secondary to blunt trauma; however, the term "handlebar hernia" was coined in 1980.[1] There have been several published case reports and case series of handlebar hernias in the pediatric population. Of these, the vast majority were diagnosed via abdominal

imaging. In all prior reports, patients with TAWHs who received imaging had suspicious ultrasound or CT scan findings. TAWHs can be diagnosed via ultrasound, but CT scans are being increasingly utilized to diagnose hernias and evaluate for other intraabdominal injuries.

A PubMed search for "traumatic abdominal wall hernia" or "handlebar hernia" since 1990 revealed 43 cases of TAWH caused by handlebar injuries from bicycles or motorcycles in the pediatric population (Table 1).[2–35] Of these children with "handlebar hernias," the mean age was 10.8 years. (range = 4 to 16 years) and 97.4% were male (38/39). The majority (65.7%) of handlebar TAWHs were diagnosed with CT scan (25/38),[2–5,8,12–15,17,20,21,23,24,28,29,32,34] 23.7% via abdominal ultrasound (9/38),[7,11,18,25–27,30,33,35] and only 10.5% with physical exam alone (4/38).[6,9,10,22] The majority of patients had some findings on physical exam, either ecchymosis, swelling, or bulging. All four cases diagnosed via physical exam alone had a bulge with Valsalva.[6,9,10,22] All other patients in our literature review with skin changes or swelling were evaluated further with abdominal imaging. Importantly, all patients with a TAWH who received abdominal imaging, either CT scan or ultrasound, had positive imaging findings revealing either a fascial defect or herniation of abdominal contents. The case we presented above is unique. A CT scan was done on presentation yet revealed no acute findings related to the abdominal wall, only mild subcutaneous tissue stranding. This, therefore, highlights the critical need for clinical suspicion and a thorough physical exam in patients with blunt handlebar trauma to the abdomen. The majority (94.8%, 37/39) of TAWHs occur in the lower abdomen, with only two cases revealing hernias in the upper abdomen.[11,20] This has been speculated to be due to the tension of the abdominal wall musculature between the bony prominences of the pelvis, leading to increased susceptibility to traumatic disruption in that area.[29]

When blunt trauma has enough impact to cause a traumatic abdominal wall hernia, there must also be a clinical concern for underlying intraabdominal injury, including to the bowel, mesentery, and pancreas. A recent retrospective review from a Level I pediatric trauma center revealed an overall incidence of TAWH of 0.1% following blunt abdominal trauma.[31] In this series, only 27.3% identified a hernia on physical exam, whereas 80% of hernias were visible on CT (8/10). Only two of these were related to handlebar injury. At this institution, 65% of patients with TAWHs had a concurrent intraabdominal injury requiring operative intervention, including five bowel injuries, four mesenteric injuries, and two urologic injuries.[31] In our literature review, 31.6% (12/38) of patients with a handlebar hernia had an underlying intraabdominal injury; two patients had a mesenteric disruption,[14,20] five patients had bowel hematomas,[21,28,32] and five patients had bowel perforations.[8,15,17,18,21] Additionally, one patient developed bowel incarceration within the first 24 hours after injury.[26] Almost all patients were treated operatively. Four patients were treated nonoperatively,[4,7,23,24] three patients underwent delayed open repair,[2,9,35] and the remainder were repaired immediately. One delayed repair was planned, and the other two occurred because the patients presented weeks after their traumatic injury. Of the hernias repaired immediately, 91.4% (32/35) were repaired via open technique.

Conclusion

In the setting of significant blunt abdominal trauma from a handlebar injury, we recommend obtaining an abdominal CT scan, which can be helpful for not only the diagnosis of TAWH but also the diagnosis of underlying abdominal injuries. The vast majority of TAWHs are visible on abdominal CT. A significant proportion of patients with TAWHs have concurrent underlying abdominal injuries, many of whom have suspicious findings on axial imaging. However, in the immediate period after blunt abdominal trauma, abdominal injuries may be missed on axial imaging. Therefore, any worrisome symptoms, including fever, tachycardia, leukocytosis, or worsening abdominal exam, should raise clinical concern for an underlying intraabdominal injury and consideration of diagnostic laparoscopy. Given the risk of underlying intraabdominal injury and the risk of delayed incarceration or strangulation, we believe operative intervention on TAWHs should be the standard of care. Our case report highlights that not all TAWHs are visible on imaging, and a comprehensive physical exam, including an abdominal examination while standing, is essential.

Lessons Learned

Our case presented above emphasizes the importance of not relying exclusively on imaging, maintaining a high index of clinical suspicion, and performing a thorough physical exam.

Table 1. Review of the Literature. Published with Permission

Article	Age	Gender	Diagnosis	Visceral Injury	Management
Iinuma et al. (2005)	11	M	CT	N/A	Delayed open surgery
Chen et al. (2005)	9	M	CT	N/A	Open surgery
Litton et al. (2008)	13	M	CT	N/A	Nonoperatively
So et al. (2018)	10	M	CT	N/A	Laparoscopic surgery
Mitchell et al. (2011)	14	M	Physical exam	N/A	Open surgery
Aggelidou et al. (2018)	6	M	US	N/A	Nonoperatively
Shukla et al. (2018)	15	M	CT	Perforated small bowel	Open surgery
van Bemmel et al. (2011)	7	M	Physical exam	N/A	Delayed open surgery
Perez et al. (1998)	11	M	Physical exam	N/A	Open surgery
Yegane et al. (2010)	4	M	US	N/A	Open surgery
Kubota et al. (1999)	9	M	CT	N/A	Open surgery
Mitchiner et al. (1990)	7	M	CT	N/A	Open surgery
Haimovici et al. (2007)	15	M	CT	Mesenteric disruption	Open surgery
Chew et al. (2009)	16	M	CT	Gangrenous jejunum	Open surgery
Klimek et al. (2013)	Unknown, two patients	Unknown	Unknown	N/A	Open surgery
Pederiva et al. (2016)	9	M	CT scan	Ileal perforation	Open surgery
Yaylaci et al. (2014)	11	M	US	Jejunal perforation	Open surgery
Lopez et al. (2011)	14	M	Unknown	N/A	Laparoscopic surgery
Rowell et al. (2011)	14	M	CT	Mesenteric disruption	Laparoscopic surgery
Talutis et al. (2015)	11	M	CT	None	Open surgery
	9	M	CT	Jejunal contusion	Open surgery
	7	F	CT	Ileal perforation	Open surgery
Tianyi et al. (2017)	8	M	Physical exam	N/A	Open surgery
Upasani et al. (2013)	12	M	CT	N/A	Nonoperatively
Matsu et al. (2007)	9	M	CT	N/A	Nonoperatively
Persano et al. (2014)	6	M	US	N/A	Open surgery
Vincent et al. (2018)	12	M	US	Incarcerated bowel	Open surgery
Decker et al. (2012)	13	M	US	N/A	Open surgery
Rinaldi et al. (2020)	12	M	CT	N/A	Open surgery
	13	M	CT	Sigmoid hematoma	Open surgery
Yan et al. (2011)	8	M	CT	N/A	Open surgery
Mancel et al. (2003)	7	M	US	N/A	Open surgery
Hafezi et al. (2020)	Unknown, two patients	Unknown	Unknown	Unknown	Unknown
Rathore et al. (2012)	15	M	CT	Cecal hematoma	Open surgery
	15	M	CT	Duodenal hematoma	Open surgery
	13	M	CT	N/A	Open surgery
	9	M	CT	Cecal hematoma	Open surgery
	11	M	CT	N/A	Open surgery
Schmidt et al. (2018)	15	M	US	N/A	Open surgery
Goliath et al. (2004)	11	M	US	N/A	Open surgery
Thakur et al. (2013)	9	M	US	N/A	Delayed open surgery

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