Case report

Handlebar sign: a bruise with underlying visceral injury

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SUMMARY

A 14-year-old boy presented with a painful swelling topped by a bruise overlying the skin of the right inguinal region without peritonitis. This was the area of impact of bicycle handlebar while riding 6 days ago. On contrast-enhanced CT scan, we found a traumatic abdominal wall hernia (handlebar hernia) near the right deep ring without any solid organ, bowel or urinary bladder injury. Inguinal exploration revealed a defect in transversus abdominis and internal oblique muscle which was repaired and meshplasty was done. Delayed presentation and ignorance towards 'handlebar sign' is associated with visceral injury (haematoma/perforation) will incur the risk of rising morbidity and mortality. With CT scan we can assess the abdominal cavity to rule out associated visceral or vascular injury. Surgical repair for restoring disrupted anatomy with or without meshplasty is the preferred approach.

BACKGROUND

Traumatic abdominal wall hernia (TAWH) is a rare entity caused by blunt abdominal trauma, which is caused by disruption of the abdominal wall musculature and fascia while the skin is intact. Handlebar hernia is a more localised type of TAWH caused by forceful impact over abdomen by perpendicular rotation of bicycle handlebar.¹ Absence of obvious signs of major trauma, haematoma or peritonitis may cause a delay in presentation and miss during the initial examination. Also, the typical handlebar sign (ecchymosis) is missed due to a lack of awareness and rarity of its incidence.² We here stress on the clinical aspect of examination and to keep high suspicion of such injuries when a history of trauma with handlebar is noted. In most of the treatment of the cases is a surgical repair to restore anatomy and resect and reconstruct devitalised tissues.

CASE PRESENTATION

A 14-year-old boy presented to the emergency department with complaint painful swelling in the right iliac fossa gradually increasing for the last 4 days he gave a history of blunt abdominal trauma with bicycle handlebar 6 days ago. There was no history of fever, vomiting or abdominal distension. Constipation and obstipation were not noted, was able to have food and defecate without any issues. Neither had he had any signs nor do symptoms while urination.

On physical examination, he had a pulse of 92/min and blood pressure of 110/78 mm Hg. We

found a globular solitary swelling over the right inguinal region and had semicircular ecchymosis over it (handlebar sign) (figure 1). The swelling was tender on palpation, partially reducible and had positive cough impulse. Rest of the abdomen was unremarkable.

INVESTIGATIONS

The focused assessment with sonography for trauma was negative. But we need to rule out bowel perforation, solid organ laceration or any vascular injury; hence, a contrast CT scan of the abdomen and pelvis was done which showed a 3 cm×2 cm defect in the right anterior abdominal wall lateral to the inguinal canal at S2-S4 vertebral level through which omentum and a small segment of the small bowel seen herniating (figure 2). There was no bowel, urinary bladder or any other solid organ injury. There was no vascular injury or any injury to the pelvic bone. There was no haematoma or collection seen in the muscular structures. Complete blood count and other initial biochemical laboratory panel were within normal limits.

DIFFERENTIAL DIAGNOSIS

Owing to the tender partially reducible swelling an obstructed or strangulated enterocele needs to be considered.

Other differentials to be considered are sliding-hernia with visceral wall like sigmoid or urinary bladder should be kept in mind.

Rarely there can be a traumatic aneurysm associated with such injuries. Rectus sheath or intramuscular haematomas.

TREATMENT

The swelling reduced when anaesthesia was induced and the inguinal region was explored. We had our first glance of the content which was omentum we reduced it back into the abdominal cavity to note a 3 cm×2 cm in transversus abdominis and internal oblique muscle (figure 3). The small bowel which was underlying the defect examined till ileocaecal junction, caecum and proximal ascending colon which were normal; no evidence of enteric contents, pus, blood or ascites noted. The peritoneal layer was ripped apart due to the traumatic blow and reperitonealisation was not seen maybe because of the contents keeping the edges apart. The defect in the muscle and fascia was closed anatomically and meshplasty was done.

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Figure 1 Handlebar sign (ecchymosis) seen near right inguinal region. Note the bruising casting a semicircular shape like the end of handlebar.

OUTCOME AND FOLLOW-UP

The patient tolerated the procedure well and was shifted to the trauma ward and had a smooth recovery. He was discharged on postoperative day 4.

The patient is doing well 1 month after surgery without any symptoms. The handlebar sign (ecchymosis) has subsided now.

DISCUSSION

In 1906 Selby was the first to report a case of abdominal wall hernia after the trauma but the credit to coin and describe 'handlebar hernia' goes to Dimyan *et al* which was published in 1980.³ Handlebar hernia forms a typical group of disease moiety because of its acute nature and typical pathophysiology which demands to be paused and pondered on. These hernias are acutely formed due to a large force is impacted on an abdominal wall over a comparatively small cross-section of circular ends of

Figure 2 Transverse section of CT scan showing the defect in the lower abdominal muscles (red solid arrow). Small bowel and part of omentum is noted herniating through this defect.

Figure 3 Intraoperative view of defect (black solid arrow) in the internal oblique and transversus abdominis muscle after retracting external oblique aponeurosis (white solid arrows) through which omentum is herniating. Note the absence of peritoneal covering/sac. Spermatic cord (white solid arrow head) seen medially.

the handlebars which get rotated perpendicularly. Consider the formula for calculating the force of impact that is,

$$\text{Force} = \{\text{Mass (in kg)} \times \text{Velocity}^2 \text{ (m/sec)}\} / 2 \times \text{Distance (metres)}$$

The force of impact is directly proportional to the weight of the rider and velocity of the bicycle, but it is inversely proportional to the distance. In a study conducted by Dennis *et al*, the weight of the patient played a statistically significant role in causing abdominal wall injuries ($p=0.001$) thus proving the significance of the above equation.⁴

In case of handlebar injuries, this equation plays a major role as the distance is reduced suddenly by the perpendicular rotation of the bicycle handlebar which is inversely proportional to the force thereby abruptly surging the force of impact. The huge force generated is passed on to the abdominal wall over a small cross-section of the circular end of handlebar creating a watershed zone disrupting the musculature. This huge force is high enough to lacerate the taut muscles of the abdomen. The skin receives bruising but lack laceration due to its elastic nature.⁵ In cases of TAWH there is lack of bony underlying surface which may also have a role in sparing the skin disruption.

This is what we think maybe the mechanism of handlebar sign and handlebar hernia.

TAWH actual incidence is not known but few studies have mentioned its incidence to be ranging from 0.1% to 9.2% and are most commonly found to be involving lower abdomen.⁴⁻⁶ But this is an association with internal injuries in 25% to as high as 70% cases.^{2,7} Handlebar injury contributes 84.6% of reported cases of TAWH.⁶ 50% of patients will present with signs which are classical of a hernia, that is, cough impulse and reducible swelling.^{7,8} Peritonitis is presented in only 38%–54% of patients.¹⁹

Initially, TAWH was considered to be devoid of peritoneal sac but around 17% of cases have reported the presence of it.^{5,8} Wood *et al* gave a classification based⁵ on size and mechanism of the injury which was as follows:

- ▶ Type 1: small defects caused by blunt trauma with objects such as bicycle handlebar. It is the most common type. (35%).
- ▶ Type 2: large defect caused by high energy trauma.
- ▶ Type 3: a defect that involves intra-abdominal bowel herniation.

Dennis *et al* classified TAWH based on CT scan findings⁴ as follows:

- ▶ Grade I: subcutaneous tissue contusion.
- ▶ Grade II: abdominal wall muscle haematoma.
- ▶ Grade III: single abdominal wall muscle disruption.

Patient's perspective

I (patients' father) very glad to receive the kindly of treatment our doctors gave us. They explained us the problem with the handlebar hitting over the abdomen like my son had and told us to get evaluated in detailed that needed CT scan and surgery. The not only reassured me and my family but also reassured my kid and made him mentally ready to undergo surgery. I will appeal to other parents to report and get their child evaluated if they have handlebar injury like my son.

Learning points

- ▶ Blunt abdominal trauma in accidents involving handlebars should be assessed for handlebar hernia specially showing handlebar sign.
 - ▶ Handlebar sign may be seen as a small bruise over abdomen but can be associated with serious internal injuries and morbidity.
 - ▶ Such injuries should be evaluated with contrast CT scan as focused assessment with sonography for trauma may miss visceral injuries and hernias.
 - ▶ Surgical repair is preferred with or without meshplasty.
- ▶ Grade IV: complete abdominal wall muscle disruption.
 - ▶ Grade V: complete abdominal muscle disruption with herniation of abdominal contents.
 - ▶ Grade VI: open herniation.
- A plain radiograph will be able to show us a pneumoperitoneum in 54%–85% of cases.⁹ But the investigation of choice is contrast-enhanced CT scan which will allow us to assess the whole abdominal cavity and also rule out associated injuries.^{2 4 5 7}
- Surgical repair of the defect is the preferred approach by most of the centres in more than 90% of cases.^{2 5 8} Delayed operative management after initial stabilisation and reduction in localised haematoma and oedema is also considered.^{2 10} Mesh is commonly used as most of the symptomatic defects are large.^{2 8 10} For

smaller defect, an anatomical closure of muscle layers is sufficient⁸ without mesh and also in cases where there is some form of contamination.² Conservative management is reserved (done in 8.77%–24%) for stable asymptomatic cases^{6 8} Spontaneous closure of the defect is seen in 3–6 months followed by conservative management.⁵

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