Bicycle Handlebar Injuries in Children During the COVID -19 Pandemic

Consequences of the ongoing coronavirus disease 2019 (COVID-19) pandemic include nationwide school closure. In countries with limited access to the internet and remote learning, 90% of enrolled students are being confined at home. With children resorting to recreational activities, we have seen an increasing trend of sports-related abdominal trauma in our region.

Bicycle handlebar injury (BHI) accounts for 5-14% of motor vehicle injuries that result in abdominal trauma in children [1]. Although, it is a low-impact injury, it can lead to severe internal organ damage. The initial signs are minimal and the symptoms develop hours after the injury, resulting in delay in seeking medical attention. We report four consecutive children who had serious internal organ damage secondary to BHI with one child with life-threatening abdominal compartment syndrome (ACS).

These four children (3 girls) were admitted with BHI to the pediatric intensive care unit of our tertiary teaching hospital between April, 2020 and May, 2021. The median age was 12 years and there was a significant delay in presenting to hospital. (median time to reach hospital; 14 hours). Clinical symptoms were varied with abdominal pain and distension, hematuria and handle bar-tattooing. Radiological imaging showed liver and renal laceration. All children required blood transfusion and the median hospital stay was 13 days. The children were managed conservatively with no mortality.

One child among the four had life-threatening ACS with a stormy clinical course. She was a 15-year-old female who sustained minor bruises over the abdomen after a fall from a bicycle, and arrived 16 hours after trauma at our center. On arrival, she was in hemorrhagic shock with handlebar tattooing on the abdomen (**Fig. 1**). The Focused assessment with sonography for trauma (FAST) and radiological imaging showed hemo-peritoneum and liver laceration. In spite of fluid resuscitation and massive blood transfusion, the shock did not resolve, with persisting oliguria. There was a progressive increase in abdominal distension and respiratory distress worsened requiring mechanical ventilation. With the suspicion of ACS, the intra-abdominal pressure (IAP) was serially monitored. An IAP of >26 mm Hg along with organ dysfunction was diagnostic of ACS [5], thus decompression was done with a peritoneal drain, which resolved the shock. She was later extubated and discharged after 10 days of hospital stay.

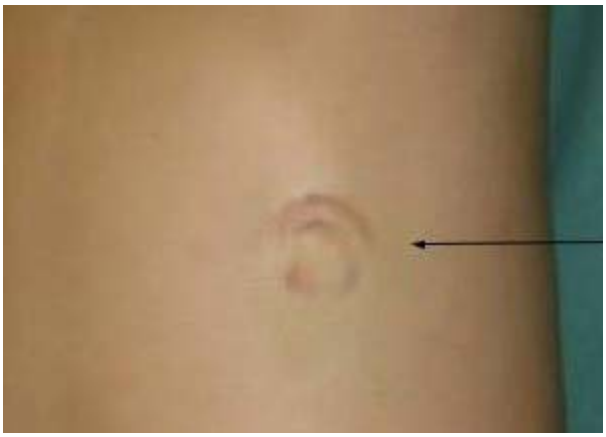

Fig. 1 Handlebar tattooing over the abdomen (black arrow).

With the closure of schools in the pandemic era, we have witnessed an increase in the frequency of BHI from 2% (1/50) to 15% (4/26) of all the trauma admissions before and after the onset of the pandemic, respectively. The median age of our group of children was similar to other reports, with the abdomen being the most common site of injury [2]. As with our report, other authors have reported an increase in odds of having a serious intra-abdominal injury whenever there is a handlebar imprint [4]. Delayed presentation is a major risk factor for increased morbidity [4].

In all the children, FAST identified major injuries which was later confirmed by CT. We found that FAST had high sensitivity in detecting serious intraabdominal trauma similar to previous reports. Management of BHI is challenging, especially when the presentation is late. When compared to other modes of abdominal trauma, the requirement of surgical intervention is more in BHIs [2]. We managed to treat the children conservatively, especially the one with ACS with timely abdominal catheter decompression thereby avoiding emergency laparotomy. There is a relative paucity of literature on ACS in children compared to adults. There are no reported cases of ACS secondary to BHI in the literature. Intraperitoneal bleed and requirement of massive resuscitation are responsible for 8% of the ACS associated with high (50%) mortality, which was also present in our child [3]. Serial IAP monitoring is recommended if two or more risk factors for ACS are present [5].

BHIs are frequently underestimated and the occurrence of ACS can be overlooked. Serial physical examination and IAP monitoring are recommended in children with BHI for early recognition and management of ACS. Non-invasive measures to reduce IAP, if performed in time, reduce the requirement of decompressive laparotomy, which is associated with high mortality rates.

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Langerhans Cell Histiocytosis and Osteosarcoma in Children: A Radiological Mimic

Osteosarcoma presents in adolescent age with radiologically aggressive bone tumor, while Langerhans cell histiocytosis (LCH) commonly presents with radiological features of a less aggressive bone lesion [1,2]. We report here two cases of osteosarcoma and LCH with an unusual radiological presentation.

***Case* 1**: A 30-month-old boy presented with swelling over proximal left leg and limping of one-month duration without history of trauma. A 2×2 cm hard swelling, fixed to bone, with mild tenderness was present without any systemic abnormalities. *X*-ray showed a well-defined expansile lytic lesion with narrow zone of transition in meta-diaphyseal region without cortical breaks or significant periosteal reaction (**Web Fig. 1A**). Magnetic resonance imaging (MRI) showed multiseptated peripherally enhancing eccentric lesion without significant periosteal reaction, soft tissue component (**Web Fig. 1B** and **C**). Age and radiological findings were suggestive of LCH. Biopsy showed malignant spindle cells with osteoid formation, typical of osteoblastic osteosarcoma. Immunohistochemistry (IHC) for analplastic large cell lymphoma (ALCL) (CD30) and LCH (Langerin) were negative and CD99 was cytoplasmic positive but without crisp membrane positivity, which ruled out Ewing sarcoma. Thus, diagnosis of osteosarcoma was confirmed. Metastatic work-up was negative. He received six cycles (29 weeks) of methotrexate, adriamycin, cisplatin (MAP) chemotherapy. After 10 weeks (2 cycles) of chemotherapy, MRI post contrast T1 image showed interval regression of adjacent marrow changes and periosteal reaction with reduction in thickness and enhancement of internal septations suggesting treatment response (**Web Fig. 2A and B**). As the child was only 30-months-old, wide-excision and endoprosthetic implant was not a feasible option. Parents were unwilling for above-knee amputation. Hence, we proceeded with wide excision, extracorporeal radiotherapy, and internal fixation. At end-of-treatment, disease was in complete remission (**Web Fig. 2C**). Presently, the child is on follow-up without any evidence of disease, 3-year post-treatment.

***Case* 2**: An 11-year-old girl presented with right thigh pain and limping of one-and-half-month duration without history of trauma. Diffuse swelling and tenderness were present with normal overlying skin at the proximal left thigh without any systemic abnormalities. Blood investigations were normal. *X*-ray showed an irregular lytic lesion involving the upper meta-diaphyseal region with periosteal reaction and cortical-break (**Web Fig. 1D**). MRI showed expansile heterogeneously enhancing lesion involving femoral neck with cortical-break and soft tissue component, which was suggestive of an aggressive bone tumor (osteosarcoma or Ewing sarcoma) (**Web Fig.1E** and **F**). Another lytic lesion was noted in right posterior acetabulum. Biopsy showed sheets of cells having moderate cytoplasm with convoluted vesicular nuclei admixed with eosinophils, diagnostic of LCH. There was no evidence of small round blue cells (for Ewings sarcoma or non-Hodgkin lymphoma) or malignant cells with oseoid formation (for osteosarcoma). IHC for CD1a was diffusely strongly positive. Skeletal survey did not reveal any other bone involvement. She was diagnosed to have multifocal bone LCH without risk-organ involvement. She was started on LCH III protocol. Re-evaluation after 12 weeks induction with vinblastin and prednisolone showed residual lytic area, area of mineralization with regression of periosteal reaction and cortical break (**Web Fig. 2D**). End-of-treatment skeletal survey showed areas of remineralization with cortical thickening without any periosteal reaction, soft tissue component or cortical break (**Web Fig. 2E**). Currently, at 18-month post-treatment, she has no evidence of disease, and can walk without support.

Osteosarcoma presents radiologically with features of aggressive bone lesions like periosteal reaction, periosteal elevation, osteoid formation in soft tissue, wide-zone of transition, cortical break, and pathological fracture [3]. Only 2% of patients present before 5 years of age [1]. In LCH, early lesions appear lytic, expansile, with irregular margin, cortical thickening, and smooth periosteal reaction. As lesions become chronic, they may resolve or appear as punched-out well-defined lesion with sclerotic margins [2]. LCH usually presents at a median age of 3 years and multisystem involvement is more common [4].

Rarely osteosarcoma can radiologically mimic a variety of conditions [5]. In a series of 52 patients (adults and children), six cases of high grade osteosarcoma diagnosed by cytology had atypical radiological appearance and one case of radiological osteosarcoma had histopathological diagnosis of soft tissue sarcoma [5]. In a series by Sundaram, et al. [6] two children with well demarcated osteolytic lesions in tibia diagnosed radiologically as aneurysmal bone cyst, later on were diagnosed as osteosarcoma on open biopsy.

In case 2, child presented at an older age, which is a common age of presentation for aggressive bone tumors. Radiological