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Navigating perils at the US-Mexico border: an illustrated exploration of trauma among southern border migrants

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Abstract: Surge in migrants at the US-Mexico border, intensified by Coronavirus disease 2019 (COVID-19), has led to over 2.7 million U.S. Border patrol encounters in 2022. This article explores trauma among Southern border migrants, categorizing injuries from desert crossing, border wall traversal, fleeing, and train travel. Desert migration poses risks from harsh terrain, extreme temperatures, and dehydration. The border wall, covering a quarter of the border, results in varying falls, correlating with increased morbidity at greater heights. Motor vehicle use introduces dangers, including high-speed chases and altercations, causing significant morbidity. "La Bestia," cargo trains, expose passengers to assault, coercion, and injuries during boarding attempts. The study details organ-based injuries, emphasizing distinct patterns in facial trauma, thoracic injuries, abdominopelvic injuries, and lower extremity injuries. Controlled and uncontrolled falls have diverse outcomes, with pediatric populations facing increased morbidity. In conclusion, migrants face serious risks, including heat-related illnesses, violent crimes, and traumatic injuries. Southern border migrants, often deported without complete care, represent an underserved population. This exploration sheds light on their unique healthcare needs, urging attention to their challenges in a concise manner.

Keywords: Border Wall; Desert Crossing; "La Bestia" Train; Southern Border Migrants; Undeserved Populations; US-Mexico Border

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1. Introduction

The number of migrants seeking refuge and asylum in the United States continues to increase yearly, exacerbated by the recent Coronavirus disease 2019 (COVID-19) pandemic. The total number of U.S border patrol encounters has now exceeded 2.7 million in 2022, which is a more than 5-fold increase from 2017 (1).

Current published literature suggests that most border-related injuries are related to boarder-wall crossing, fleeing, and motor vehicle collisions (MVCs) (2). Our institution is near a large portion of the border, and we treat a high number of migrants who sustain injuries while attempting to cross the border. In addition to categorizing these injuries by organ-based system, we classify these injuries as relating to desert crossing, border wall crossing, fleeing (which includes MVCs), and traveling on trains.

In this pictorial essay, we present imaging and clinical findings of traumatic and non-traumatic injuries related to border crossing events.

2. Case presentation

2.1. The desert

Hiking through the open desert itself can lead to morbidity and mortality. In addition to arduous terrain with venomous and aggressive animals, the desert also exposes migrants to extreme high daytime temperatures and freezing desert nights (3,4). High temperatures can lead to severe dehydration, rhabdomyolysis, heat stroke, and death (5). A previous study investigating the inherent hazards of traveling in the desert found that trauma, gastrointestinal, musculoskeletal/orthopedic, and exposure-related injuries were the most common injuries sustained in a desert setting, with an increased incidence of injury after traveling for an average of 3.6 days (6). Rhabdomyolysis is a severe dehydration and heat-related injury sustained by migrants traveling in the desert that we encounter at our hospital (Figure 1).

2.2. The wall

Approximately one quarter of the border has a physical barrier. The walled portion varies in construction including steel and concrete and varies from 15-30 feet in vertical height (7).

Figure 1 A young woman found wandering the desert for multiple days presented with altered mental status and clinically found to have heat stroke. Axial SWI MIP images (a, b) demonstrate bilateral hemorrhagic thalamic infarcts (arrows), with additional hemorrhagic rhombencephalitis (arrows), a presumed sequelae of heat stroke. Axial CT image in soft tissue window (c) demonstrates a striated and hyperattenuating appearance of the bilateral gluteal musculature (arrows), which was postulated to represent heterotopic calcification secondary to rhabdomyolysis

Figure 2 21-year-old female after a controlled fall from the border wall (approximately 25 feet) landing on her right foot. Right lateral foot radiograph (A) and associated clinical photographic image (B) demonstrates severe comminuted, open, pilon fracture with rotated and displaced fragments (dashed arrow in A) and a portion of the distal tibia protruding through the plantar soft tissue (solid arrow and image B). Sagittal CT of the thoracic and lumbar spine, bone window (C) demonstrates acute fractures of the L1-L3 superior endplates (solid arrows) with minimal compression deformity, sequelae of an axial loading injury

Falls from this height can lead to significant morbidity and mortality Lapostolle et al. concluded that the height of the fall, impact surface, and whether the patient landed head-first were all independent indicators of mortality (8). A recent 2022 study from San Diego demonstrated increased hospital admissions, initial injury severity scale (ISS), healthcare costs, and deaths with increasing the border wall height (9). Demetriades et al. found that while the incidence of intracranial injuries and solid/hollow visceral injuries were similar, the overall incidence of spinal fractures after sustaining a fall from a height >15 feet were significantly increased in patients greater than 14 years of age (10). Spine injuries were the most common type of neurotrauma observed in patients jumping off the border wall (11). Moreover, extension of the physical barrier of the border wall is directly correlated with increased spine injuries, increased healthcare costs, and increased spine operations (12).

Despite ample published literature about fall from heights, information regarding the mechanism of the type of fall is sparse. At our institution, we divide falls into controlled versus uncontrolled mechanisms, which result in different injury patterns. A patient with a controlled fall lands on their feet with resultant lower extremity dominant injuries (Figure 2). Additionally, the lower extremities absorb the impact force energy which gives relative protection to the rest of the body and central nervous system.

Conversely, uncontrolled falls do not initially land on their feet, instead impacting various parts of their bodies resulting in more unpredictable and complex injury patterns with increased morbidity and mortality, specifically in the pediatric population. Despite the protective factor of having a higher cartilage content and elasticity, pediatric neurotrauma is highlighted by their disproportionately large craniums shifting their center of gravity while falling from a height, often uncontrollably onto their heads (Figure 3), resulting in devastating intracranial injuries (13). Uncontrolled falls also tend to emulate blunt trauma injuries seen with MVC. In our experience, patients with uncontrolled falls from the border wall present similarly to high impact MVCs and often arrive comatose with life threatening intracranial, visceral, or devastating spine injuries (Figure 4).

2.3. The chase

Motor vehicles will be used by migrants at various stages of their journey into the USA. They may cross the border in a vehicle or cross on foot and then be picked up in the USA by a driver hired by the migrants to assist in their clandestine journey. Various payment structures incentivize drivers to overload their vehicles with migrant passengers. The drivers may remove seats and/or loading migrants in the back of pickup trucks or in the trunk of a car to increase passenger capacity (14). In our experience, MVCs that occur in this situation typically result in significant morbidity (Figures 5 and 6) as the passengers are unrestrained. In addition to high-speed

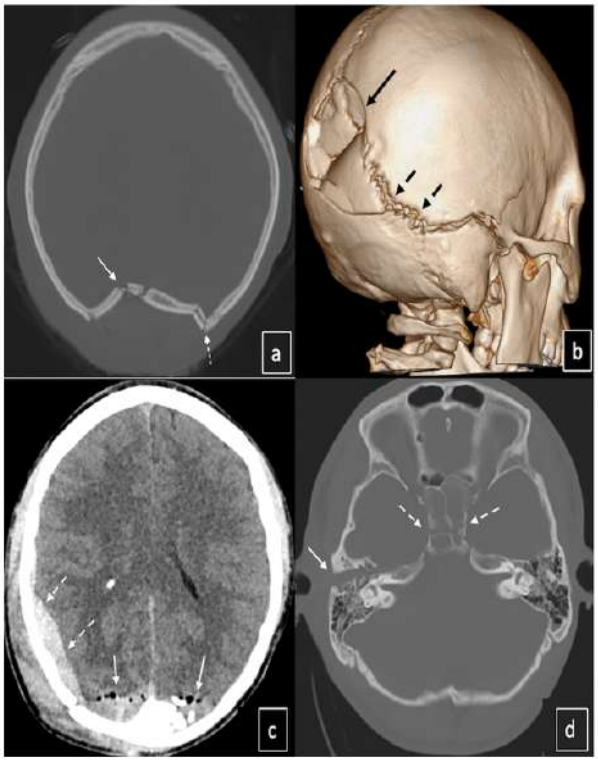

Figure 3 17-year-old male after an uncontrolled fall from the border wall. Axial (a) and 3D reconstruction (b) images demonstrate a comminuted and depressed (solid arrows) occipital bone fracture extending inferolaterally with traumatic diastasis of the lambdoid suture (dashed arrows). Axial brain window (c) shows a right parietooccipital subdural hematoma (dashed arrow) with numerous foci of pneumocephalus (solid arrow). Axial bone window (d) demonstrates a transverse fracture of the right petrous temporal bone (solid arrow) involving the otic capsule (not shown), middle ear cavity, and a transsphenoidal skull base fracture (dashed arrow)

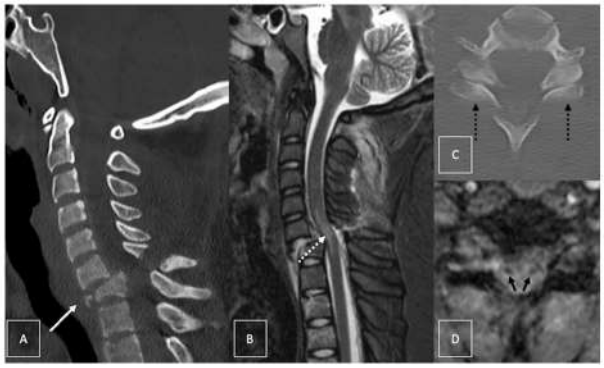

Figure 4 19-year-old female presenting after 20-30 ft. uncontrolled fall from the border wall. Sagittal CT of the cervical spine (A) demonstrates a severe flexion-dislocation injury at the C7 spinal level resulting in a hemorrhagic cord contusion (arrows). Note the bilateral locked facets on the axial bone window (solid black arrows, C). Sagittal STIR sequence demonstrates extensive cord edema (dashed white arrow, B). Axial MEDIC image demonstrates gradient susceptibility within the ventral cord, consistent with cord hemorrhage (solid black arrows, D)

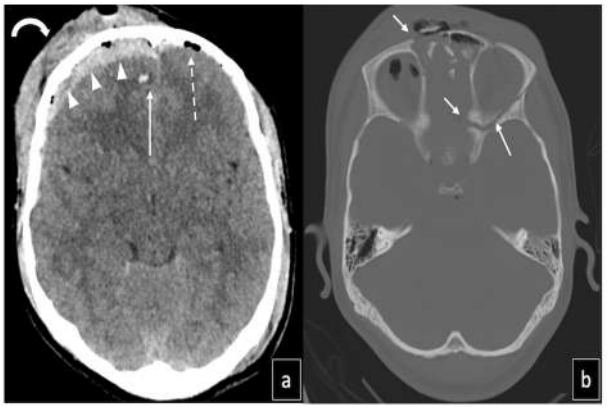

Figure 5 Adolescent male was found in the trunk of a vehicle involved in a MVC while fleeing from border patrol. Axial CT brain window (a) demonstrating extensive intracranial traumatic injury with right frontal subdural hematoma (arrowheads), pneumocephalus (dashed arrow), intraparenchymal hemorrhage (solid arrow) and a right frontal subgaleal hematoma (curved arrow). Axial bone window (b) shows a complex naso-orbital ethmoid (NOE) fracture (solid arrows) with associated discontinuity of the carotid canal (not shown)

Figure 6 Young adult male who sustained injuries while fleeing from border patrol. Patient was on the bedliner, in the back of a pickup truck which rolled multiple times during a high-speed chase. Coronal (a) and sagittal (b) thoracic/lumbar spine CT scan demonstrate a severe three column flexion distraction injury (solid arrows) with retropulsed ossific fragments through the mid-thoracic spine (b, dashed arrow) resulting in a devastating spinal cord injury. Large paravertebral (a, arrowheads) and supraspinous (b, arrowheads) hematomas are also visualized

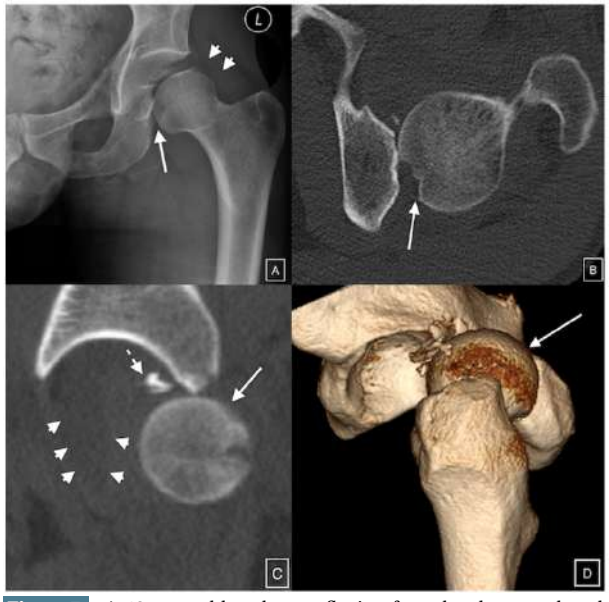

Figure 7 A 42-year-old male was fleeing from border patrol and subsequently tackled to the ground. Anteroposterior (AP) radiograph (A) demonstrating posterior subluxation of the left femoral head (arrow) with a large hip joint effusion (arrowheads). Axial CT bone window (B) demonstrates an impacted left femoral head fracture with involvement of the fovea capitis (arrow). Sagittal CT scan (C) with 3D reconstruction (D) again demonstrate the posterior subluxation (arrows) with displaced intra articular fragments (dashed) and layering hemarthrosis (arrowheads)

Figure 8 A young adult female traveling on 'La Bestia' fell off the cargo train which subsequently ran over both of her lower extremities resulting in a devastating traumatic injury. Anteroposterior radiograph of the right ankle (A) demonstrates an open traumatic amputation of the right midfoot and hindfoot (solid arrows) with extensive mangling of the entire foot and a degloving injury (dashed arrows in A,B, clinical photographic images in C,D). Lateral radiograph of the left tibia and fibula shows an open, severely comminuted, and displaced fractures of the distal third left tibia and fibula (solid arrows, B) with extensive maceration and near circumferential laceration of soft tissues (clinical photographic image D), resulting in traumatic near amputation of the left lower extremity

chases and MVCs, injuries may occur during physical altercation between border patrol agents and migrants (Figure 7).

2.4. The Train

"La Bestia" (the beast), is the colloquial name given to the cargo freight trains that originates at the Guatemalan border of Southeastern Mexico, traveling north to a station near Mexico City and connecting to a network of freight trains. Every year, hundreds of thousands of Central American migrants resort to utilizing "La Bestia" as a conduit to reach the U.S. border. During the perilous 1,500 mile journey, about 1 in 4 passengers are at risk of being physically or sexually assaulted, with many subjected to coercion/extortion by gang members (15). Others are injured while attempting to board the moving trains or while riding on top of the cargo trains. The utilization of railroads to gain entrance into the US has long been a method employed by migrants. Previous studies have shown that bony and soft tissue injuries are common with railroad crossing, many of which necessitate limb amputation(16). This is congruent with our institutional experience, exemplified by the following case (Figure 8).

3. Conclusion

Significant illicit migration across the border between Mexico and the USA exposes migrants to serious risk of morbidity and mortality from harsh climate, violent crime, and trauma. Traveling through the open desert subjects migrants to risk of heat-stroke and rhabdomyolysis. Devastating traumatic injury mechanisms result from MVC and riding on the exterior of freight trains. Unrestrained and overloaded MVCs become mass casualty-like events. Jumps from the border wall can be characterized as controlled where the victim lands on their feet creating lower extremity dominant injury pattern, vs uncontrolled falls where patients present with complex blunt trauma injuries affecting various body parts. Unfortunately, migrant patients are often deported and lost to follow-up, potentially never receiving complete care. The Southern border migrants are a unique underserved population who may suffer unusual and severe injury mechanisms.

4. Declarations

4.1. Acknowledgement

None.

4.2. Authors' contribution

Research investigation and Project administration: MG and SN; Supervision and Project administration: RM and BS; Conceptualization: RM, BS, MG, SN. All authors actively participated in discussions and approved the final manuscript.

4.3. Conflict of interest

None.

4.4. Funding

None.

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