



Accidental Penetrating Thoracic Injury with a Screwdriver in a Child: A Case Report

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Abstract

Accidental penetrating injuries are common among children, either with a sharp or a blunt object. The screwdriver is an uncommon weapon; therefore, injuries caused by it represent an even rarer subset. Inadvertent injuries in the chest with a screwdriver as a stabbing weapon are extremely unusual. Penetrating chest injuries can be fatal if they cause wounds in the cardiac chambers or major thoracic vessels. We describe a 9-year-old child with an unintentional penetrating thoracic injury caused by a screwdriver. An explorative left anterior thoracotomy showed that the tip of the implanted screwdriver was lying near the left subclavian vessels and the apex of the lung, but it did not perforate any of those. The screwdriver was dislodged, and the wound was closed. The patient had an event-free 1-week hospital stay.

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Introduction

Trauma causes 60% of deaths in children and adolescents in the United States, and in the majority, the cause is an accidental injury.¹ Following the head and extremities, the chest is the most frequently injured organ,² involved in 0.2% to 7% of cases of trauma in children.³

Penetrating thoracic injuries (PTIs) are less frequently found than blunt thoracic injuries.^{2, 4} Such injuries might occur because of a fall onto an item or as a direct hit.

Stabbing, gunshots, and explosive injuries are commonly found causes of PTIs. Stab wounds are the most common, and explosive injuries are the most dangerous PTIs.⁵ Rare cases of PTIs with wheel spokes, sewing needles,⁶ surgical needles,⁷ and icepicks⁸ have been reported. The screwdriver is also among the rare causes of PTIs, and injuries caused by it are dangerous because of its pointed end and rigid structure.⁹

PTIs can impair 2 life-sustaining circuits of the body: the respiratory and circulatory systems. They can be

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divided into injuries within and outside the cardiac box. The former is associated with higher mortality and requires surgical management more often.¹⁰ A stab wound is a type of low-velocity PTI because of its impact on a small area.⁸ The exterior of the wound can be misleading, requiring a thorough survey.

PTIs are deemed an important topic because of their potentially severe consequences. Most patients with PTIs expire before they reach the hospital. We herein describe a boy who sustained an accidental PTI with the screwdriver while playing.

Case Report

A 9-year-old boy of average height and weight for his age was brought to the pediatric emergency department with no documented comorbidities 5 hours after a PTI with a screwdriver. According to the attendants, while playing on the ground with a screwdriver in his hand, the boy suddenly fell, and the screwdriver slipped through his hand and penetrated his chest. He was taken to 3 local hospitals, whence he was referred to the tertiary care center.

On examination, the child was lying on the bed with a screwdriver, 6×100 mm in size, implanted perpendicularly at the infraclavicular region, 2 cm lateral to the sternal edge in the left chest area. The wound was leaking a moderate amount of serosanguinous fluid. The patient was aware and oriented to time, location, and person and followed all instructions. He was afebrile and had a pulse of 88 beats per minute, a blood pressure of 110/70 mmHg, a respiratory rate of 20 breaths per minute, and an oxygen saturation level of 97%. Emergency aid and tetanus toxoid immunoglobulins were given. The pediatric cardiovascular surgery department was informed to attend the call immediately. Chest X-rays were taken in anteroposterior and lateral views (Figure 1 b & c). Extended focused assessment with sonography for trauma (EFAST) showed an absence of fluid in the third space. Provisional echocardiography with the limited study protocol (because of the patient's condition) demonstrated the normal size and contractility of all 4 chambers with no evidence of a foreign body or abnormal collection. The suprasternal view showed normal flow in the ascending, transverse, and descending parts of the aorta. All baseline investigations were within the normal range.

The patient was admitted, and an explorative left anterior thoracotomy for the removal of the instrument was planned. Following the induction of anesthesia and antiseptic measures, an incision was made at the fourth intercostal space to enter the thoracic cavity. Next, the source of the bleeding was inspected, and outward force was applied, which dislodged the instrument. Bleeding was staunched with electrocautery, and the exit wound was closed. Finally, a chest drain was placed, followed by an aseptic dressing.



Figure 1. This picture shows a perpendicularly implanted screwdriver in the left chest area of the patient.

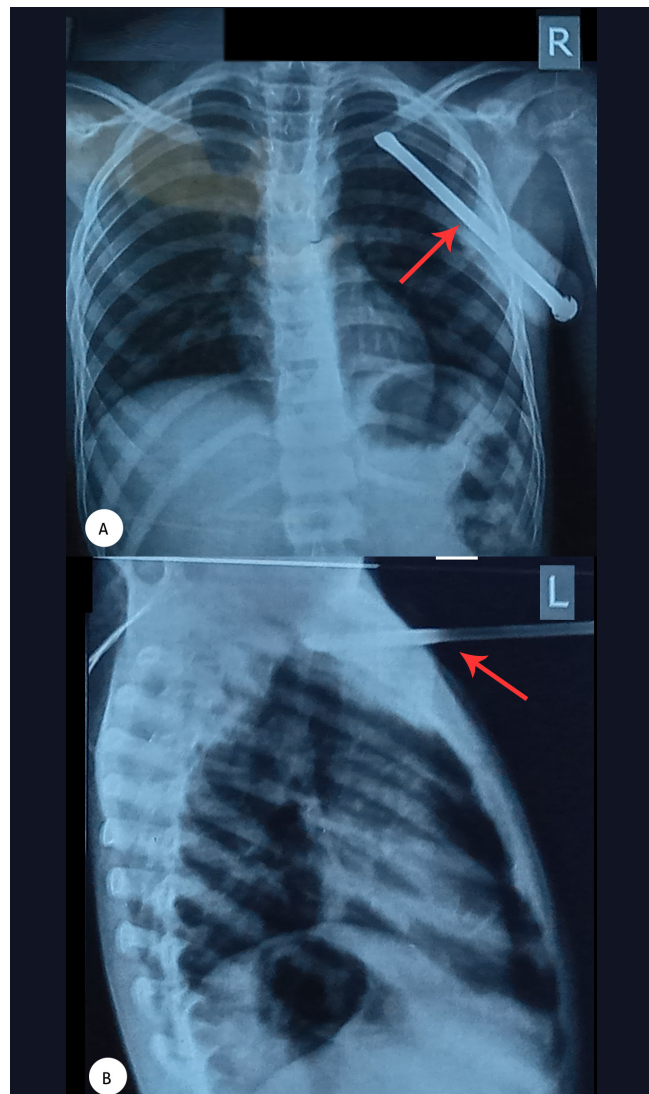


Figure 2. Chest X-rays of the patient in anteroposterior A) and lateral B) views show the opaque shadow of a screwdriver through the chest on the left side (arrows).

Postoperative echocardiography with full protocol showed normal right and left ventricular chamber size and contractility with normal atrial and mitral valves and pulmonary venous return. Septal defects, abnormal accumulation of fluid, or foreign bodies were not found. The ejection fraction was 67%. The patient had an uneventful postoperative period with no signs of infection, and he was discharged after 1 week with a scheduled follow-up.

Discussion

PTIs are common in young adults from low socioeconomic background¹¹ and are predominantly found in males.^{4, 5, 10} The common manifestations of PTIs are chest pain, dyspnea, and shock. They can lead to life-threatening complications, such as cardiac tamponade, hemopneumothorax, pulmonary embolism, and arrhythmia.⁶ Cardiac contusions, hemothorax, pneumothorax, or hemopneumothorax are associated with significant mortality in hospitalized patients regardless of other factors.¹²

Electrocardiographic findings range from normal to ST-segment and T-wave abnormalities, premature beats, and sinus brady- or tachycardia.⁶ Time-to-surgery is crucial in PTIs, and POCUS has proven to save the initial 30 minutes time-to-surgery compared with the control group.¹³ In stable but suspicious high-risk injury patients, echocardiography and computerized tomography chest are the modalities of choice,¹¹ with a sensitivity of 76.9% and a specificity of 99.7% for hemopneumopericardium.¹² Computerized tomography angiography can be used to identify injuries to major thoracic vessels, provided the risk versus the benefit of radiation exposure is justified.¹⁴

The first post-trauma hour is crucial because of its association with highest mortality, followed by the first to sixth hours afterward.¹⁵ Such cases are initially reported in emergencies before specialized teams are taken on board. The emergency department's approach to trauma must be well-organized.

The new injury severity score (NISS) can predict mortality and determine management. The treatment options include observation, tube thoracostomy, median sternotomy or thoracotomy with or without cardiac bypass, and open-heart surgery.⁴⁻⁶ Cardiorrhaphy is an effective method of suturing the tear in the cardiac muscle.¹² In this case, we performed a left anterior thoracotomy without cardiac bypass for the removal of the screwdriver.

Conclusion

PTIs are rapidly fatal and require a structured evaluation and resuscitation in a rational and timely manner. The penetrating foreign body acts as a plug and prevents blood

loss; therefore, it is critical to keep it in its place until arrival at an emergency aid facility. The management of a PTI depends upon its severity. In the described case, a left thoracotomy provided a beneficial outcome.

References

1. Pólos M, Domokos D, Şulea CM, Benke K, Csikós G, Nagy A, Skoda R, Szabó A, Merkel E, Hartyánszky I, Szabolcs Z, Merkely B, Becker D. Needle in the heart: a rare case of cardiac tamponade caused by a migrated foreign body and mimicking ST segment elevation myocardial infarction. *BMC Cardiovasc Disord* 2021;21:143.
2. Hasadia R, DuBose J, Peleg K, Stephenson J, Givon A, Kessel B; Israel Trauma Group. The Use of Chest Computed Tomographic Angiography in Blunt Trauma Pediatric Population. *Pediatr Emerg Care* 2020;36:e682-e685.
3. Lee L, DeCara JM. Point-of-Care Ultrasound. *Curr Cardiol Rep* 2020;22:149.
4. Kim JS, Inaba K, de Leon LA, Rais C, Holcomb JB, David JS, Starnes VA, Demetriades D. Penetrating injury to the cardiac box. *J Trauma Acute Care Surg* 2020;89:482-487.
5. Mikrogianakis A, Grant V. The Kids Are Alright: Pediatric Trauma Pearls. *Emerg Med Clin North Am.* 2018;36:237-257.
6. Oruç M, Ülkü R. Evaluation of factors affecting prognosis in penetrating thoracic injuries. *Turk Gogus Kalp Damar Cerrahisi Derg* 2018;26:598-605.
7. Cunningham RM, Walton MA, Carter PM. The Major Causes of Death in Children and Adolescents in the United States. *N Engl J Med* 2018;379:2468-2475.
8. Dieng PA, Diop MS, Ciss AG, Ba PS, Diatta S, Gaye M, Fall ML, Ndiaye A, Ndiaye M. Penetrating Heart Injury due to Screwdriver Assault. *Case Rep Cardiol* 2015;2015:140507.
9. van As AB, Manganyi R, Brooks A. Treatment of thoracic trauma in children: literature review, Red Cross War Memorial Children's Hospital data analysis, and guidelines for management. *Eur J Pediatr Surg* 2013;23:434-443.
10. Plurad DS, Bricker S, Van Natta TL, Neville A, Kim D, Bongard F, Putnam B. Penetrating cardiac injury and the significance of chest computed tomography findings. *Emerg Radiol* 2013;20:279-284.
11. Ismail MF, al-Refaie RI. Chest trauma in children, single center experience. *Arch Bronconeumol* 2012;48:362-366.
12. Onan B, Demirhan R, Öz K, Onan IS. Cardiac and great vessel injuries after chest trauma: our 10-year experience. *Ulus Travma Acil Cerrahi Derg* 2011;17:423-429.
13. Jiang CL, Gu TX, Wang C. Surgical treatment of posttraumatic foreign bodies in the heart or great vessels. *Chin Med J (Engl)* 2006;119:2018-2020.
14. Mihalache S, Adăscăliței PD. Tratatamentul plăgilor cardiace înjunghiate. O experiență de 31 ani [Treatment of cardiac stab wounds. A thirty-one-year experience]. *Chirurgia (Bucur)* 2005;100:255-258.
15. Demetriades D, Kimbrell B, Salim A, Velmahos G, Rhee P, Preston C, Gruzinski G, Chan L. Trauma deaths in a mature urban trauma system: is "trimodal" distribution a valid concept? *J Am Coll Surg* 2005;201:343-348.