



## Case Report

# Jael's syndrome: Removal of a retained intracranial kitchen knife blade – A case report

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## ABSTRACT

**Background:** Jael's syndrome is defined as an intentional injury caused by a knife in the skull or the face. It is a rare yet challenging situation in clinical practice. Initial triage is the key to optimal management.

**Case Description:** We describe the case of a right-handed 30-year-old man presenting to the emergency for headaches 15 days after a stabbing attack into the skull using a kitchen knife. He was conscious with no neurological deficit or history of seizures. The wound had already healed. A cerebral computed tomography (CT) scan showed a retained kitchen knife blade. The stab wound extended through the temporal lobe and ended a few centimeters before the brainstem. The blade was removed under general anesthesia. Postoperative follow-up was satisfying without any neurological worsening. The control CT scan showed a remaining knife edge in the bone flap. It was decided to monitor the patient regularly, and he was discharged 3 days later.

**Conclusion:** This case highlights the medicolegal importance of physical examination and radiological exploration in penetrating head injury.

**Keywords:** Case report, Head, Jael's syndrome, Knife blade, Penetrating trauma, Stab injury

## INTRODUCTION

Penetrating brain injury (PBI) is a rare clinical entity. It carries high morbidity and mortality and often happens in adult male patients after a stabbing assault or a suicide attempt.<sup>[4,7]</sup> Gunshots are the most common cause. However, in our country, it is usually due to nonmissile projectiles and sharp weapons such as kitchen knives, rods, or nails.<sup>[5]</sup>

Jefferson defined penetrating injury using a knife into the skull or the face as Jael's syndrome in 1968.<sup>[13]</sup> The term is rooted in a biblical story of Sisera's murder by Jael. Computed tomography (CT) scan is the best technique to detect metallic foreign bodies (FBs) and to assess intracranial vasculature injury in the acute phase.<sup>[11]</sup> Nonetheless, it should not delay treatment. In some cases, surgery is performed before radiological exploration. It should be done as soon as possible in the following order: access, FB removal, wound exploration, debridement, hemostasis, and dura plasty.<sup>[11]</sup> Postoperative follow-up is important to diagnose infection and vascular complications such as aneurysm, pseudoaneurysm, and arteriovenous fistula.<sup>[12]</sup>

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## CASE REPORT

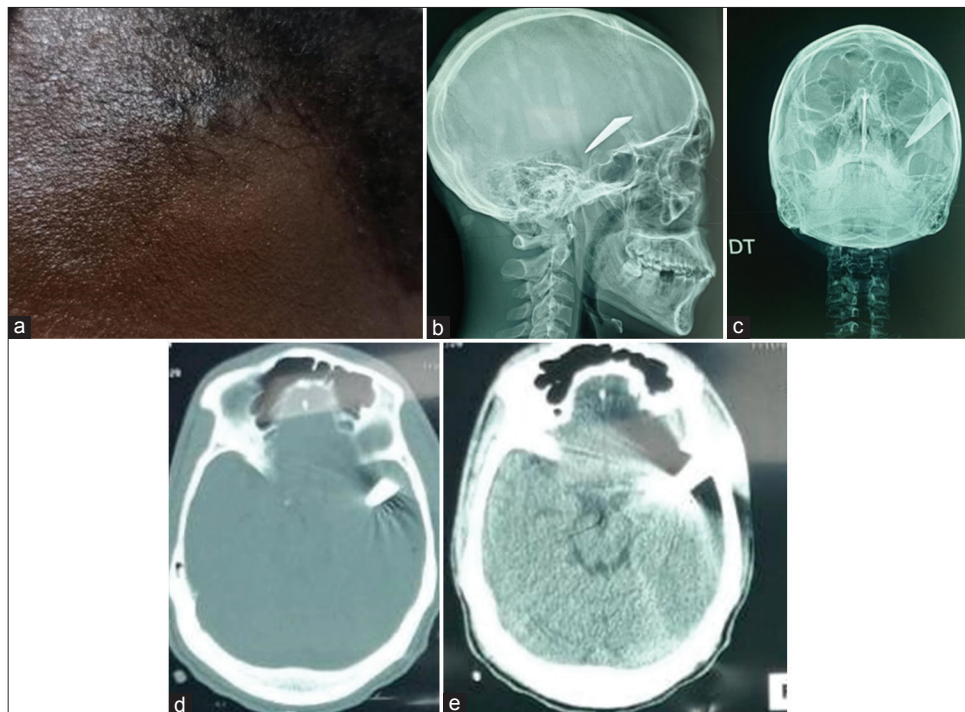
We describe the case of a right-handed 30-year-old patient with no medical history presenting to the emergency department for headaches 15 days after a penetrating head injury following a stabbing attack by a kitchen knife. The handle had broken at point-blank range. The patient was afebrile and conscious with no neurological deficit or history of seizures and the wound had already healed [Figure 1a]. Skull X-ray [Figure 1b and c] and CT scan [Figure 1d and e] revealed a knife blade cutting from the superior temporal line through the left temporal parenchyma, in a downward and backward path, measuring approximately 2 cm, with no signs of hemorrhage or vascular damage. Even though the patient was paucisymptomatic, it was decided to operate on him to reduce the risk of knife blade migration and drug-resistant epilepsy. Surgical treatment consisted of a frontotemporal craniotomy around the knife through a pterional approach, debridement of necrotic parenchymal tissue, safe hemostasis using bipolar forceps, and application of oxidized regenerated cellulose before dura plasty [Figure 2a-c]. The knife blade was removed from the bone to be handed over to the authorities since it constitutes the only evidence, and the skull flap was fixed after meticulous examination [Figure 2d and e]. There was no evident sign of the remaining blade fragment. Cefazolin-based antibiotic prophylaxis was administered, as well as analgesics, anticonvulsants, and antitetanic vaccine.

Postoperative follow-up was straightforward, with no signs of neurological worsening. However, the control CT scan showed a small remaining knife edge in the bone flap [Figure 2f]. The patient refused to be reoperated and it was decided to monitor him regularly. He was discharged on antiepileptic and antibiotic therapy 3 days later. One-month and 6-month postoperative follow-up did not reveal any sign of meningitis or seizures. The electroencephalogram was normal. The main limitation of this case is long-term follow-up. Hence, clinical, electrical, and radiological monitoring will be carried out regularly and long enough to detect complications such as osteitis, seizures, or aneurysms and to manage treatment.

## DISCUSSION

PBI is a life-threatening situation. It is mostly due to firearms.<sup>[14]</sup> Nonetheless, in our country, it is often a stabbing incident or a suicide attempt caused by nonmissile low-velocity objects such as knives (Jael's syndrome), rods, nails, or even wood splinters.<sup>[5]</sup> It usually occurs among civilians. While high kinetic energy projectiles cause significant damage due to direct tissue injury and cavitation, low-velocity ones produce damage mainly along the trajectory<sup>[3]</sup> [Table 1].<sup>[5,10-12,14]</sup>

Initial assessment is crucial to triage. It depends mainly on clinical status. In some cases, surgery is performed



**Figure 1:** (a) Illustration of the healed stab wound, (b-c) illustration of the plain X-ray showing the retained knife blade, (d-e) illustration of axial CT scan showing the artifact generated by the retained kitchen knife blade.

**Table 1:** Illustration of some cases of Jael's syndrome cases upon review of the literature.

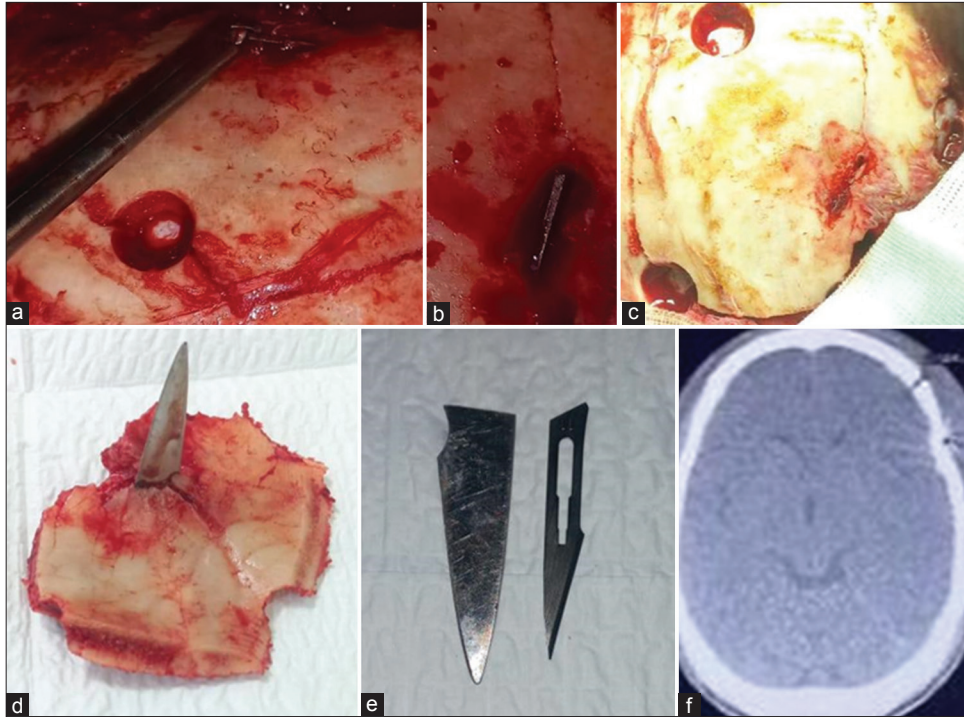
Authors	Age	Gender	Cause	Localization	Hemodynamic instability	Neurological deficit	Neurovascular compromise	Surgery	Complications
Hogerle et al. <sup>[7]</sup>	47	Male	Aggression	Petrosal area, middle ear	-	-	+	+	Hear loss
Gonya et al. <sup>[6]</sup>	30	Male	Aggression	Frontal area	-	-	-	+	-
Lesieur et al. <sup>[10]</sup>	22	Male	Alcohol intake	Temporal area	-	-	?	?	?
Iwakura et al. <sup>[8]</sup>	28	Male	Suicide	Parietal area	-	-	-	+	-
Kodadek et al. <sup>[9]</sup>	20	Male	Aggression	Temporal area	-	-	-	+	?

immediately. Otherwise, patients need to undergo radiological exploration to assess the severity of the injury and overall prognosis. Magnetic resonance imaging is contraindicated in patients with metallic FBs. Head X-ray and CT scan remain available and rapidly performed. Objectifying vascular injury in the acute phase is essential using CT angiography.<sup>[11]</sup>

Complications following PBI could happen immediately after the trauma or later. They include hemorrhage, contusion, edema, infection, FB migration, cerebrospinal fluid leak, hydrocephalous, seizures, and vascular injuries like aneurysm, pseudoaneurysm, thrombus, dissection,<sup>[16]</sup> or arteriovenous fistula. Factors associated with aneurysmal arterial injuries are subarachnoid hemorrhage or intracranial hematoma, bihemispheric trajectory, or wound extension through a well-irrigated area like the temporal lobe. Literature is controversial about the role of systematic antiepileptic therapy in a patient with no clinical or electrical signs of seizures. Thus, the patient should be monitored regularly and long enough after the incident to diagnose these complications.<sup>[12]</sup>

In fact, patients with retained intracranial knife blades have a higher risk of perioperative infection and vascular complications. Taylor *et al.* observed an increased incidence of vascular and infectious complications as well as mortality within the group of patients with retained transcranial knife blades. In addition to that, the handle break adds complexity to the problem since the blade constitutes evidence. Hence, this category of patients requires special attention and caution since the situation carries particular medicolegal implications.<sup>[2,15]</sup> Lesieur *et al.* described the case of a 22-year-old left-handed man presenting with acute alcohol intoxication in which the ensuing hangover was due to a knife blade deeply retained in the temporal fossa. This case emphasizes the unpredictability of retained FB in PBI or Jael's syndrome.<sup>[1,10]</sup> Thus, physical examination and radiological exploration in PBI are important, regardless of the timing of admission.

PBI is a vital emergency. The goal of treatment is resuscitation. Bleeding and high intracranial pressure should be controlled. Although triage is based mainly on clinical status, an indication for surgery is controversial. In fact, a Glasgow Coma Scale lower than 6 with fixed pupils is a factor of poor prognosis. In addition to that, radiological findings such as brainstem injury or deep localization should reconsider surgery since exploration or fragment retrieval could be harmful. It is highly recommended to perform surgery as soon as possible, preferably before 12 hours after trauma to reduce the risk of infection. Surgical practice depends on radiological patterns. In minor penetrating injuries, the goal is to extract the FB and perform debridement and removal of necrotic tissue, hematoma evacuation, hemostasis, and dura-mater plasty. Significant brain swelling is an indication of decompressive craniectomy.<sup>[1,12]</sup>



**Figure 2:** (a-c) Operative illustrations of the frontotemporal craniotomy around the retained kitchen knife blade, (d-e) illustration of the retained kitchen knife blade, (f) illustration of the artifact due to the remaining knife edge in the bone flap.

In Jael's syndrome, "inline" removal is preferable. It depends mostly on how fixed the blade is. One of the used maneuvers is the application of vise grips to the protruding blade and using a mallet to pull the FB out in the direction of its insertion. Other surgeons perform a craniectomy or a craniotomy around the knife blade. For retained blades, Van Dellen and Lipschitz described a D-shaped craniectomy with the straight side against the blade to free it from the bone. However, it's not clear which technique (craniectomy or craniotomy) is best to achieve the optimal results and reduce the risk of operative complications.<sup>[15]</sup> On the other hand, regardless of the technique used, monopolar forceps should not be used to detach the musculoaponeurotic flap.

## CONCLUSION

PBI is associated with high morbidity and mortality. Radiological exploration should be performed rapidly, when possible, without delaying resuscitation. Nevertheless, surgery is not always indicated. In Jael's syndrome, "inline" removal is preferable.

## Authors' contributions

Dr. Malak El Marrakchi: Literature search, manuscript preparation, editing, and review. Dr. Nahla Zian: Literature search. Dr. Meryem Ait Benali: literature search. Pr.

Farouk Hajhouji: manuscript review. Pr. Said Ait Benali: a manuscript review.

## Ethical approval

Institutional Review Board approval is not required.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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