



Case Report

Adrenal gland injury due to gunshot

Vivek Angara, Jody C. Digiaco^{*}

Department of Surgery, Nassau University Medical Center, East Meadow, NY, 11554, USA

ARTICLE INFO

Article history:

Received 23 October 2019

Received in revised form

7 January 2020

Accepted 20 January 2020

Available online 24 January 2020

Keywords:

Adrenal injury

Gunshot wound

Penetrating trauma

ABSTRACT

Adrenal gland trauma is a rare phenomenon, due to the small size and retroperitoneal location of the organ. The majority of adrenal gland trauma is due to blunt force injury and is only rarely encountered due to the penetrating mechanisms. A 20-year-old male sustained a gunshot wound to the left abdomen. Upon exploration, he was found to have a through and through injury to the left adrenal gland, among other injuries. Injury to the adrenal gland due to penetrating trauma is exceptionally rare. The principles of management are to control bleeding from the gland with debridement and hemostasis rather than attempt to resect the entire organ. The management of a penetrating injury to the adrenal gland is straightforward and should not be a contributor to a patient's morbidity or mortality.

Production and hosting by Elsevier B.V. on behalf of Chinese Medical Association. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

The adrenal glands are paired retroperitoneal ductless glands superior and medial to the kidneys at the level of the 11th ribs. Despite their small size, averaging less than 5 cm in length and about 3 g in weight, both the left and right adrenal glands receive an extensive arterial supply from the inferior phrenic artery, the aorta, and the renal artery, all of which arborize as they approach the gland to as many as 50 branches.¹ The venous system of each gland is relatively simple, each draining through a single central vein. On the right, it is short and drains directly into the inferior vena cava. On the left, it is longer and receives the left inferior phrenic vein before emptying into the left renal vein.

The incidence of adrenal gland injury due to trauma is low, ranging from 0.44%–0.61%, all of which virtually are due to blunt force trauma.^{2–4} As such, adrenal trauma tends to be incidentally discovered and usually associated with injuries to other organs, most commonly the ribs, liver, kidneys, and spleen.^{2,3,5} Penetrating injury accounts for only 1.4%–18.6% of all adrenal trauma and has been associated with higher rates of exploratory laparotomy, adrenalectomy, and overall mortality as compared to blunt trauma.^{2–6} Of note, we were unable to find reports of bilateral adrenal injury after penetrating trauma. It was previously believed that adrenal injuries were associated with high rates of morbidity and mortality, but this has been recently disproved.^{2–6} Adrenal

gland injuries are a marker for neither. Adrenal trauma is a negligible contributor towards a patient's overall injury severity score, further indicating that when present, injury to the gland is an incidental finding in the setting of more acute trauma.^{2,4}

Injury to the adrenal gland itself rarely requires aggressive intervention. Management is directed towards repair and preservation of viable tissue rather than removal.^{3,5,6} We present a 20-year-old male who sustained a gunshot wound to the left upper quadrant with an exit wound in the left back. The patient was taken for emergent exploratory laparotomy and a left adrenal gland injury was identified during surgery, along with injuries to the liver, stomach, and pancreas.

Case report

A 20-year-old male presented at a level I trauma with a gunshot wound to the left upper quadrant, with an exit wound through the left back. He was taken to the operating room immediately for exploratory laparotomy. Upon entering the peritoneal cavity, approximately 200 mL of hemoperitoneum was discovered. All 4 quadrants of the abdomen were packed. As the packing was removed, an American Association for the Surgery of Trauma Grade I injury to the left lobe of the liver with no active bleeding was noted. The bullet had also traversed the anterior and posterior stomach along the lesser curvature. The wound edges of the gastric injuries were debrided and the gastrostomy sites were closed using a thoracoabdominal stapler reinforced with 2-0 silk sutures.

The most extensive injury involved the body of the pancreas which required a distal pancreatectomy with splenectomy. Upon

^{*} Corresponding author.

E-mail address: jdigiaco1@numc.edu (J.C. Digiaco).

Peer review under responsibility of Chinese Medical Association.



Fig. 1. Computed tomography scan of the abdomen with contrast performed after initial surgery. Arrow points to left adrenal. Note evidence of hemostatic agent on left adrenal. Closed suction drain is in splenic bed.

further exploration, the bullet tract continued towards the left kidney. No renal injury was identified, but a grade I adrenal injury was discovered. An intravenous pyelogram demonstrated no extravasation. The adrenal injury was managed with debridement of devitalized tissue and placement of an absorbable oxidized regenerated cellulose hemostatic agent. Removal of the gland was not necessary. No other injuries were identified.

Following the procedure, a computed tomography scan of the abdomen and pelvis demonstrated expected post-operative changes and no additional injuries. Evidence of the adrenal injury was noted, as the inferior portion appeared irregular and frayed, with associated peri-adrenal fluid (Fig. 1). The patient's post-operative course was unremarkable and he was ultimately discharged in stable condition on postoperative day 6. The patient never exhibited any signs or symptoms consistent with adrenal gland dysfunction during his hospital course. Long term follow-up occurred for 4 years (Fig. 2). No clinic symptoms or laboratory studies suspicious for adrenal dysfunction were identified.

Discussion

This case demonstrates common and uncommon features of adrenal trauma. Notably, this case represents a rare phenomenon: a



Fig. 2. Computed tomography scan of the abdomen performed 2 months after discharge. Arrow points to left adrenal with indistinct edges and post-operative changes.

penetrating injury of an adrenal gland. As is the case in the majority of reported adrenal trauma, our patient presented with an incidental finding of adrenal trauma that was associated with more significant injuries that required operative management. Furthermore, upon discovery, the adrenal injury did not necessitate any direct surgical intervention at the time other than debridement of devitalized tissue and local hemostasis. It therefore seems appropriate that surgical management should be focused on those injuries that require immediate surgical care and time should not be wasted by focusing on the adrenal injury. Our patient experienced a relatively benign post-operative course despite the reportedly high incidence of morbidity and mortality associated with adrenal trauma, especially in the setting of penetrating trauma to the adrenal gland.

How an adrenal gland injury due to penetrating injury is diagnosed depends in part on the mechanism and clinical condition of the patient upon presentation. Patients who present after penetrating trauma such as gunshot wounds, shotgun wounds, stabbing, or other impalements with hemodynamic instability typically proceed to the operating room without significant pre-operative diagnostic studies. These patients will have the extent of their injuries diagnosed and addressed at laparotomy, including adrenal gland injuries. Alternatively, select patients may present with a clinical picture amenable to pre-operative diagnostic procedures, during which a CT scan may identify an adrenal gland injury. In our patient, the adrenal gland injury was identified during the initial laparotomy due to continued bleeding from the organ, and was addressed with debridement of devitalized tissue and hemostasis. Due to the extensive arterial and venous network of vessels that surround the adrenal, this approach is preferable with regards to the ease of attaining hemostasis and temporal expediency during a trauma laparotomy. In addition, the adrenal tissue that remains has the potential to recover some of its endocrine function. Excising the gland in its entirety would require hemostasis of the arterial plexus that surrounds the gland, or of the arterial branches supplying the gland from the inferior phrenic and renal arteries and from the aorta.

Adrenal insufficiency after trauma is rare, and the presence of a unilateral injury to the adrenal gland is neither associated with nor predictive of subsequent adrenal insufficiency.^{6,7} No cases of adrenal insufficiency have been reported after penetrating injuries of an adrenal gland.^{2,4–6} Therefore, routine monitoring for adrenal insufficiency does not appear to be necessary in the absence of specific indications.

Although a rare finding, penetrating injuries of the adrenal gland can pose a significant challenge to the surgeon when encountered unexpectedly, such as during an emergent laparotomy for trauma. Attention should be focused on those injuries that warrant immediate surgical management for control of hemorrhage and contamination. Given the extensive blood supply of the adrenal gland, debridement and hemostasis of the injury to the adrenal gland is preferable to attempting to remove of the entire injured organ.

Funding

Nil.

Ethical Statement

All procedures performed were in accordance with best practices and standard of care. This article does not contain any studies with human participants performed by any of the authors.

Declaration of Competing Interest

The authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cjtee.2020.01.003>.

References

1. Gray H. *Anatomy, Descriptive and Surgical*. New York, NY: Bounty Books; 1988: 996–998.
2. DiGiacomo JC, Angus LDG, Coffield E. Adrenal injuries: historical facts and modern truths. *World J Surg*. 2016;41:975–979. <https://doi.org/10.1007/s00268-016-3840-3>.
3. Raup VT, Eswara JR, Vetter JM, et al. Epidemiology of traumatic adrenal injuries requiring surgery. *Urology*. 2016;94:227–231. <https://doi.org/10.1016/j.urology.2016.03.022>.
4. DiGiacomo JC, Gerber N, Angus LDG, et al. Blunt adrenal injury: results of a state trauma registry review. *Am Surg*. 2019;85:390–396.
5. Stawicki SP, Hoey BA, Grossman MD, et al. Adrenal gland trauma is associated with high injury severity and mortality. *Curr Surg*. 2003;60:431–436. [https://doi.org/10.1016/s0149-7944\(02\)00796-1](https://doi.org/10.1016/s0149-7944(02)00796-1).
6. Gómez RG, McAninch JW, Carroll PR. Adrenal gland trauma: diagnosis and management. *J Trauma*. 1994;35:870–874. <https://doi.org/10.1097/00005373-199312000-00012>.
7. Castaldo ET, Guillamondegui OD, Greco JA, et al. Are adrenal gland injuries predictive of insufficiency in patients sustaining blunt trauma? *Am Surg*. 2008;74:262–266.