INVITED ARTICLE: CLINICAL PEARL

Contemporary management of abdominal stab wound with retained knife – A practical guide

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Clinical case

A 20-year-old man presented to the emergency department at 0200 having been stabbed in the abdomen with a knife. Primary survey findings were as follows: Airway intact, respiratory rate 22/min, SpO^2 96% on room air, heart rate 90 beats/min, temperature 37°C, blood pressure 130/60 mmHg, Glasgow Coma Scale 15. Secondary Survey showed an anterior abdominal stab wound with knife in situ in the mid-abdomen along with generalised abdominal tenderness. No other wounds were noted.

Introduction

The incidence of penetrating abdominal trauma (PAT) varies widely depending on geography. In New Zealand, where the proportion of major trauma secondary to penetrating injury is approximately 5%, the overall volume of stab wounds (SW) is relatively low compared with countries such as the United States of America and South Africa.[1-5] There is no current national guideline for the management of abdominal SW and thus the treatment is largely clinician dependent.[1] The specific clinical scenario of abdominal SW with an associated retained knife is even rarer, but is challenging to manage. Most literature on the topic consists of anecdotal case reports. Very few centres will have accumulated sufficient experience to formulate management algorithms for this particular scenario.[3-9] This article focuses on the general principles and management strategies for this specific injury. This is based on the author's personal published and institutional experience over a decade from a high-volume major trauma centre in South Africa. It is aimed at medical students and qualified clinicians who may encounter such injury in the emergency department.

Definitions

RETAINED KNIFE OR RETAINED BLADE

A "retained knife" is defined as the entire knife with the handle as an intact single unit. A "retained blade" is defined as the knife blade alone without the handle, which remains embedded in the abdomen following a stab injury.

ANATOMICAL DEFINITIONS

For descriptive purposes, the precise anatomical definitions are important. The *anterior abdomen* is defined anatomically as extending from the costal margin to the inguinal ligament, anterior to the mid-axillary line. The *posterior abdomen* is similarly defined anatomically as extending from the inferior angle of the scapular to the iliac crests, and posterior to the mid-axillary line. Figure 1 is an example of retained knife in the anterior abdomen. Figure 2 is an example of retained knife blade in the posterior abdomen.

Figure 1: Retained knife in the anterior abdomen

Figure 2: Retained blade in the posterior abdomen

Initial management

Although such injuries often appear dramatic, their spectacular nature must not distract clinicians from assessing the patient in a systematic manner. All patients should be managed according to Emergency Management of Severe Trauma (EMST)/Advanced Trauma Life Support (ATLS) principles.[10] This begins with a primary survey using the "ABCDE" mnemonic to identify and treat life threatening injuries. The major determinants are the presence of haemodynamic instability and/or generalised peritonitis. These mandate immediate laparotomy and further imaging does not alter management decision. It is also crucial to examine for other concurrent SW that can easily be missed. An algorithm for management of abdominal retained knife is summarised in Figure 3.

General principles

The abdominal retained knife or blade must be left in situ and no extraction should be attempted in the resuscitation room. Uncontrolled extraction outside of the operating theatre may result in loss of any tamponade effect the retained knife had been exerting and precipitate haemorrhage that is difficult to control.[3-5] Those with haemodynamic instability, or who are unresponsive to simple resuscitation, should be expedited to the operating theatre without further investigation.

Investigations

Those who are haemodynamically stable should undergo further radiological imaging. Plain radiography can be performed liberally in the resuscitation room. However, cross-section imaging with computed tomography (CT) with intravenous contrast requires some consideration. In principle, a CT scan should be obtained to delineate the knife and potentially injured anatomical structures so that extraction can be planned with this information. In general, if the knife is retained in the anterior abdominal wall, a laparotomy is required and is in fact, the author's preferred approach. CT seldom alters this management decision. Based on the author's published series of 42 consecutive cases, 72% of all laparotomies performed for anterior abdominal SW

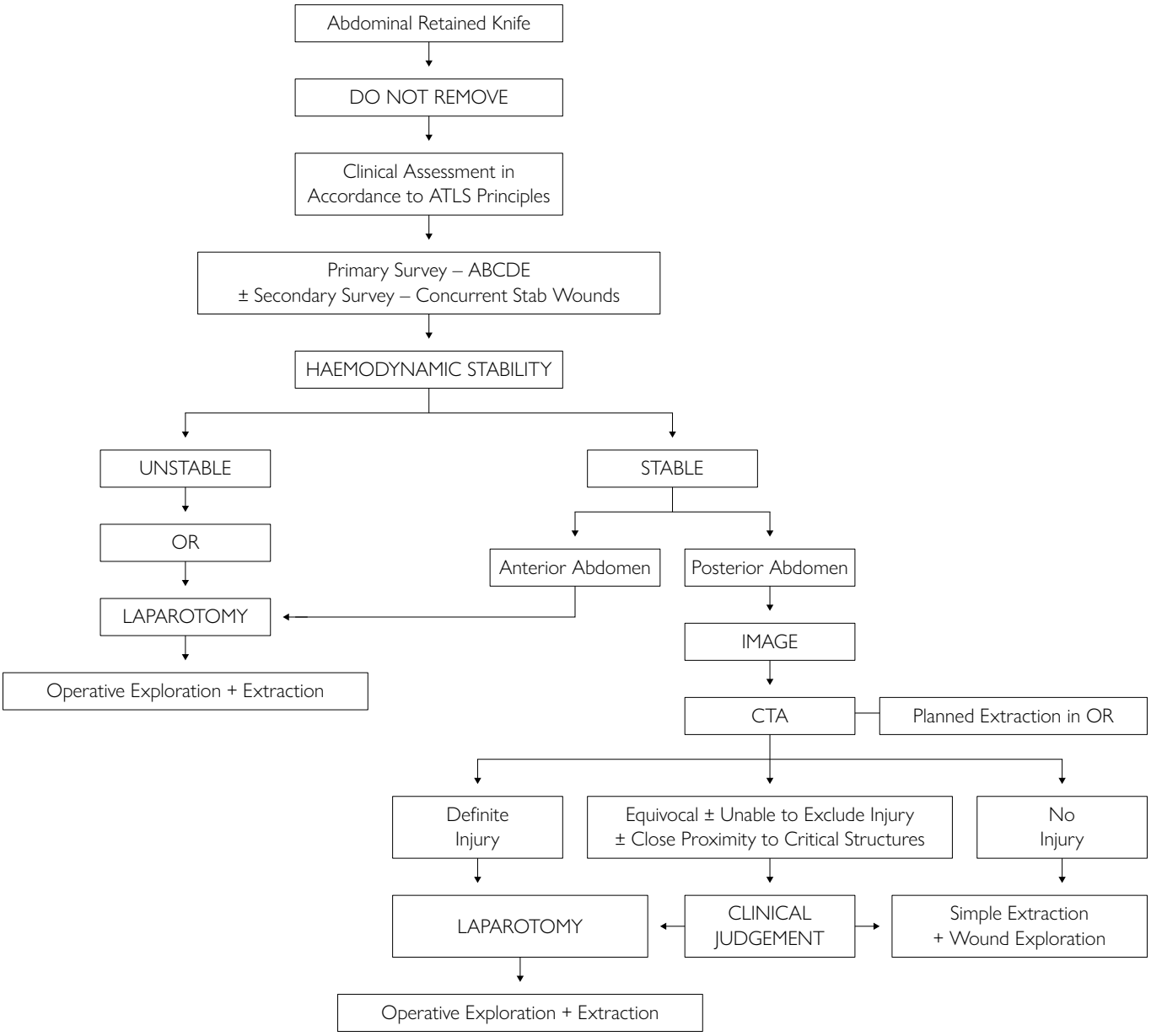

Figure 3: Algorithm for management of abdominal SW with retained knife.

with a retained knife had intra-abdominal injuries.[3] However, in cases of a retained knife in the posterior abdomen, the clinical scenario is very different. The thick musculature and bony vertebrae offer a degree of protection, making a significant intra-abdominal injury less likely. The incidence of intra-abdominal injury is approximately 33% based on previous published series.[3] If there is an injury it may be retroperitoneal, subtler, and difficult to detect clinically or by wound exploration alone. A CT scan in this setting is useful and may help avoid unnecessary laparotomy. A retained blade is more common in the posterior abdomen as it may be lodged in the bony vertebral body.[3] Patients with a posterior abdominal SW with a retained knife should be placed on the trolley in the resuscitation room either laterally or prone to prevent the knife from accidentally being advanced further. All CT scans in these patients should be performed with the patient prone.

Operative management

The operative management of abdominal SW with a retained knife is divided into two procedures. Simple extraction and wound exploration (SEWE) is defined as withdrawal of the retained knife along the path of its trajectory, without operative exploration. This is followed by wound irrigation and or closure. Operative exploration and extraction (OEE) is defined as formal exploration of the abdomen via midline laparotomy, followed by extraction. Additional procedures to address any associated injuries may be undertaken at this point. These may include, but are not limited to, repair of injuries such as hollow viscus perforation.

As discussed earlier, a patient with anterior abdominal SW and associated retained knife should undergo a laparotomy i.e. OEE, without further investigations, regardless of haemodynamic stability. Patients with a posterior abdominal SW with a retained knife who are haemodynamically normal should undergo a CT. Once in the operating theatre, the patient should be induced to undergo endotracheal intubation performed in the lateral position. Once the airway is secured, further positioning depends on the planned procedure. For OEE, the knife is extracted in the lateral position and the patient then placed supine for the laparotomy. For SEWE, the patient is kept in lateral position or turned prone, at the discretion of the operating surgeon.

Other considerations

The removal process also places the surgeon at risk and care must be taken to avoid injury to staff involved in the removal process. The author's preference is a "no touch technique" employed utilising two large Northfield Bone Rongeurs or heavy forceps. The knife itself is

often contaminated and can contain embedded clothing and other materials. The overall wound sepsis rate is as high as 14%.[3-5] Prophylactic antibiotics and thorough wound irrigation are critical.

Key learning points

1. Uncontrolled extraction of a retained abdominal knife outside of the operating room must be avoided at all costs.
2. Those with haemodynamic instability and/or generalised peritonitis should be expedited to the operating theatre without further imaging.
3. Preoperative cross-sectional imaging helps identify injured structures and planning extraction.
4. Simple extraction and wound exploration or operative exploration and extraction are largely determined by the injury.
5. Retained knives in the anterior abdomen usually require formal laparotomy but is often not necessary for retained knives in the posterior abdomen.

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About the author

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