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Gastrointestinal anastomosis (GIA) stapler as a safe and efficacious damage control tool for high-grade liver injury in hemodynamically unstable patient- A case report

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ABSTRACT

INTRODUCTION: Liver injury occurs in approximately 5% of all trauma admissions. There are many traditional ways of controlling hemorrhage from the liver and here we report a case in which a GIA 75 stapler was successfully used to manage Grade IV liver injury in a hemodynamically unstable patient.
PRESENTATION OF CASE: 45 years old policeman presented in the emergency, after sustaining a gunshot injury to his abdomen. At presentation, he was hemodynamically unstable and had a single entry wound in the epigastrium. He was rushed to the operating room (OR) for exploratory laparotomy which revealed a shattered left lobe of the liver. Gastrointestinal anastomosis 75 stapler device was used for non-anatomical left segmentectomy (segments I and II). Perihepatic packing was done and the patient shifted to the surgical intensive care unit (SICU). He was re-explored within 24 h. No active bleeding was seen after the packs were removed and the abdomen was closed. The next day he was moved out of SICU and was discharged on the 10th day of admission.
DISCUSSION: The concept of damage control surgery rests on quick control of life-threatening bleeding and a GIA stapler can be effectively used for rapid non-anatomical resection of the liver in trauma. This can prevent the depletion of physiological reserves and the life-threatening death triad.
CONCLUSION: GIA stapler device is an effective, safe, and rapidly deployable tool for managing high-grade liver injury in a hemodynamically unstable patient.

1. Introduction

Liver injury occurs in approximately 5% of all trauma admissions [1]. Large surface area and more anterior location beneath the subcostal margin make the liver a more susceptible organ to sustain both blunt or penetrating injuries. The management of liver trauma continues to evolve with improved techniques of diagnosis and management, both operatively and nonoperatively. However, high-grade liver injuries which include major parenchymal disruption, retrohepatic venous injuries, and those involving the portal triad continue to remain a challenge and despite technological advances, associated with high mortality [2]. Therefore, despite our progress in liver injury management, many avenues for improvement remain to be explored.

Operative management for managing Grade IV hepatic injuries and non-responders associated with active hemorrhage and hemodynamic instability includes multiple surgical techniques ranging from initial packing, manual compression, Pringle's maneuver, direct suturing, balloon inflation, use of energy devices to ligation of vessels and hepatic resection [3]. We report a case of a patient as per SCARE 2018 criteria [4], who sustained a high-grade hepatic injury and underwent damage control surgery, where the GIA stapler device was used to perform non-anatomical liver resection and control active bleeding. This uncommon method of managing liver injuries was found to be safe, effective, and more importantly time-saving for the patient.

2. Presentation of case

A 45 years old policeman, with no prior medical and significant family history, was brought to the trauma bay in the ER after sustaining a single gunshot injury to his abdomen from a high-velocity weapon. The incident occurred while pursuing a terrorist in Karachi, early morning at around 6.30 Am. He was shifted to the Emergency room of a tertiary care hospital within 20 min after sustaining the injury.

On arrival, advanced trauma life support system protocols were initiated and immediate resuscitation was started. During the examination, he was agitated with a heart rate of 100 beats/min,

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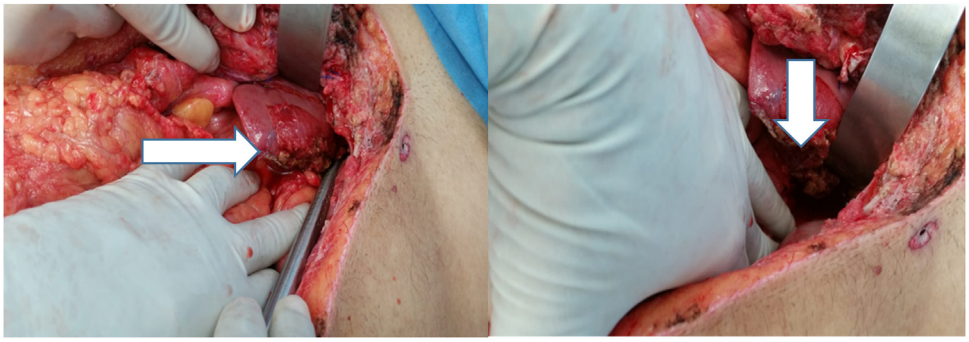

Fig. 1. (a) shows the resection end of the liver with an intact stapled line, Fig. 1(b) shows dry entire surgical filed without evidence of bleeding.

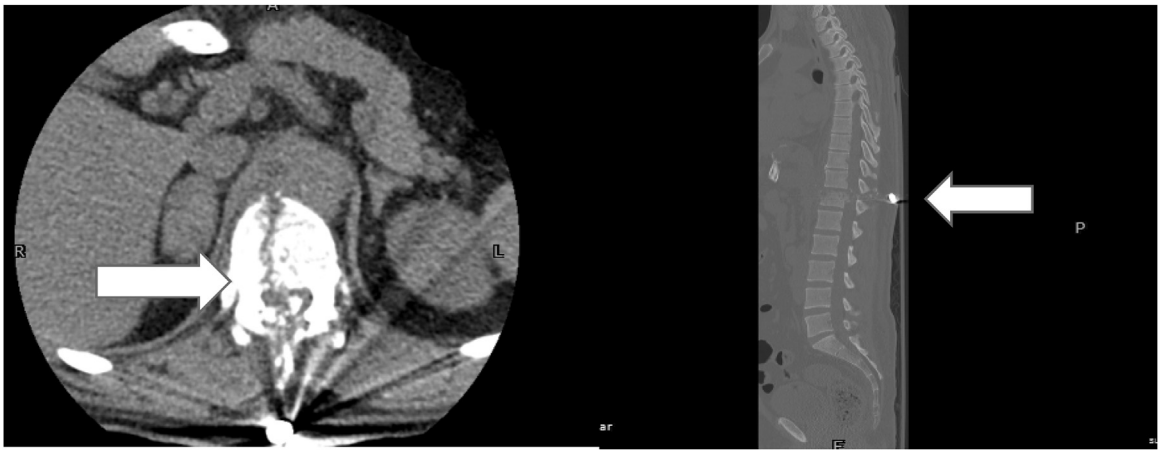

Fig. 2. a shows the CT spine with a burst fracture of the D12 vertebra with complete cord transection, Fig. 2.b shows a sagittal section of the CT spine with the bullet at the tip of the spinous process of the D12 vertebra.

BP of 70/35 mm Hg, and respiratory rate of 30 breaths per minute. Abdominal examination showed a single entry wound on his mid-epigastrium, 3 cm below the xiphoid process, and no exit wound identified. There was generalized tenderness with distension and absent gut sounds. He had numbness in his lower legs and unable to move his bilateral lower limbs. A lax anal tone was also found on the digital rectal examination and the findings were suggestive of spinal injury as well. Fluid resuscitation was initiated but he did not respond hence massive transfusion protocol (MTP) was activated and an immediate decision was taken to move him to the operating room (OR) for exploratory laparotomy by the trauma team, which was lead by consultant trauma and acute care surgeon.

In OR, an exploratory laparotomy was performed by a mid-line incision starting from the xiphoid process to 4 cm below the umbilicus. All 4 quadrants were packed and the source of bleeding was identified to be the hepatic parenchyma. The incision was extended to the right subcostal area for better exposure and mobilization of the liver. Meanwhile, uncrossed match blood was transfused with a ratio of 3:3:3, packed RBCs, FFPSs, and platelets, and immediate decision for damage control surgery was made. After stabilizing the mean arterial pressure (MAP) at 55, packs were carefully removed. On exploration, segments II and III of the liver were completely fractured with normal-looking parenchyma without any evidence of intrinsic parenchymal disease like cirrhosis. However, active pooling of blood was noted underneath the liver. Peri-hepatic packing failed to control the bleed and gastrointestinal anastomosis (GIA 75) stapler used for non-anatomical segmental resection of the liver. Three GIA 75 cartridges with 4.8 mm staple height were used for this purpose and resection of the shattered liver provided exposure to the bleeding vessels. Tributaries of the left hepatic vein and some branches to IVC were actively bleeding which were suture ligated with vicryl 2/0. Adequate hemostasis was controlled and other viscera were inspected. No other visceral injury was identified. Intraoperative arterial blood gas showed a pH. of 7.29 and the patient had hypothermia of 35 degrees centigrade. His abdomen was temporarily packed and closed with a vacuum dressing.

He was shifted to ICU for the correction of physiological disturbances where he responded very well and improved. The next day he was taken back to OR for the definitive procedure and fascial closure. As shown in Fig. 1 (a and b) there was no active bleeding, no pooled blood, and no evidence of bile leakage from cut ends of the liver. The abdomen was irrigated and 13 Fr Jackson Pratt drain was placed in the subhepatic location.

The patient was extubated the next day and stepped down to a high dependency unit and later in the general ward. To investigate his spinal injury, a CT scan spine without contrast was done which showed a burst fracture of the vertebral body of D12 with complete cord transection and bullet in the subcutaneous location at the tip of the spinous process of D12 (Fig. 2.a and b).

Rehabilitation and physiotherapy were started for the spinal injury. The patient was discharged on the 10th day of admission and later followed in the clinic where his bullet was removed under local anesthesia. He was tolerating diet and had normal bowel movements. His skin staplers were removed and he was advised to continue physiotherapy. His final histopathology specimen reported a segment of the liver that measures 12 × 6 × 3 cm (length, breadth, and height) with multiple lacerations without any evidence of parenchymal disease. He has been followed up for 1 year and has developed no long term complications.

Fig. 3. a shows the resection of liver parenchyma with help of a GIA stapler. Fig. 3.b shows the resected part of the liver (Source internet).

3. Discussion

The use of Stapling devices in surgical procedures is very common nowadays, it is not only safe and effective but reduces overall operative time. In hepatobiliary surgery, the operative technique plays a significant role in overall morbidity and mortality. Various types of staplers are in use for hepatobiliary procedures [5]. Their role is well established for transection of hepatic vessels but the use of staplers for resecting liver parenchyma has only been gradually introduced and still debatable. The potential complications from the use of staplers in hepatic resection are blood loss due to incomplete sealing of vessels or tearing of a major vein while placing the device. However, recent publications have reported the use of staplers as safe and efficient as it decreases the amount of blood loss, total operative time dramatically, the overall cost of the procedure, and also eliminates the need to do a Pringle maneuver or other vascular control [6]. It has also been found to reduce the incidence of bile leak or biloma.

The use of staplers to divide hepatic vessels during hepatectomy is viewed as an accomplishment that has helped in reducing major blood loss while performing elective resection. Furthermore, segmentectomies and wedge resections performed with stapler also showed promising results [7]. Schemmer et al. [8] in their series of 416 patients of elective liver resection reported that the use of endo GIA stapler as a safe and effective technique for liver resection with a mortality rate of around 4% and biliary fistula complication rate around 7%. Although they were all elective oncological cases, the median value of blood loss was around 700 mL.

During a trauma laparotomy, the surgeons' main aim is to control the hemorrhage. The procedure is highly dependent upon the skills of the surgeon and the equipment available. The total time taken to achieve hemostasis plays a critical role in the management of all types of major hemorrhage as delays can bring about and propagate the lethal triad of trauma. Outcomes of hepatic injuries greatly depend upon the grade of liver injury and fatal outcomes have been observed with Grade IV and above liver injuries. Massive hemorrhage from liver injury results in significant mortality ranges from 10% to 15% [9].

The surgical technique for performing stapled resection of liver parenchyma is simple and easy to learn. In non-anatomical and non-oncological resection of the liver, especially in the setting of trauma, the injured and devascularized portions of the liver parenchyma are removed peripheral to the fracture line, leaving just one surface, requiring suture or ligation of bleeding vessel. The liver tissue can be fractured stepwise with a clamp if the parenchyma is too thick to accommodate the GIA stapler [8]. Liver parenchyma is then subsequently divided with GIA staplers as shown in Fig. 3a and b.

The goal of the operative management of liver trauma is to achieve adequate hemostasis, minimize contamination and bile leak and initiate damage control resuscitation as soon as possible. The use of stapler devices for hepatic resection can be feasible and rapidly achieve the desired outcome. Our patient did not develop any short or long term complications after the procedure and recovered uneventfully.

4. Conclusion

GIA stapler device is an effective, feasible, and safe instrument in providing rapid control of hemorrhage in cases of high grade live injuries in a hemodynamically unstable patient. Controlled clinical trials should be done to investigate the safety and efficacy of this operative technique in trauma surgery. Additionally, the increase in the operative procedure cost with the use of staplers needs to be compared with the cost reduction due to the decrease in the total operative time.

Declaration of Competing Interest

We declare that we have no conflict of interest.

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We did not receive any funding for this study.

Ethical approval

Exemption was soughted from Ethical review committee (ERC) of Aga Khan University Hospital Karachi with ERC no 2020-5109-14294. ERC letter is attached with this submission.

Consent

Written informed consent was taken from patient and a copy of it is available to Editor in chief.

Author contribution

The concept of reporting the case, seeking consent, and drafting the main manuscript was done by Dr. Sabah Saqib.

Dr. Wafa Iftekhar contributed to collecting and writing patient information which includes presentation in Emergency room.

Dr. Hasnain Zafar, the primary attending surgeon, proofread the article and provided the final approval.

All above authors were also part of surgery of patient.

Registration of research studies

This is a case report and was not an experimental or observational study which requires registration. This is not a research study.

Guarantor

Sabah Uddin Saqib, corresponding author will be main guarantor in this study.

Provenance and peer review

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