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Surgical Care of a Young Man with a Gunshot Wound of the Abdomen

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1. Abstract

An 18-year-old male sustained an isolated gunshot wound to the abdomen with an entrance wound in the right lower quadrant. He was transported to a level 1 trauma center from an outlying hospital. He received tranexamic acid (1 gram) during transport. At the time of admission, he was alert and able to follow commands. The initial vital signs revealed Blood pressure - 136/110 Pulse-90 Respirations -21 and a temperature-97.9 degree. An initial FAST was positive. The CXR was clear. An arterial blood gas was performed with a base deficit of 0. The hemoglobin was 11.3 with a platelet count of 138,000. The patient was taken to the operating room for exploration with a unit of packed cells infusing.

2. Case Report

A midline incision was made. Large volume hemoperitoneum was evacuated and obvious bleeding from the right lobe of the liver was evident. The right and left upper quadrants were packed and resuscitation continued. The packs to the right lobe of the liver were removed. A grade IV liver injury was evident. The portal triad was looped with a 1-inch penrose drain (encircling the hepatoduodenal ligament). In-flow occlusion was achieved with a curved Debakey clamp. Bleeding from the liver (segments 5 and 8) slowed significantly and hepatorrahphy was performed using clips and 3-0 silk suture. # 1 chromic liver sutures were utilized to provide additional hemostasis at the dome of the right lobe. The Pringle maneuver was utilized for a total of 28 minutes and on release of the clamp, minimal oozing was evident. A large Zone 2 retroperitoneal hematoma was evident and expanding. The right colon was mobilized and active bleeding coming from a rent in Gerotas fascia was noted. The hemotoma was evacuated. Bleeding from the right renal hilum was evident (Grade V). A right nephrectomy was then performed ligating and dividing the renal artery, the renal vein and the right ureter. Once hemostasis was secured the stomach and duodenum were evaluated. A grade II duodenal perforation in the first part of the duodenum was evident. This was a tangential injury and was repaired in two layers using 3-0 vicryl for the initial layer followed by 3-0 silk. A Kocher maneuver was performed with a thorough evaluation of the second and third portion of the duodenum along with the pancreas. The small bowel was run from the ligament of Trietz to the ileocecal valve. No further injuries were detected. The colon was evaluated in it's entirety and no colonic injury was evident. The packs previously placed in the left upper quadrant were removed and the spleen was intact. The lesser sac was entered through the gastrocolic ligament and the back wall of the stomach and pancreas were without injury. 200 cc's of saline along with 2cc's of methylene blue was instilled into the stomach. No leakage from the duodenal repair was noted. Intraoperatively the patient received 6 units of packed cells, 6 units of fresh frozen plasma, 1 cryoprecipitate and 2 platelet packs. The estimated blood loss was 1500 cc's. Two drains were placed in the hepatorenal space and brought out through a separate stab wounds. The midline fascia was closed with a running looped #1 PDS. The skin was closed with staples. The patients' post-operative course was benign. The urinary catheter placed at the time of surgery was removed on day two. The urine was clear at that time. The abdominal drains was removed prior to discharge. He was discharged to home after a 6 day hospital stay eating and having normal bowel activity.

3. Discussion

The operative care for this patient may be characterized as routine but the principles demonstrated should be highlighted. First this patient arrived with a narrow pulse pressure. This can be a harbinger of ongoing hemorrhage and has been associated with the need for transfusion [1]. A positive abdominal ultrasound in combination with penetrating abdominal trauma fulfill two criteria for initiating a massive transfusion protocol using the Assessment of Blood Consumption scale [2]. This is an essential step in making certain that adequate resources are available for intra-operative and post-operative care. Third, there was no need for CT imaging in this instance as mandatory exploration was clearly indicated.

Regarding the sequencing of intra-operative steps; the first priority is to stop on-going hemorrhage. Packing the liver is essential and often effective in this regard [3]. Bleeding from the liver was addressed initially. In-flow occlusion will provide both diagnostic information and a therapeutic advantage [4]. If bleeding stops it implies hemorrhage from a portal venous source or a hepatic artery source. If the left hepatic artery arises from the left gastric, clamping the hepatoduodenal ligament will not control this bleeding. Exploration of the laceration with clipping or suturing small vessels and biliary radicles is effective. Liver sutures placed parallel to the laceration may aid in hemostasis. The Pringle maneuver (in-flow occlusion) should be time limited as additional ischemic injury to the liver is best avoided if possible [5]. Exploring an expanding retroperitoneal hematoma is critical and in this instance a right nephrectomy provided definitive treatment of the bleeding hilar injury [6,7]. Placing drains in the region of the hepatorrhaphy provides a way to monitor for continued hepatic hemorrhage and may provide egress for bile accumulations in the post-operative period.

A careful hollow viscus evaluation must be done in the setting of penetrating injury. Evaluating the entire small bowel and colon is mandatory in performance of a trauma laparotomy.

In this instance the duodenal perforation (tangential in nature) was detected and repaired uneventfully. Checking the repair with the used of methylene blue is a helpful adjunct [8].

Another important adjunct was the pre-hospital administration of TXA. Crash 2 data provided a clear signal that early administration of tranexamic acid is associated with decreased mortality from hemorrhage [9]. A second dose administered after admission is recommended. It was not utilized in this instance as the source of bleeding was controlled and adequate coagulation factors were administered.

In summary this case reviews the care of a young man who sustained an isolated gunshot wound to the abdomen without an exit. He sustained a Grade V right kidney injury and a Grade IV right lobe of liver injury with a Grade II duodenal injury. In-flow occlusion of the portal triad was performed and hepatorrahphy achieved. A right nephrectomy was performed for on-going hemorrhage from the hilum of the right kidney. The duodenum was repaired and his post-operative course was uneventful.

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