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Experience of Conservative Management of Abdominal Solid Organ Blunt Trauma

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ABSTRACT

Abdominal solid organs like liver, spleen and kidneys are one of the most vital organs of the human body. Liver is the second largest organ of human body with about 2 percent of body weight in adults. The spleen is the largest organ of the lymphatic system. Both the kidneys together represent 0.4 percent of the total body weight. They perform many of the vital functions involving excretion and detoxification, coagulation, immune function, absorption and storage of essential minerals and storage and filtration of blood. Injury to the liver, spleen and kidneys are one of the most common solid organ injuries in blunt trauma. The expected line of management includes initial diagnostics and resuscitation in the emergency room (including chest and pelvic X-ray, and bedside ultrasonography) followed by cross-sectional imaging (protocol-based trauma imaging with CT and contrast-enhanced multiphase protocols according to need). Initial resuscitation should be done in parallel with monitoring of vital signs with observation preferably in an ICU or high-dependency ward until definitive imaging and reporting has been completed and a management is planned. Treatment should be planned as per age, presence of co-morbidities, and changes in physiological status of the patient. Non-operative management should be preferred in patients of all ages irrespective of the grade of injury and in the absence of other abdominal injuries requiring interventions provided that the haemodynamic status is stable.

Keywords: Abdominal, solid, liver, spleen, kidney, injury, non-operative

INTRODUCTION

Liver is the second largest organ of human body with about 2 percent of body weight in adults. It receives its blood supply from two sources: 80 percent is delivered by the portal vein, which drains the spleen and intestines and the remaining 20 percent, the oxygenated blood, is delivered by the hepatic artery. Based on Couinaud classification, the liver is divided into eight independent functional segments. Each segment has its own portal pedicle consisting of the hepatic arterial branch, portal branch, and the bile duct with a separate hepatic venous branch that provides outflow[1]. Functions of liver are secretion of bile; metabolism of bilirubin; vascular and haematological functions like storage of blood; synthesis of prothrombin, fibrinogen and clotting factors; detoxification, storage of vitamins and minerals and immunological functions[2].

The spleen is the largest organ of the lymphatic system measuring about 10 cm to 12 cm and weighing about 150 g to 200 g. It is situated between the fundus of the

stomach and the diaphragm in the left hypochondriac region of the abdominal cavity, relatively below the left costal margin between 9th and 11th ribs. It is densely vascularised and covered in a weak outer connective tissue capsule which allows for protection and also the expansion of the organ. The hilum contains nerves, splenic vessels, attachments for the splenorenal and gastrosplenic ligaments. Functions performed by spleen include filtering of blood, removing microbes and inadequate red blood cells (RBCs), producing white blood cells (WBCs), and antibody synthesis. The spleen consists of 2 different tissue types, termed white pulp and red pulp. The white pulp tissue is involved with the production and maturity of WBCs, particularly lymphocytes (types B and T) and thereby the production of antibodies. The red pulp tissue is involved more so with the filtering aspect of the blood by removing old, damaged, and/or useless red blood cells.

Each of the two kidneys weigh approximately 150 g in adults and both together represent 0.4 percent of the total body weight. Each kidney is supplied by a single renal artery originating from the abdominal aorta. Renal artery branches to form anterior and posterior divisions at the hilus and further divides to interlobar arteries, arcuate arteries and interlobular arteries. Kidney performs the function of filtration, reabsorption, and secretion to keep the organism in balance in terms of water, minerals, electrolytes, and hydrogen ion concentration and eliminate the toxic substances produced by the body. The major known hormonal functions of the kidney influence blood pressure, calcium metabolism, and red blood cell production.[5]

Injury to the liver, spleen and kidneys are one of the most common solid organ injuries in blunt trauma. The severity of injury is classified by the extent of disruption of the organ anatomy, as described by the American Association for the Surgery of Trauma (AAST) Organ Injury Scale. During the primary and secondary survey in an injured patient there is always a chance of potential dynamic alteration in the event of ongoing haemorrhage due to the primary injury or additional injuries and co-morbidities. The expected line of management includes initial diagnostics and resuscitation in the emergency room (including chest and pelvic X-ray, and bedside ultrasonography) followed by cross-sectional imaging (protocol-based trauma imaging with CT and contrast-enhanced multiphase protocols according to need). Initial resuscitation should be done in parallel with monitoring of vital signs with observation preferably in an ICU or high-dependency ward until definitive imaging and reporting has been completed and a management is planned[6].

Treatment should be planned as per age, presence of co-morbidities, and changes in physiological status of the patient. Non-operative management should be preferred in patients of all ages irrespective of the grade of injury and in the absence of other abdominal injuries requiring interventions provided that the haemodynamic status is stable. This requires close cooperation between all team members (surgeon, anaesthetist, intensivist, interventional radiologist, nurse staff, and coordinators) and intermittent reassessment of the patient. Age above 55 years, polytrauma with a high burden of injury, and moderate-to-high splenic injury are associated with failure of non-operative management. These patients warrant extra vigilance to change in physiology, with a low threshold for surgery. Anticoagulative/ antiplatelet treatment is another obvious risk factor, and adequate transfusion and antidote measures might need to be taken. Patients who are haemodynamically unstable (for example, with severe hypotension, tachycardia, loss of consciousness) with no response to resuscitation should be taken to the operating theatre for trauma laparotomy[7,8,9].

The following study is a case series on the experience of five cases which are managed conservatively successfully in the Department of Surgery of Jorhat Medical

College and Hospital, a tertiary care centre of rural Assam, India between June and December 2023

CASE SERIES

CASE 1:

A 29 year old male patient had an RTA 2 hours prior to admission. On arrival at the casualty, patient was semi-conscious with tachycardia, tachypnea, hypotension with a GCS of E2V2M6. After initial resuscitation, CECT whole Abdomen was done which showed a laceration of 2.9×2.3 cm in the anterior aspect of upper pole of spleen with contusion. The was perisplenic haematoma of 15.4 mm in thickness (figure 1). So, it was splenic injury of grade 2. The patient was initially managed in ICU with antibiotics, antianalgesics with resuscitation with packed RBCs and fresh frozen plasma with strict immobilization and taking care for bedsores. Regular monitoring of vitals is done. The patient was shifted to ward a week later with return to mobilization and was discharged 7 days later. Follow-up was done at 2 weeks and 6 weeks.

Figure 1: Splenic laceration (black arrow) with perisplenic haematoma (green arrow)

CASE 2:

A 19 year old male patient had an RTA 6 hours prior to admission. On arrival at the casualty, patient was semi-conscious with tachycardia with a GCS of E3V4M6. The blood pressure and respiratory rate was normal. After initial resuscitation, CECT whole Abdomen was done which showed ill-defined non enhancing hypodense area of 2.8 cm depth involving the anteroinferior pole of the spleen at the level of 10th left rib. There was associated intraparenchymal haematoma of size 35×25 mm.(approx.) with minimal haemoperitoneum. Splenic hilum is intact. So, it was splenic injury of grade 2. There was fracture of both bones of left forearm with multiple soft tissue injuries. The patient was initially managed in ICU with antibiotics, antianalgesics with resuscitation with packed RBCs and fresh frozen plasma with strict immobilization and taking care for bedsores. Regular monitoring of vitals is done. The patient was shifted to ward a week later with return to mobilization and was discharged 7 days later. Follow-up was done at 2 weeks and 6 weeks.

CASE 3:

A 47 year old male patient had an RTA 6 hours prior to admission. On arrival at the casualty, patient was conscious with tachycardia with a GCS of E4V5M6. The blood pressure and respiratory rate was normal. After initial resuscitation, CECT whole Abdomen was done which showed a small parenchymal laceration of depth 4mminvolving posterior-superior aspect of upper pole with sub-capsular haematoma involving whole of the splenic surface. Splenic hilum is intact. So, it was splenic injury of grade 1. There was associated fracture of left 7th and 8th rib. The patient was initially managed in ICU with antibiotics, anti-analgesics with resuscitation with packed RBCs and fresh frozen plasma with strict immobilization and taking care for bedsores. Nebulization is done for minimal bilateral pleural effusion Regular monitoring of vitals is done. The patient was shifted to ward a week later with chest physiotherapy and return to mobilization and was discharged 7 days later. Follow-up was done at 2 weeks and 6 weeks.

CASE 4:

A 55 year old female patient had an RTA 3 hours prior to admission. On arrival at the casualty, patient was semi-conscious with tachycardia, tachypnea, hypotension with a

GCS of E2V1M5. Abodomen was firm with intact bowel sounds on examination. After initial resuscitation, CECT whole Abdomen was done which showed a deep lacerations involving right lobe of liver approx 2-4 cm. There was associated non-enhancing intra-parenchymal laceration (haematoma) 8×6 cm in the right lobe of liver adjacent to the lacerated area. No evidence of vascular pedicle injury, devascularisation and peri-hepatic collection (figure 2). So, it was liver injury of grade 3. There was associated right sided 6th rib fracture. The patient was initially managed in ICU with antibiotics, antianalgesics with resuscitation with packed RBCs and fresh frozen plasma with strict immobilization and taking care for bedsores. Regular monitoring of vitals is done. The patient was shifted to ward two weeks later with return to mobilization and was discharged 7 days later. Follow-up was done at 2 weeks and 6 weeks.

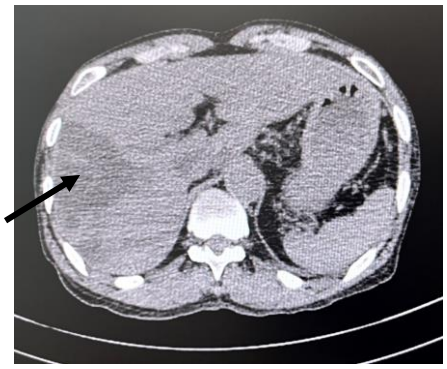

Figure 2: Deep laceration involving right lobe of liver with associated intra-parenchymal haematoma (black arrow)

CASE 5:

A 17 year old male patient had an RTA 3 hours prior to admission. On arrival at the casualty, patient was conscious with tachycardia and tachypnea with a GCS of E4V5M5. Abdomen was mildly distended with intact bowel sounds on examination. After initial resuscitation, CECT whole Abdomen was done which showed linear hypodense non-enhancing areas in segment VI of liver with maximum depth of 24 mm. Minimum collection noted in the adjacent subcapsular space along the inferior margin of segment VI projecting into the hepatorenal pouch. So, the impression is AAST grade II liver injury in the form of parenchymal lacerations and small sub-capsular haematoma and mild haemoperitoneum. No evidence of vascular pedicle injury, devascularisation and peri-hepatic collection (figure 3). The patient was initially managed in ICU with antibiotics, antianalgesics with resuscitation with packed RBCs and fresh frozen plasma with strict immobilization and taking care for bedsores. Regular monitoring of vitals is done. The patient was shifted to ward two weeks later with return to mobilization and was discharged 7 days later. Follow-up was done at 2 weeks and 6 weeks.

Figure 3: Parenchymal laceration associated with subcapsular haematoma (black arrow)

DISCUSSION

The study conducted by S Buci *et al* showed that out of the 173 patients with liver trauma, 83.2% were male. Principal cause was motor vehicle crashes (50.9%). Blunt trauma was the cause 129 cases (74.6%), and penetrating trauma occurred in 44 cases (25.4%). Initially 88 cases (50.9%) were managed conservatively. This approach was successful in 73 cases (42.2%) and failed in 15 cases (17.2%). The success rate of conservative treatment by grade of injuries was as follows: grade I (38.4%), grade II (30.1%), grade III (28.8%), and grade IV (2.7%) ($p < 0.00001$) associated intra-abdominal injuries ($p = 0.00051$). The study concluded that likelihood of success in using conservative treatment had a significant correlation with the grade of liver injury and associated intra-abdominal injuries. The limited hospital resources and low level of consensus on conservative

treatment had a negative impact on the level of success.[10] Similar findings were derived in the study conducted by A Okus *et al* which showed that Nonoperative treatment in abdominal trauma is safe and effective. Patients with clinical stability and normal physical examination findings can be treated nonoperatively with close monitoring.[11] The findings of our study are similar to both these studies.

Another study done by S Arslan *et al* concluded that conservative management should be preferred in patients with liver injuries who are hemodynamically stable. Conservative management has some advantages, including shorter duration of hospital stay, less need for blood transfusion and lower morbidity and mortality rates.[12] Similar findings were concluded in the study conducted by E Leevan *et al*.[13] In our study, close monitoring of all the patients was done so that homeostatic instability can be corrected if present. The study conducted by S Corn et al concluded that embolization of patients had the lowest rates of complications and mortality compared to those undergoing surgery.[14]

Another study conducted by S Arslan *et al* had similar findings to our study and showed that a large proportion of splenic injuries recover with conservative therapy with advantages which include short hospitalization time, less need for blood transfusion, and less morbidity and mortality.[15]

The studies conducted by E Leevan *et al* and C Lanchop *et al* recommended new minimally invasive techniques including angioembolization, stenting, and percutaneous drainage. However, the studies acknowledge role for open surgical exploration in patients with haemodynamic instability or those who fail initial conservative/minimally invasive management.[16,17] Another study conducted by R Veeratterapillay et al provided similar recommendations.[18] Our study also concluded similar findings

CONCLUSION

Conservative management of abdominal solid organs like liver, spleen and kidneys are important for maintain homeostasis of the body as they perform many vitals functions for survival. However, for high grades of injury with haemodynamic instability, operative management is the way forward. Recent studies showed upcoming minimally invasive techniques for management of abdominal solid organ trauma. However, further studies are required in this aspect.

Declaration by Authors

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