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SHOULD ANGIOGRAPHY BE ROUTINELY EMPLOYED IN HIGH GRADE LIVER INJURIES UNDERGOING DAMAGE CONTROL SURGERY?

HASAR KONTROL CERRAHİSİ SONRASI ANJİYOGRAFİ RUTİN OLARAK YAPILMALI MIDIR?

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ÖZET

Giriş: Karaciğer travmalarına yaklaşım klinik takipten hasar kontrol cerrahisine kadar değişiklik göstermektedir. Bu çalışmanın amacı, hasar kontrol cerrahisi uygulanan hastalara anjiyografi rutin olarak yapılmalı mıdır yoksa depacking sonrası kanama olursa yapılmak üzere beklenilmeli midir sorusuna cevap aramaktır.

Method: Ocak 2000 ve Aralık 2010 tarihleri arasında künt veya penetran karaciğer yaralanması tanısı ile kliniğimize başvuran ve hasar kontrol cerrahisi uygulanan hastalar çalışmaya dahil edilmiştir. Hastaların demografik verileri, travma mekanizması, şok durumu, injury severity skoru (ISS), karaciğer yaralanma derecesi, eşlik eden yaralanmalar, anjiyoembolizasyon, hastane yatış süresi, depacking zamanı ve mortalite bilgileri kayıt altına alınmıştır.

Sonuçlar: Çalışmaya 513 karaciğer yaralanması olan hasta dahil edilmiştir. Bu hastalardan 60'ına hasar kontrol cerrahisi uygulanmıştır. Yirmibir hastaya anjiyoembolizasyon yapılmıştır. Yüksek ISS ile ilişkili olarak şok durumu ($p=0.009$) ve eşlik eden organ yaralanmaları ($p<0.001$) anlamlı bulunmuştur. En sık eşlik eden yaralanma ekstremite yaralanmaları olup, anjiyoembolizasyon yapılan grupta mortalite oranı % 19, anjiyoembolizasyon yapılmayan grupta % 14 olarak saptanmıştır ($p=0.369$).

Tartışma: Hasar kontrol cerrahisi sonrası karaciğer yaralanmalarının çoğunda anjiyoembolizasyon yapılması gerekmemiştir. Anjiyoembolizasyon depacking sonrası kanaması devam eden olgular için saklanmalıdır.

Anahtar kelimeler: Anjiyografi; embolizasyon; travma; packing.

ABSTRACT

Objective: The management of traumatic liver injuries involves various strategies ranging from observation to operative intervention and includes various options such as angiography and/or damage-control surgery. In this study, we aimed to clarify whether routine angiography is necessary or can be reserved for selected patients with persistent bleeding after depacking.

Methods: During the 11-year period from January 2000 to December 2010 all patients with blunt or penetrating trauma who sustained a liver injury and underwent a damage control laparotomy in our institution were retrospectively reviewed. Following variables were extracted from patient charts: demographics, the mechanism of injury, shock status, Injury Severity Score, liver injury grades, associated injuries, angioembolization, duration of hospitalisation, time to depacking, mortality. Angioembolization.was performed when persistent bleeding was encountered after depacking.

Results: A total of 513 patients with hepatic injury were admitted during the study period. Damage control surgery was undertaken in 60 patients, of whom 21 patients underwent angioembolization. The factors associated with a high Injury Severity Score were admission in shock status ($p=0.009$) and associated organ injuries ($p<0.001$). Extremity injury was the most commonly encountered associated injury (n=15, 25.0%). In the damage control surgery group, mortality was not significantly different between angioembolization (n=4, 19%) and non-angioembolization (n=14, 33%) groups ($p=0.369$).

Conclusion: The most patients with abdominal packing after liver trauma may not require routine angiography. Angioembolization may be used selectively in patients with persistent bleeding after depacking.

Key words: Angiography; embolisation; trauma; packing

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INTRODUCTION

The management of liver injuries involves various strategies ranging from observation to operative intervention and includes various options such as angiography, and damage-control surgery (1,2). The incorporation of interventional radiologic techniques, particularly angioembolization (AE), represents a logical extension of modern damage control techniques (3-5). Before 90's mortality rates of complex hepatic trauma varied between 30-60%, which currently decreased as far as 10-15% (4-8).

In a small series, the successful use of AE was documented in 75% of patients after damage-control surgery with a large number of subsequent liver-related complications (6). In this study, we aimed to clarify if hepatic angiography is always necessary before depacking or could be reserved for selected patients undergoing hepatic packing during a damage control surgery.

METHODS

After obtaining institutional review board approval, all patients admitted to Trauma and Emergency Surgery Service, Istanbul School of Medicine, Istanbul University during the 11-year period from January 2000 to December 2010 with blunt or penetrating trauma undergoing a damage control laparotomy were reviewed retrospectively.

Following variables were extracted from chart review: demographics, the mechanism of injury, shock status, Injury Severity Score (ISS), associated injuries, angioembolization, hospital length of stay, time to depacking. The severity of the liver injury was graded according to the guidelines published by the Organ Injury Scaling Committee of the American Association for the Surgery of Trauma on the basis of computed tomography (CT) scan or operative findings (9).

All patients were followed up in the Intensive Care Unit post-operatively and underwent contrast enhanced spiral CT scan before angiography. CT scans were obtained using the high speed helical scanner after administration of intravenous contrast and 5-mm axial plans were obtained from the lower chest through the pelvis. Patients with contrast extravasation were taken to the interventional radiology suite immediately. AE was performed either with Gelfoam or stainless steel coils.

All patients were taken to the operating room for depacking after 24-72 hours unless they developed hypothermia, acidosis, or coagulopathy. When surgical control of bleeding was not achievable after depacking, repacking is performed and the patient was taken to the interventional radiology suite.

Angiography-related complications (groin hematoma, pseudoaneurysm/fistula at cannulation site, and contrast related acute renal failure), liver-related complications (delayed liver hemorrhage, bile leakage, biloma, hepatic necrosis, intrahepatic abscess, and perihepatic abscess), and thoracic complications (pleural effusion, acute respiratory distress syndrome) were reviewed.

Comparisons of patient characteristics were performed using Mann-Whitney-U test for continuous variables and x^2 analysis for categorical variables using a commercially available statistics software package (SPSS, Version 12.0, Chicago, IL). A p value <0.05 was considered statistically significant.

RESULTS

A total of 513 patients with hepatic injury were admitted to Trauma and Emergency Medicine Service during the study period; 370 patients were managed conservatively, 83 patients were treated with definitive repair (primary suture repair, segmental liver resection, homeostasis with argon or topical agent), and 60 patients were treated with damage control surgery (abdominal packing).

There were 52 men and 8 women with a median age of 24 years (3-55 years). The median depacking time was 2 (0-3) days, the median duration in hospital was 15.5 (1-60) days. The median Injury Severity Score (ISS) was 25.5 (18-43). The mechanism of injury was blunt trauma in 34 (56.7%) and penetrating trauma as a gun-shot injury in 12 (46.2%), stab wound injury in 14 (53.8%).

The median ISS was 25 (18-43) in patients with blunt trauma and 21.5 (18-41) in patients with penetrating trauma (p=0.230). Twenty-one out of 60 patients underwent angiography, and in all cases either hepatic arterial or portal venous injuries were detected and angio-embolized (Figure 1).

There were 4 patients with grade 3 and 17 patients with grade 4 liver injury in the AE group (Table 1). The median ISS in AE group was 18 (18-43). In the AE group, 13 patients had sustained blunt trauma, and 8 patients penetrating trauma (p=0.333).

Left hepatic artery embolization was performed in 5 patients; right hepatic artery embolization in 2 patients; right portal vein embolization in 2 patients; and hepatic artery distal branch embolization in 12 patients. The only predictor of angiography was an associated other organ injury (p=0.029). Age, type of trauma (blunt vs penetrating), and shock status were not related to AE (p=0.695, p=0.333, and p=0.718, respectively).

Pleural effusion was the most common complication (n=11, 18.3%). One patient developed biliary fistula and one patient developed hemobilia, both were treated with endoscopic retrograde cholangio-pancreatography. In cases treated with right hepatic artery embolization, a cholecystectomy was performed.

Mortality occurred in 17 patients (28.3%) with a median age of 24.5 (4-55) years. All were admitted with shock (systolic blood pressure < 90 mm Hg) and median length of stay was 0 (0-11) days. The median ISS was 21 (18-43). In the mortality group, blunt trauma was significantly more frequent as compared to penetrating trauma (p=0.028). Mortality was not significantly different between AE (n=4, 19%) vs non-AE (n=14, 33%) groups (p=0.369).

The factors associated with a high ISS were: admission with a shock status (p=0.009) and an associated organ injury (p<0.001). Age (p=0.506) and type of injury (penetrating versus blunt) (p=0.230) were not related to high ISS. Extremity injury was the most common associated injury (n=15, 25.0%) (Table 2).

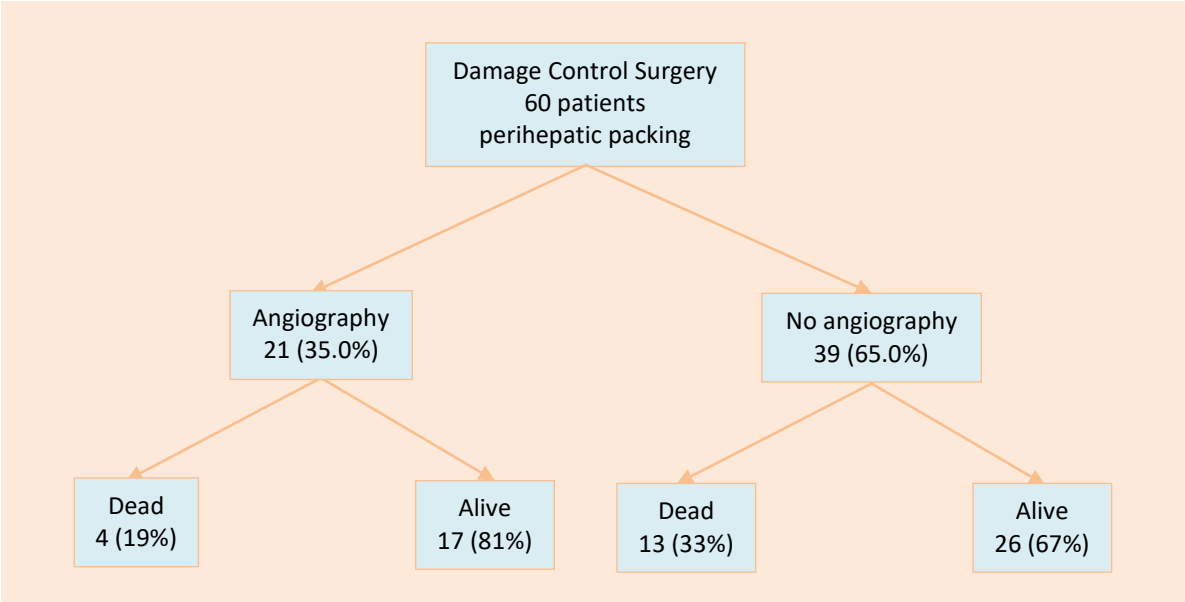

Figure 1. Damage control surgery

Table 1. Grades of liver injuries.

Grades of liver injury	Angioembolization	No Angioembolization
Grade 2	0	7
Grade 3	4	17
Grade 4	17	15

Table 2. Associated injuries

Associated injuries	Number of patients	%
Extremity fractures	15	25
Head trauma	8	13.3
Hollow visceral injury	10	16.7
Chest trauma	16	26.7
Major vessel injury	4	6.7
Pelvic fracture	2	3.3
Spleen injury	6	10.0
Pancreas injury	2	3.3
Diaphragm injury	2	3.3
Urinary bladder injury	1	1.7
Vena cava injury	1	1.7

DISCUSSION

Non-operative management of hepatic injuries has become a treatment of choice in stable patients when other indications for exploratory laparotomy are excluded (10-15). However, a management plan involving a multimodal surgical strategy is essential. Mohr et al. reported a 58% morbidity rate for AE performed due to severe hepatic trauma (7).

Exsanguinating abdominal and retroperitoneal hemorrhage is potentially lethal when associated with coagulopathy, hypothermia and acidosis. Temporary abdominal packing is a lifesaving procedure; and allows a surgical control of bleeding and provides a valuable time for recovery in the ICU before the definitive surgical repair (16, 17). In the study of Stylianos et al., 22 of patients with refractory hemorrhage were treated with abdominal packing with an 18% mortality rate (16).

Patients undergoing damage control laparotomy require intensive and aggressive resuscitation and may require additional procedures to control bleeding. Ongoing bleeding after damage control laparotomy remains a most challenging problem. In the postoperative period, it is often difficult to differentiate active hemorrhage of parenchymal vessels from non-mechanical, coagulopathic bleeding. Patients with severe liver trauma have a high risk of arterial bleeding deep from liver, and after packing an additional angiographic procedure may be required (17, 18). The rationale for angiography is to detect and eliminate a ruptured intrahepatic hematoma due to bleeding branches of hepatic artery (18). Johnson et al. revealed this in their series of 19/37 patients with packing, 9 of whom underwent angiography, and their therapeutic liver angiography rate was 75% (6). AE as an adjunct may decrease the mortality in severe liver trauma (6, 18). Richardson and colleagues attributed improved survival to several factors. Significant contributors included earlier use of hepatic packing and increasing use of angiographic embolization for arterial bleeding (19). Asensio et al. considered early postoperative angiography and angioembolization as an integral part of the approach to the management of these patients. They reported mortality rates as low as 8-22% for grade IV and V hepatic trauma (5).

Duane et al. compared patients who underwent surgical treatment alone with patients who underwent angiography alone, and reported that angiography was associated with longer intensive care unit (ICU) stay and higher mortality (20). We performed angiography when bleeding persisted after depacking. In these circumstances, re-packing was performed and angiography was performed, with adjunctive embolization whenever necessary. Hagiwara et al. reported that in 612 patients with blunt abdominal trauma, CT scan revealed grade 3-5 liver injuries in 51 patients, who subsequently underwent angiography. They demonstrated a 30% mortality rate in patients who underwent angiography as opposed to 65% mortality in those without angiography (4).

In the literature, the timing of angiography in the management of severe liver trauma is controversial. According to Johnson et al, severe hepatic injury, of AAST grade IV or more, is an indication for immediate postoperative angiography (21). Our data showed that angiography after initial damage control surgery may not always be needed. In 39 out of 60 patients, no further bleeding was detected after depacking and angiography was not performed. In the damage control surgery group, mortality was not significantly different between AE (n=4, 19%) vs non-AE (n=14, 33%) groups (p=0.369). On the other hand, if bleeding persisted after depacking, angiography was a lifesaving adjunct, since all patients required a subsequent embolization.

CONCLUSION

Non-operative management of hepatic injuries has become a treatment of choice in stable patients when other indications for exploratory laparotomy are excluded. In the damage control surgery setting, angioembolization may be used selectively in patients with persistent bleeding after depacking.

LIST of ABBREVIATIONS

angioembolization (AE)
American Association for the Surgery of Trauma (AAST)
computed tomography (CT)
endoscopic retrograde cholangio-pancreatography (ERCP)
intensive care unit (ICU)

COMPETING INTERESTS

The authors declare that they have no competing interests.

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