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Detection of traumatic pancreatic duct disruption in the modern era

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ABSTRACT

Background: Pancreatic trauma management hinges upon the presence or absence of pancreatic duct injury, but the optimal method of assessment is unclear. This study endeavored to evaluate the methods of pancreatic duct assessment in modern practice.

Methods: Patients presenting to LAC + USC Medical Center (01/2008–06/2015) with a pancreatic injury were identified (ICD-9 codes). Demographics, clinical data, technique of duct evaluation, and outcomes were analyzed.

Results: 71 patients with pancreatic injury were identified. 21 patients (30%) underwent CT scan (sensitivity 76%). Sixteen (76%) then underwent laparotomy while 5 (24%) were managed successfully nonoperatively. Most (n = 50, 70%) underwent immediate laparotomy. Overall, 66 patients (93%) were managed operatively. The majority were assessed intraoperatively for ductal injury with visual inspection alone (n = 62, 94%). Four (6%) underwent intraoperative pancreatography via duodenotomy/cholecystotomy, which were all inconclusive.

Conclusion: In the evaluation of pancreatic duct injury, intraoperative pancreatography is frequently inconclusive and should have a limited role. Clinical suspicion for ductal injury based on intraoperative visual inspection alone should guide the management of pancreatic injuries.

Summary for Table of Contents: The management of pancreatic trauma hinges upon the integrity of the main pancreatic duct. The optimal strategy for identification of pancreatic duct injury was previously unknown. This study found that intraoperative visual inspection alone is sufficient to guide the management of pancreatic injuries. Intraoperative pancreatography is unnecessary.

Introduction

Pancreatic injuries resulting from trauma are notoriously challenging to both diagnose and manage. They are uncommon, especially those that involve the pancreatic duct. They are also frequently associated with other injuries (>90% in modern series) and carry an inherent lethality (16–17% mortality) due to the anatomic region surrounding the pancreas.[1] As a result, the literature on the optimal work-up of patients with suspected pancreatic duct injury is lacking. This is problematic because the management of pancreatic injury is directed by the status of the duct.

In order to secure the diagnosis of pancreatic duct injury, techniques such as computed tomography (CT) scan or magnetic resonance cholangiopancreatography (MRCP) can be performed outside of the operating room (OR) but are only suitable for stable patients. The current literature on CT scan and MRCP indicates that both of these methods have poor sensitivity in the diagnosis of duct injuries in trauma.[2–4] Intraoperative techniques for duct evaluation include a variety of methods of pancreatography, including on-table endoscopic retrograde cholangiopancreatography (ERCP) and pancreatography via cholecystotomy or cannulation of the pancreatic duct, either through a duodenotomy to access the ampulla of Vater or by direct cannulation through injured pancreatic parenchyma. The ability of these tests to accurately define the status of the duct is unclear, as is the frequency with which these tests are utilized in modern practice. Consequently, at this time, the optimal method for diagnosing a pancreatic duct injury has not

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been established.

Therefore, the primary objective of this study was to examine the various investigations used to evaluate the pancreatic duct for injury, including the frequency of use, ability to correctly identify the presence or absence of ductal injury, and rates of associated complications. The secondary objectives of the study were to examine the patient demographics, injury data, surgical management, and outcomes associated with pancreatic injury in a high-volume trauma center. Our hypothesis was that invasive and time-consuming methods of duct evaluation, including all forms of intraoperative pancreatography, are rarely used in trauma patients and that simple visual inspection of the injured gland is sufficient to confirm or exclude the diagnosis of pancreatic duct injury in the majority of patients.

Material and methods

Institutional Review Board approval was granted from the University of Southern California. Between January 2008 and June 2015, all patients who sustained a pancreatic injury (AAST grades I-V) as defined by ICD-9 codes (863.81–863.84, 863.91–863.94)[5] were retrospectively identified from the LAC + USC Medical Center trauma registry. Both blunt and penetrating mechanisms were included. There were no exclusion criteria. Patient charts were then reviewed.

Patient demographics, injury characteristics (mechanism of injury, date of injury, associated injuries, AAST grade of pancreatic injury, Injury Severity Score [ISS]), investigations (CT scan, MRCP, ERCP), surgical procedures, technique of pancreatic duct evaluation, and outcomes (mortality, complications, failure of non-operative management, hospital length of stay, intensive care unit [ICU] length of stay, and need for mechanical ventilation) were abstracted.

At LAC + USC, patients who present after penetrating abdominal trauma are brought emergently to the operating room if they are hemodynamically unstable, have evidence of peritonitis or evisceration, or are unevaluable. Otherwise, these patients undergo CT scan (64-slice [0.5 mm] multidetector system; Aquilion 64 CFX Multislice CT Scanner; Toshiba Medical Systems Corporation, Japan). Intravenous contrast (Omnipaque 350; GE Healthcare, Princeton, NJ) is used routinely.

Data collection was performed using a computerized spreadsheet (Microsoft Excel 2007; Microsoft Corporation; Redmond, WA) and analyzed using SPSS Statistics 23 (IBM Corporation; Armonk, NY). Descriptive statistics were calculated for the clinical variables defined above. Continuous variables are presented as mean ± standard deviation; median (range). Categorical variables are presented as n (%).

Results

Patient demographics and injury data

Seventy-one patients with a pancreatic injury were identified over the study period. The mean age was 35 years (range 11–87) and 86% (n = 61) were male (Table 1). The mechanism of injury was penetrating in 51 patients (72%), of which 41 (80%) were gunshot wounds (GSW) and 10 (20%) were stab wounds (SW). The remaining 20 patients (28%) were injured by blunt mechanisms: 9 (45%) as auto vs pedestrian, 7 (35%) in a motor vehicle collision, and 4 (20%) in a motorcycle crash.

The mean AAST pancreatic injury grade was II (range I-V) (Table 1). There were 22 patients (31%) with AAST grade I injuries, 17 (24%) with grade II, 29 (41%) with grade III, 2 (3%) with grade IV, and 1 (1%) with grade V. Associated injuries were common (n = 70, 99%), most frequently the stomach (n = 31, 44%), liver (n = 24, 34%), colon (n = 19, 27%), kidney (n = 19, 27%), and spleen (n = 19, 27%)

Table 1
Patient Demographics, Clinical Data, Management, and Outcomes. Continuous variables are presented as mean ± standard deviation; median (range). Categorical variables are presented as n (%).

	Patients (n = 71)
Demographics	
Age, years	35 ± 17; 29 (11–87)
Gender, male	61 (86%)
Mechanism of Injury4 (20%)	
Penetrating	51 (72%)
GSW	41 (80%)
SW	10 (20%)
Blunt	20 (28%)
AVP	9 (45%)
MVC	7 (35%)
MCC	4 (20%)
Injury Data	
Injury Severity Score (ISS)	24 ± 13; 20 (4–75)
AAST Pancreatic Injury Grade	2 ± 1; 2 (1–5)
I	22 (31%)
II	17 (24%)
III	29 (41%)
IV	2 (3%)
V	1 (1%)
Management	
Immediate Laparotomy	50 (70%)
CT Scan	21 (30%)
Other Pre-Operative Duct Assessment	0 (0%)
Nonoperative Management (NOM)	5 (7%)
Total Operative Management	66 (93%)
Intra-Operative Duct Evaluation	
Visual Inspection	62 (94%)
Pancreatography	4 (6%)
ERCP	0 (0%)
Duodenotomy	1 (2%)
Cholecystotomy	3 (5%)
Outcomes	
Mortality	14 (20%)
Hospital LOS	25 ± 26; 15 (1–131)
ICU LOS	12 ± 16; 5 (0–78)
Ventilator Days	5 ± 9; 1 (0–39)
Need for ICU	59 (83%)
Need for Mechanical Ventilation	40 (56%)
Failed NOM	0 (0%)
Pancreatic Complication*	10 (14%)

GSW, gunshot wound. SW, stab wound. AVP, auto vs. Pedestrian. MVC, motor vehicle collision. MCC, motorcycle crash. CT, computed tomography. ERCP, endoscopic retrograde cholangiopancreatography. LOS, length of stay in days. ICU, intensive care unit.*Pancreatic Complications included leak, abscess, fistula.

Table 2
Associated injuries.

Injury	Patients (n = 71)	Percentage (%)
Any	70	99
Stomach	31	44
Liver	24	34
Colon	19	27
Kidney	19	27
Spleen	19	27
Duodenum	14	20
Diaphragm	12	17
Small Bowel	9	13
IVC	5	7
PV/SMV/IMV	5	7
Gallbladder	4	6
Aorta	3	4
Celiac Axis/SMA	1	1
Extra-Abdominal	19	27

IVC, inferior vena cava. PV/SMV/IMV, portal vein/superior mesenteric vein/inferior mesenteric vein. SMA, superior mesenteric artery.

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