AAST Acute Care Surgery Didactic Curriculum

Blunt and Penetrating Pancreatic Injury

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Background / Epidemiology:

- Management of Pancreatic Injury is challenging for a number of reasons:
  - Rarity of Injury; < 1% of blunt injured patients
  - Difficulty of Diagnosis
  - High rate of associated injuries
  - Associated morbidity with all grades but especially high grade injury (Grade III-V)
  - Lack of high volume series
- Mortality 10-30% and is often related to associated injuries
- Morbidity rate as high as 60% with pancreas related complication rates in up to 40%
- Characterization is done using the AAST Organ Injury Grading Scale for Pancreatic Injury:

AAST Organ Injury Grading Scale - Pancreatic Injury			
Grade	**Type**	**Description**	**AIS**
I	Hematoma	Minor contusion without ductal injury	2
	Laceration	Superficial laceration without duct injury	2
II	Hematoma	Major contusion without duct injury or tissue loss	2
	Laceration	Major laceration without duct injury or tissue loss	3
III	Laceration	Distal[1] transection or distal parenchymal injury with duct injury	3
IV	Laceration	Proximal[1] transection or parenchymal injury involving with duct injury or ampullary involvement	4
V	Laceration	Massive disruption of pancreatic head	5

1. Anatomic landmark distinguishing proximal to distal is the superior mesenteric vein.

Diagnosis:

- Diagnosis of blunt pancreatic injury (BPI) remains challenging and a high degree of clinical suspicion is needed especially in high-risk mechanisms (e.g., handlebar injury, upper lumbar chance fracture, upper abdominal seat belt sign).
- Delayed diagnosis results in increased morbidity and mortality.
- CT scan should be obtained as part of initial workup. Sensitivity for identification of BPI in several series is low (47-57%). However, 64 slice multi-detector imaging has been shown to increase both the sensitivity and specificity of BPI including identification of pancreatic duct injury (PDI).
- Increased risk of PDI is associated with lacerations involving > 50% of the parenchyma and large amounts of peripancreatic fluid and should prompt additional investigation.
- Pancreatic enzymes are non-specific and infrequently elevated on initial admission. It is reasonable to obtain these in a delayed fashion (> 6 hours) in patients with indeterminate findings on CT or those who are unexaminable, or if a patient develops clinical symptoms to assist in deciding on further diagnostic imaging.

Identification of Main Pancreatic Duct Injury:

- Identification of Main PDI remains challenging.
- Intraoperative findings associated with / diagnostic of main PDI include: direct visualization of a ductal injury, complete pancreatic transection, laceration through more than 50% of the diameter of the pancreas, central pancreatic perforation, and severe maceration of the pancreas.
- Main PDI may not be present in cases where these findings occur, may occur in the absence of these operative findings. Strategies are needed to identify PDI injuries in these patients and in non-operatively managed patients. For operative patients with clinical high grade injury where the presence of ductal injury is of concern:
    - Intraoperative cholangiopancreatography via cholecystostomy is reasonable though its diagnostic yield is low.
    - Pancreatography through a duodenotomy or distal pancreatic transection and cannulation of the distal duct **should not be done** as the findings are often inconclusive and causes compromise to otherwise normal structures that may lead to complications (e.g., duodenal leak, distal pancreatic leak, loss of pancreatic tissue that when combined with more proximal injury may lead to pancreatic insufficiency causing diabetes or malabsorption).
    - ERCP may be considered if available.
    - Intraoperative US of the duct is rapid and noninvasive and reasonable but requires specialized equipment and training and its accuracy is unknown.
    - Drainage with or without formal closure and post operative evaluation is a useful strategy.

- MRCP has been widely utilized to diagnose PDI in patients managed non-operatively and in select operatively managed patients. However, its results should be interpreted with caution.
    - In a recent multicenter series:
        - The sensitivity of MRCP was 37% though its specificity was 94%.
        - The negative predictive value of MRCP in this series was 73%.
        - Of the patients who had PDI missed on MRCP 66% developed a pancreatic specific complication.
        - 25% of patients with a low grade pancreatic injury were re-characterized as high grade based on the presence of a main PDI on MRCP
- ERCP has a higher diagnostic accuracy. Its use as a diagnostic modality should be considered in the following:
    - To confirm MRCP findings when these would either lead to a major resection in an otherwise low-grade injury or continued non-operative management in high CT grade injury.
    - If there is a need to clearly delineate ductal anatomy.

Management:

- Given the rarity, heterogeneity, high rate of associated injuries and difficulty of identification of main PDI in patients with pancreatic injury the best practice for management has been difficult to ascertain.
- A number of recent publications by the Western Trauma Association (WTA) multicenter trials committee have delineated current best practices and identified areas in need of additional study and divided management based on low injury and high injury grade.

WTA Management of Low Grade Pancreatic Injury (LGPI):

- Findings / Suggestions were based on 728 patients admitted with AAST-OIS Grade I & II injuries from 2010-2018 at 29 level I & II Trauma Centers.
- Findings:
    - Penetrating - 37% vs Blunt - 63%
    - Concordance between CT and operative findings in 109 patients was 75% (84% for Grade I and 66% for Grade II injuries) with most (86%) discordance being graded higher on operative grading.
    - MRCP was obtained in 13% of patients and ERCP in 7%.
    - 31% of patients were managed nonoperatively (including patients who underwent laparotomy but whose pancreas was not explored).
    - 54% of patients underwent operative drainage alone.
    - 10% Underwent distal pancreatectomy.
    - 5% underwent other pancreatic procedures (debridement, suturing, inspection)
    - High volume centers utilized less resection and more nonoperative management
    - Pancreas related complications (PRC - pancreatic leak, peripancreatic abscess, pancreatic fistula, delayed pancreatic pseudocyst) were more common in

Grade II (Grade II - 25% vs Grade I - 17%) and after penetrating trauma (Penetrating - 37% vs Blunt - 11%) and occurred overall in 21% of patients.
    - Nonoperative management had the lowest rate of PRC at 4%.
    - For operatively managed patients PRC were lower after drainage alone (26%) than for those treated with resection (42%).
    - For patients treated with resection there was no difference in PRC based on the method of pancreatic stump closure (stapled with duct suture, stapled without duct suture, hand-sewn without stapling).
- Suggestions:
    - In the absence of suspicious findings on CT or other indications for laparotomy LGPI should be managed nonoperatively.
    - In the presence of suspicious findings on CT (laceration involving > 50% of the parenchyma or major pancreatic hematoma / contusion) without other indications for laparotomy patients should be managed nonoperatively and cholangiopancreatography should be considered to evaluate for main PDI.
    - In LGPI that undergoes operative management, drainage should be preferred over resection.

WTA Management of High Grade Pancreatic Injury (LGPI):

- Findings / Suggestions were based on 426 patients admitted with AAST-OIS High Grade III - V injuries from 2010-2018 at 32 level I & II Trauma Centers and included an evaluation of changes in time related to the publication of a WTA Practice Management Algorithm in 2013.
- Findings:
    - Penetrating - 53% vs Blunt - 47%
    - Concordance between CT and operative findings in 176 patients was only 38% (41% - Grade III, 22% - Grade IV, and 40% - Grade V). CT was considered diagnostic of main pancreatic duct integrity in only 26%
    - In Grade IV and V injury the use of MRCP doubled and ERCP quadrupled over time.
    - Grade III Injuries:
        - Management did not change significantly over time
        - Most treated with resection (77%)
        - No difference in PRC between resection (41%) and drainage (33%)
    - Grade IV-V Injuries:
        - Resection trended downward with time (56% vs 39%)
        - There was a significant decrease in PRC after resection (32%) as compared to operative drainage (61%)
            - Grade IV: resection (31%) vs drainage (55%)
            - Grade V: resection (33%) vs drainage (77%).
    - In distal resection (222 patients) the rate of PRC was not associated with closure technique: resection without duct suture (37%), stapled with duct suture (47%) or hand sewn (48%).