Surgical Management and Outcomes of Combined Pancreaticoduodenal Injuries: Analysis of 75 Consecutive Cases

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BACKGROUND: Combined pancreaticoduodenal injuries (CPDI) are complex and result in significant morbidity and mortality. Survival in CPDI after initial damage-control laparotomy (DCL) and pancreaticoduodenectomy was evaluated in a large cohort treated in a Level I trauma center. We hypothesized that bivariate analyses would accurately identify factors influencing morbidity and mortality.

STUDY DESIGN: The records from a prospective database of 453 consecutive patients treated for pancreatic injuries between January 1990 and April 2015 were reviewed to identify those with CPDI. Primary and secondary end points assessed were death and morbidity.

RESULTS: Seventy-five patients (69 men, median age 27 years, range 14 to 56 years) with CPDI, underwent 161 operations (range 1 to 9 operations). Twenty-nine patients with complex CPDI underwent a DCL and 46 had definitive treatment during the initial operation. Nineteen had a pancreaticoduodenectomy, either during the initial operation ($n = 13$) or after the DCL ($n = 6$). Postoperative complications occurred in 63 (84%) patients. Twenty-one (28%) patients died, including 15 (43%) of 35 patients with associated vascular injuries. Sixteen (84%) of the 19 patients who had a pancreaticoduodenectomy survived. Significantly more complications related to bleeding, disseminated intravascular coagulation, and hypovolemic shock occurred in those patients who eventually died and significantly more abdominal sepsis and fistulas occurred in patients who survived. Mortality was related to associated vascular injuries overall ($p < 0.01$), major visceral venous injuries ($p < 0.011$), and the combination of vascular plus the total number of associated organs injured ($p < 0.046$).

CONCLUSIONS: Despite using DCL in CPDIs, morbidity (84%) and mortality (28%) remain substantial. Careful selection of patients undergoing pancreaticoduodenectomy resulted in 84% survival. Associated vascular injuries, major visceral venous injuries, and combined vascular and associated organs injured influenced outcomes and mortality. (J Am Coll Surg 2016;222: 737–749. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

Severe injuries involving both pancreas and duodenum continue to be a considerable cause of morbidity and mortality, even when treated in well-resourced high-volume trauma referral centers.[1,2] Most deaths occur early and are due to associated injuries and the consequences of uncontrolled blood loss and shock.[3,4] Late deaths are usually due to resistant intra-abdominal sepsis and multisystem organ failure.[5,6] The 5 most crucial factors influencing management and outcome are grade of pancreatic head damage, degree of ischemia and viability of the duodenum, extent of ampullary damage, presence of visceral vascular injuries, and magnitude of associated organ injuries. These issues determine both the scale of intervention and ultimate survival. Both the early use of damage-control surgery and

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Abbreviations and Acronyms
AAST = American Association for the Surgery of Trauma
CPDI = combined pancreaticoduodenal injury
DCL = damage-control laparotomy
RTS = Revised Trauma Score

the need for pancreatic and duodenal resection are important considerations when treating complex combined pancreaticoduodenal injuries (CPDIs), but have not been applied consistently in high-risk situations.[3]

The optimal surgical management of CPDIs is currently characterized by continued controversy and contradiction. The reasons for the lack of clear guidelines and the paucity of reliable and robust data are manifold. Synchronous combined duodenal damage seldom occurs in tandem with injuries to the head of the pancreas.[2] In the prospective TARN (Trauma Audit and Research Network)[2] and STAG[7] databases, CPDIs occurred in only 0.2% and 0.3% of predominantly blunt abdominal injuries, and a large cohort study from Cape Town reported double the number of CPDIs after abdominal gunshot wounds compared with blunt trauma.[8] The relative infrequency of this type of injury suggests that most surgeons will have had minimal operative exposure and limited personal experience when dealing with complex CPDIs. These deficiencies are compounded by the lack of data and clarity in surgical publications, which consist mostly of small retrospective or outdated series and collective reviews that do not provide an authoritative or comprehensive analysis of the problem. In addition, the lack of a practical and universally relevant classification that can be applied to accurately predict the outcomes of CPDIs has hampered progress. Both the widely used Lucas[9] and American Association for the Surgery of Trauma (AAST)[10] classifications have flaws that hinder a detailed comparison of treatment choices in major CPDIs. For example, in the pancreatic injury AAST classification, no provision is made for associated duodenal injuries, which can be a critical factor determining the need for a pancreaticoduodenectomy.[6]

The current study addressed 3 of the major unresolved issues in severe CPDIs, namely, survival after initial damage-control surgery, outcomes after pancreaticoduodenectomy, and evaluation of predictive factors for morbidity and mortality in a large cohort of consecutive patients using a CPDI grading score. We hypothesized that bivariate analyses would accurately identify factors influencing morbidity and mortality. In addition, the study sought to define specific criteria for the selection of the type of surgery for complex combined injuries using robust and reliable methodology and objective and reproducible end points.

METHODS

Study population

The study design was a retrospective observational cohort analysis using a faculty approved and registered prospective database that documents the information of all patients with pancreatic injuries treated in the Level I trauma center and the Hepatopancreatobiliary and Surgical Gastroenterology Units in Groote Schuur Hospital, Cape Town. After approval by the University of Cape Town Human Research Ethics Committee, an analysis was done of consecutive patients who were treated for combined pancreatic and duodenal injuries between January 1990 and April 2015 at Groote Schuur Hospital in Cape Town.

Data collection

All clinical records, including surgical details, intensive care, radiology, and endoscopy reports of patients with pancreatic injuries were reviewed and updated monthly since the inception of the database. Comprehensive details of the database have been documented previously.[8,11-14] A synopsis is provided here. Data were abstracted by a specially trained nurse reviewer and recorded using a standardized data form after affirmation by a senior study surgeon. Details of the methodology used to record the variables for each patient have been published[8,11-14] and included demographic data, Revised Trauma Score (RTS), presence of shock on admission, anatomic location and grade of the pancreatic injury, associated intra- and extra-abdominal injuries, injury to operation interval, surgical procedure used, duration of hospital stay, presence and type of pancreas-related and other complications, and mortality. In this study, the admission to operation time recorded included all referrals from other hospitals, with the clock starting from the first admission at a referral hospital and therefore included helicopter and ambulance transfer times. Longer admission to operation times occurred in hemodynamically stable patients with polytrauma who required head CT scans, neurosurgery consults, and other essential procedures. Hospital length of stay and ICU length of stay were recorded as calendar days. The primary study end point was death. The secondary end point was morbidity assessed by the Clavien-Dindo classification.[15]

Definitions

Shock was defined as a systolic blood pressure <90 mmHg pre- or intraoperatively. The severity of the