Blunt Pancreatoduodenal Injury

A Multicenter Study of the Research Consortium of New England Centers for Trauma (ReCONECT)

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Objectives: To evaluate the safety of nonoperative management (NOM), to examine the diagnostic sensitivity of computed tomography (CT), and to identify missed diagnoses and related outcomes in patients with blunt pancreatoduodenal injury (BPDI).

Design: Retrospective multicenter study.

Setting: Eleven New England trauma centers (7 academic and 4 nonacademic).

Patients: Two hundred thirty patients (>15 years old) with BPDI admitted to the hospital during 11 years. Each BPDI was graded from 1 (lowest) to 5 (highest) according to the American Association for the Surgery of Trauma grading system.

Main Outcome Measures: Success of NOM, sensitivity of CT, BPDI-related complications, length of hospital stay, and mortality.

Results: Ninety-seven patients (42.2%) with mostly grades 1 and 2 BPDI were selected for NOM: NOM failed in 10 (10.3%), 10 (10.3%) developed BPDI-related complications (3 in patients in whom NOM failed), and 7 (7.2%) died (none related to failure of NOM). The remaining 133 patients were operated on urgently: 34 (25.6%) developed BPDI-related complications and 20 (15.0%) died. The initial CT missed BPDI in 30 patients (13.0%); 4 of them (13.3%) died but not because of the BPDI. The mortality rate in patients without a missed diagnosis was 8.8% (P = .50). There was no correlation between time to diagnosis and length of hospital stay (Spearman ρ = 0.06; P = .43). The sensitivity of CT for BPDI was 75.7% (76% for pancreatic and 70% for duodenal injuries).

Conclusions: The NOM of low-grade BPDI is safe despite occasional failures. Missed diagnosis of BPDI continues to occur despite advances in CT but does not seem to cause adverse outcomes in most patients.

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Despite occurring with low frequency, blunt pancreatoduodenal injuries (BPDI) are associated with serious complications.1-3 Clinical symptoms and findings from diagnostic tests, including serum amylase levels and computed tomography (CT), are unreliable.4-6 Even after intravenous and oral contrast administration, the sensitivity of CT using early-generation helical scanners ranged from 60% to 70% in most studies.7-9 New technology and protocols have improved the diagnostic ability of CT for various abdominal organ injuries, possibly including BPDI.10

Even with accurate diagnosis, the treatment options are many and the indications are unclear.11-13 Outcome studies typically include single-center series with a limited sample size. The role of nonoperative management (NOM) for BPDI is not as well defined as it is for blunt splenic or hepatic injuries.

See Invited Critique at end of article

In the present study, we evaluate the diagnosis, management, and outcomes of BPDI in 11 academic and nonacademic New England trauma centers with variable volumes of trauma admissions. In this way, we aim to offer a representative picture of the management and outcomes of BPDI in New England, with possible applicability to other regions. In particular, we examine (1) the safety of NOM in selected injuries, (2) the sensitivity of new CT technology in BPDI diagnosis, and (3) the effect of a missed diagnosis on outcome.
The medical records of patients admitted with BPDI in 11 New England trauma centers during the 11-year study (January 1, 1996, to January 1, 2007) were reviewed. Pediatric patients (≤15 years of age according to the new criteria of the American College of Surgeons Committee on Trauma) were excluded. Seven centers have direct academic affiliations and 4 do not. All but 1 of the New England states were represented, albeit disproportionately owing to the voluntary nature of participation in the study. (7 centers in Massachusetts and 1 each in New Hampshire, Maine, Vermont, and Connecticut.) Trauma admission volumes changed in each center every year but ranged from approximately 1000 per year in the 3 low-volume centers to 2000 per year in the 4 high-volume centers. We arbitrarily defined as “high-volume” centers those admitting more than 1500 patients per year.

DATA COLLECTION

The following data were collected: demographics, type of blunt trauma (fall, motor vehicle crash, assault, or other), Injury Severity Score, systolic blood pressure on hospital arrival, serum amylase levels, CT findings, types of operations, morbidity, mortality, and length of stay in the intensive care unit and hospital. The grade of BPDI was recorded according to the organ injury scale of the American Association for the Surgery of Trauma (Table 1). For patients who had injuries graded by means of CT and in the operating room, we used the operating room grade for statistical analysis as the most reliable of the 2. For patients with combined pancreatic and duodenal injuries, we recorded both and used the higher of the 2 grades in statistical analysis. The following operations were recorded: (1) for the pancreas: simple drainage, pancreateorrhaphy, distal pancreatectomy, pancreateoduodenectomy (Whipple procedure), and other and (2) for the duodenum: primary repair (simple or complex), pyloric exclusion, and other.

Table 1. Pancreatic and Duodenal Injury Scale According to the American Association for the Surgery of Trauma.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hematoma: minor contusion without duct injury</td>
</tr>
<tr>
<td>2</td>
<td>Laceration: superficial laceration without duct injury</td>
</tr>
<tr>
<td>3</td>
<td>Laceration: major laceration without duct injury or tissue loss</td>
</tr>
<tr>
<td>4</td>
<td>Laceration: distal transection or parenchymal injury with duct injury</td>
</tr>
<tr>
<td>5</td>
<td>Laceration: massive disruption of pancreatic head</td>
</tr>
<tr>
<td>1</td>
<td>Hematoma: involving a single portion of the duodenum</td>
</tr>
<tr>
<td>2</td>
<td>Laceration: partial thickness, no perforation</td>
</tr>
<tr>
<td>3</td>
<td>Laceration: involving &gt;1 portion of the duodenum</td>
</tr>
<tr>
<td>4</td>
<td>Laceration: disruption &lt;50% of circumference</td>
</tr>
<tr>
<td>5</td>
<td>Laceration: disruption of 50%-75% of circumference of D2</td>
</tr>
</tbody>
</table>

Vascular: devascularization of the duodenum

Advance 1 grade for multiple injuries to the same organ.

We defined as NOM the attempt to manage a patient nonoperatively after an injury was confirmed or if it was not known whether there was an injury. Failure of NOM was defined as an operation after a period of NOM was offered. The following were defined as BPDI-related complications: pancreatic pseudocyst, pancreatic fistula, pancreatitis, peripancreatic and peri-duodenal collections, and a leak or bleeding from a suture line of a pancreatic or duodenal procedure. A missed diagnosis was defined as a negative reading for BPDI on the initial CT and a positive reading on a subsequent CT or a positive finding in the operating room. Outcomes included failure of NOM, missed diagnoses, sensitivity of CT, BPDI-related complications, length of hospital stay, and mortality.

STATISTICAL ANALYSIS

Comparisons were performed between different groups of patients defined by the method of management (operative or NOM), timing of diagnosis (early or missed), and development of BPDI-related complications. The groups were compared using the Wilcoxon rank sum test for continuous variables and the χ² or Fisher exact test for categorical variables. Values are reported as mean (SD) for continuous variables (or as median [interquartile range (IQR)] if the mean was higher than the median) and as proportions for categorical variables. Continuous variables were further analyzed after being dichotomized across clinically or statistically meaningful cutoff points to enter into multivariable analysis. We performed 2 stepwise logistic regressions: 1 to identify independent risk factors of BPDI-related complications and another to identify independent risk factors of missed diagnosis. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each independent risk factor. After all patients with BPDI were analyzed, separate subanalyses were performed on patients with blunt pancreatic injuries (BPIs) or blunt duodenal injuries (BDIs). The sensitivity, but not the specificity, of CT was calculated. By design, the study included all patients with BPDI and a negative CT finding (false negatives for calculation of sensitivity) but not all patients without BPDI and a positive CT finding (false positives for calculation of specificity). A P= .05 was considered statistically significant for all comparisons. The study was approved by the institutional review boards of all the participating institutions.

RESULTS

Two hundred thirty patients with BPDI were identified in 11 New England trauma centers. One hundred thirty-two patients had BPI, 60 had BDI, and 38 had both. The mean (SD) age of patients with BPDI was 41.2 (19.3) years, and 163 (70.9%) were males. Eighty percent of the patients were injured in motor vehicle crashes, 11% fell from a height, and 9% had other mechanisms of injury. The mean (SD) Injury Severity Score was 23.9 (13.1), and the mean (SD) BPDI grade was 1.7 (1). One hundred thirty-eight patients (60.0%) had grade 1 injury, 30 (21.7%) had grade 2, 24 (10.4%) had grade 3, 11 (4.8%) had grade 4, and 7 (3%) had grade 5. Most patients had associated intra-abdominal (57.4%) or extra-abdominal (67.8%) injuries. The mean (SD) length of hospital stay was 17.9 (17.6) days (median, 12 days; IQR, 7-24 days). Twenty-seven patients (11.7%) died (Table 2).
NONOPERATIVE MANAGEMENT

Ninety-seven patients (42.2%) had NOM; 52 had BPI (39.4% of all patients with BPI), 28 had BDI (46.7% of all patients with BDI), and 17 had both (44.7% of all patients with both injuries). Compared with patients who underwent an operation, patients in the NOM group were found to have a lower Injury Severity Score, higher systolic blood pressure on hospital admission, lower rates of associated intra-abdominal and extra-abdominal injuries, and a lower BPDI grade. There was no difference in white blood cell counts or serum amylase levels on hospital admission. Patients in the NOM group had fewer general complications, lower mortality, and 34 patients in whom NOM was successful and 3 patients in whom NOM failed) developed BPDI-related complications: traumatic pancreatitis in 4, pseudocyst in 1, pancreatic abscess in 2, duodenal obstruction in 2, and a duodenal anastomotic leak in 1. Both patients who had a duodenal obstruction initially had NOM but had a prolonged obstruction caused by a hematoma and eventually underwent surgery. The patient with the duodenal anastomotic leak initially had NOM owing to a false CT finding but eventually underwent surgery because of increasing abdominal tenderness and free air on subsequent CT. A free perforation was found while this patient was in surgery. The perforation was sutured, leaked, and managed conservatively with success. Seven patients in the NOM group died because of severe brain injuries that were unrelated in NOM of BPDI.

BPDI-RELATED COMPLICATIONS

There were 44 patients with BPDI-related complications. Thirty-eight patients had complications (7 of them multiple) related to the pancreatic trauma, including traumat
The grade of BPDI, type of BPDI (duodenal, pancreatic, or combined), and frequency of intra-abdominal injuries were statistically significantly different between patients with and without BPDI-related complications (Table 6). The mortality rate was not different between the 2 groups, but the hospital stay was significantly longer in patients with BPDI-related complications. A BPDI grade higher than 2 (OR, 6.82; 95% CI, 1.30-12.00; \( P = .02 \)) and any pancreatic injury vs duodenal injury alone (OR, 6.82; 95% CI, 3.18-14.63; \( P < .001 \)) were the 2 independent risk factors for the development of BPDI-related complications.

Similar trends persisted when the comparisons were performed separately in patients with BPI or BDI. Patients with BPI-related complications had a longer mean (SD) hospital stay (26.4 [19.6] days [median, 10.5 days; IQR, 6-20 days] vs 16.2 [17.1] days [median, 23 days; IQR, 12-37 days]; \( P = .001 \)) but a similar mortality rate (10% vs 12.1%; \( P = .80 \)) compared with patients who did not have BPI-related complications. Similarly, patients with BPDI-related complications had a longer mean (SD) hospital stay (28.2 [21] days [median, 11 days; IQR, 6-20 days] vs 16.1 [16.8] days [median, 25 days; IQR, 12-38 days]; \( P < .001 \)) but a similar mortality rate (8.3% vs 12.4%; \( P = .58 \)) compared with patients who did not have BDI-related complications.

### MISSED DIAGNOSIS

Of 200 patients who had initial CT, the diagnosis of BPDI was initially missed in 30 (15.0%), including 15 with BPI, 13 with BDI, and 2 with both. In 6 patients (1 with BPI, 3 with BDI, and 2 both), the diagnosis was established by repeated CT, and, in the remaining 24 patients (14 with BPI and 10 with BDI), the injury was found during surgery. The median interval from admission to diagnosis in patients with missed injuries was 4 hours (IQR, 1-31 hours) compared with 1 hour (IQR, 0.7-1.9 hours) for patients without missed injuries (\( P = .01 \)). The median interval to diagnosis in patients with missed injuries was 45.4 hours (IQR, 29-72 hours) when the diagnosis was revealed by repeated CT and 2.7 hours (IQR, 0.8-4.0 hours) when the diagnosis was established in the operating room.

#### Table 6. Comparison of Patients With and Without Complications Related to Blunt Pancreatoduodenal Injury (BPDI)

<table>
<thead>
<tr>
<th>Patients, No. (%)</th>
<th>BPDI Complications</th>
<th>No BPDI Complications</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=44)</td>
<td>(n=186)</td>
<td></td>
</tr>
<tr>
<td>Age &gt;55 y</td>
<td>5 (11.4)</td>
<td>40 (21.5)</td>
<td>.31</td>
</tr>
<tr>
<td>Injury Severity Score &gt;25</td>
<td>20 (45.5)</td>
<td>71 (38.2)</td>
<td>.50</td>
</tr>
<tr>
<td>Serum amylase &gt;150 U/L</td>
<td>16 (36.4)</td>
<td>38 (20.4)</td>
<td>.05</td>
</tr>
<tr>
<td>WBC count &gt;15 000/mm³</td>
<td>17 (38.6)</td>
<td>85 (45.7)</td>
<td>.76</td>
</tr>
<tr>
<td>SBP ≤100 mm Hg</td>
<td>11 (25.0)</td>
<td>42 (22.6)</td>
<td>.94</td>
</tr>
<tr>
<td>BPDI grade &gt;2</td>
<td>21 (47.7)</td>
<td>21 (11.3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Academic center</td>
<td>34 (77.3)</td>
<td>155 (83.3)</td>
<td>.38</td>
</tr>
<tr>
<td>High-volume center</td>
<td>22 (50.0)</td>
<td>109 (58.6)</td>
<td>.31</td>
</tr>
<tr>
<td>Time to diagnosis &gt;5 h&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4 (9.1)</td>
<td>14 (7.5)</td>
<td>.65</td>
</tr>
<tr>
<td>Injury to pancreas or duodenum</td>
<td>BDI</td>
<td>4 (9.1)</td>
<td>56 (30.1)</td>
</tr>
<tr>
<td>BPI</td>
<td>32 (72.7)</td>
<td>100 (53.8)</td>
<td>.02</td>
</tr>
<tr>
<td>BDI and BPI</td>
<td>8 (18.2)</td>
<td>30 (16.1)</td>
<td></td>
</tr>
<tr>
<td>Associated intra-abdominal injuries</td>
<td>32 (72.7)</td>
<td>100 (53.8)</td>
<td>.02</td>
</tr>
<tr>
<td>Associated extra-abdominal injuries</td>
<td>32 (72.7)</td>
<td>124 (66.7)</td>
<td>.48</td>
</tr>
<tr>
<td>Nonoperative management</td>
<td>10 (22.7)</td>
<td>87 (46.8)</td>
<td>.004</td>
</tr>
<tr>
<td>General complications</td>
<td>19 (43.2)</td>
<td>55 (29.6)</td>
<td>.11</td>
</tr>
<tr>
<td>Mortality</td>
<td>4 (9.1)</td>
<td>23 (12.4)</td>
<td>.62</td>
</tr>
<tr>
<td>Hospital stay, mean (SD), d</td>
<td>27.2 (19.9)</td>
<td>15.8 (16.8)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Abbreviations: BDI, blunt duodenal injury; BPI, blunt pancreatic injury; ISS, Injury Severity Score; LOS, length of hospital stay; WBC, white blood cell.

<sup>a</sup>Five hours was selected as the cutoff point because this was the mean time from hospital admission to diagnosis for the entire population.
Patients with and without a missed diagnosis were compared (Table 7). The rates of associated intra-abdominal injuries, NOM, and pancreatic type of BPDI were higher in those with an initially missed diagnosis. All other variables, including the outcomes, were not different between the 2 groups. None of the 4 deaths in patients with initially missed injury was caused by the BPDI. One patient died of severe brain injury, 1 experienced a massive pulmonary embolism, 1 died shortly after a damage-control operation of late uncontrolled bleeding, and 1 died of respiratory failure after severe thoracic injury. The NOM independently decreased the likelihood of a missed injury (OR, 0.17; 95% CI, 0.06-0.47; P < .001), and the presence of any BPI (alone or combined) vs BDI alone independently increased the likelihood of a missed injury (OR, 5.89; 95% CI, 2.22-15.37; P < .001). When subanalyses were performed separately in patients with BPI or BDI, the results were similar between those with and without a missed diagnosis. No difference was found in any of the variables, including outcomes, between patients who had an initially missed BDI or BPI and those who did not (data not shown). There was no correlation between time to diagnosis and length of intensive care unit stay and total hospital stay in all patients or in patients with a missed diagnosis (Table 8).

**CT SENSITIVITY**

As mentioned, there were 30 false-negative initial CT findings among the 200 patients with CT. Information about the type of scanner used was available for 147 patients. Among them, a 1- or 4-slice (older-generation) scanner was used in 59 patients, whereas the remaining 88 used a 16- or 64-slice (newer-generation) scanner. The sensitivity of the initial CT for BPDI was 75.7%; specifically, for BPI it was 76% and for BDI it was 70%. The sensitivity of older-generation scanners for BPDI, BPI, and BDI was 66.7%, 65.4%, and 85.7%, respectively. These rates were 82.8%, 79%, and 50% for newer-generation scanners.

The diagnosis and management of BPDI are still under debate. This multicenter study examined 3 key questions: Is CT accurate? Are diagnostic errors detrimental? Is NOM safe? The answers produced by this analysis are no, no, and yes, respectively.

Given the low specificity of serum amylase levels and white blood cell counts, CT is the most relied-on method for assessing for BPDI. However, in most studies, its accuracy is reported to be moderate at best. Ilahi et al estimated the sensitivity of CT to be 68% in 28 patients; in 10 of them, CT either missed or underestimated the BPI. Similarly, Bradley et al examined 37 patients with BPI and found 2 false-positive and 10 false-negative CT results, for overall sensitivity of 71.4% but only 42.9% for the prediction of major ductal injury. Similar results are reported for BDI. Single-detector CT scanners were used in these studies. In a more recent study, Teh et al used a single-detector scanner during the early period and a 16-slice multidetector scanner during the late period of the project. In 50 patients with confirmed BPI, we recorded 13 false-negative and 2 false-positive CT results, whereas in 11 patients with confirmed pancreaticoduodenal injury, the CT result was false positive in 2 patients and false negative in 1. In this study, nearly 60% of the patients had 16- or 64-slice CT; the remaining had a single-detector or a 4-slice multidetector CT, which is considered to be of lower resolution compared with the technologically advanced scanners used today. Overall sensitivity was 76%, with only moderate superiority of the newer-generation scanners (82.8%) over the older ones (66.7%). It is possible that the failure of early CT to diagnose BPDI relates less to its diagnostic accuracy and more to the progression of disease, which may evolve and become apparent with time. The trauma team should be aware of this fact and be willing to repeat CT if a pancreatic injury is suspected.

It would be reasonable to assume that diagnostic errors and delays would be associated with adverse outcomes. In the present study, a missed diagnosis did not affect mortality and length of hospital stay. Patients with and without a missed BPDI diagnosis had similar mortality rates (13.3% for the initially missed group vs 8.8% for the timely diagnosed group; P = .30). This was true even when BPI and BDI were analyzed separately (14.2% vs 11.7%; P = .87 and 13.2% vs 13.3%; P = .99, respectively). It is possible that the lack of difference in mortality is caused by inadequate sample size (α β error). To maintain the ratio of almost 1 to 7 between patients with (n = 30) and without (n = 200) a missed injury and to detect a difference of 13.3% vs 8.8% as statistically significant, we would need 3472 patients for a
power of 80% and 4696 patients for a power of 90%. The lack of correlation between time to diagnosis and length of intensive care unit or hospital stay further proves that diagnostic delays did not cause serious morbidity that prolonged hospitalization. This finding is not unique in the literature. Despite the widespread notion that delayed presentation and treatment of pancreatic injuries leads to disastrous outcomes, objective evidence is hard to find. Lucas and Ledgerwood reported that a delay in treatment of blunt duodenal injuries of less than 24 hours did not seem to affect the final outcome. Similarly, there was no difference in mortality caused by duodenal injury–related sepsis between patients operated on within 12 hours of admission or between 12 and 24 hours. In a series of 55 patients with BPI admitted during 10 years and treated by distal pancreatectomy, 7 had delayed presentations, including 5 delays of 24 hours, 1 of 48 hours, and 1 of 3 weeks. There were no postoperative pancreas-related deaths, and there was only 1 pancreas-related complication, a low-output pancreatic fistula that resolved after 5 weeks. In another study of 14 patients with BPI, all 9 with early diagnosis survived, but 1 of 5 patients with delayed diagnosis died. The difference was not significant, although valid conclusions could not be drawn from this limited sample. Carr et al reported on 11 patients with late complications, including 5 pseudocysts, 1 fistula, 1 abscess, and 4 cases of recurrent pancreatitis. None of them experienced major sequelae, and expectant management or distal pancreatectomy was curative. Other researchers have supported that delayed operative intervention increased pancreas-specific mortality, although the period of delay and the nature of the injury were not specifically described.

The NOM of low-grade BPD (grades 1 and 2) is a valid concept. Most patients selected for NOM did well. The failure rate was 10.3%, and the complication rate associated with failure was 3%. One complication was caused by an error in diagnosis. Computed tomography misdiagnosed a BDI as grade 1, which then produced peritonitis and was found to be grade 3 after surgery (last patient in Table 5). There were no further sequelae. It is remarkable that nearly 60% of patients with grades 1 and 2 BPD were managed by NOM, with a success rate of 91.4%. This observation contrasts with other publications. Of 42 patients managed nonoperatively between 1988 and 1996 in 4 hospitals in North Carolina and 1 in New York, only 22 (52.4%) completed NOM successfully. However, clinical deterioration was recorded only in 6, whereas the remaining patients were operated on because of radiographic evidence of duodenal injury or a positive peritoneal lavage finding. These are not universally accepted indications of the need for an operation. There is no proof that 16 of the 22 patients would have unfavorable outcomes had NOM been continued.

Similarly, of 9 patients in the NOM group of 40 with BPI, 1 required exploration because an endoscopic retrograde cholangiopancreatography (ERCP) revealed ductal disruption and not because of clinical deterioration. Some authors reviewing the management of trauma to the pancreas do not offer NOM as an option and propose surgical drainage even for grade 1 pancreatic injuries. Other researchers believe that NOM is safe if no ductal injury is present on CT but recommend ERCP to rule it out confirmatively. We did not collect data on ERCP and, therefore, cannot document whether the high degree of NOM success was due to accurate staging by CT or careful selection of patients by additional diagnostic procedures. We consider it unlikely that all patients in the NOM group had ERCP in the Research Consortium of New England Centers for Trauma (ReCONECT).

Nearly 1 in 5 patients had BPD-related complications. The rate decreased to 1 in 10 for patients in the NOM group and 1 in 4 for operatively managed patients. Pancreatic injuries were more likely to cause complications than were duodenal injuries. A grade higher than 2 was an independent risk factor for complications. Similar figures are reported in the literature. It seems that, despite great advances in surgical techniques and resuscitation, BPD-related morbidity remains relatively unchanged.

This study is associated with the strengths and limitations of a multicenter initiative. It analyzes the largest sample of patients with BPD to date and offers a fairly representative view of the diagnostic approach and management of these patients in level I and II academic and nonacademic trauma centers. On the other hand, best practices were hard to identify, and valid conclusions could not be made for each center individually because the sample of any given institution was relatively small. Comparing 11 institutions with each other would require a much greater sample size. Defined protocols of BPD management did not exist in the participating centers, as is probably true nationally. Overall, significant differences in outcome were not found comparing academic with nonacademic centers. Failure of NOM was defined by the need for an operation. The argument could be made that NOM failed in all 10 patients who developed a complication, even if the patients were not operated on. Most of these patients had self-limited processes and recovered with minimal or no additional intervention. We could not decipher whether NOM failed because of clinical deterioration from BPD, information from additional imaging studies, or coexisting abdominal injuries. The definition of a missed diagnosis could be confusing because it relied mainly on diagnostic errors of the initial CT and not on patients who were managed inappropriately for protracted periods. We chose this definition because it reflects the potential for...

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**Table 8. Correlation Between Time From Hospital Admission to Diagnosis and Intensive Care Unit (ICU) and Total Hospital Lengths of Stay**

<table>
<thead>
<tr>
<th></th>
<th>Spearman Correlation Coefficient (r)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICU Stay</td>
<td>Hospital Stay</td>
</tr>
<tr>
<td>All patients (N=230)</td>
<td>-0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>Patients with a missed diagnosis (n=30)</td>
<td>0.09</td>
<td>0.11</td>
</tr>
</tbody>
</table>

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mortality. The fact that severe BPI is rare makes it difficult to establish evidenced-based algorithms, since no single institution is likely to have an extensive experience with pancreatic injuries, ERCP to establish ductal integrity, and discharge level on admission in the diagnosis of blunt injury to the pancreas: its significance and limitations. Ann Surg. 1997;226(1):70-74.


References


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