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High-grade pancreatic trauma in children: comparison of conservative and surgical management in two case reports

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Case Report

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Abstract

Background: Blunt pancreatic trauma in the pediatric population is a rare but high-stakes clinical challenge, accounting for approximately 0.2–9% of abdominal injuries. While non-operative management (NOM) is the gold standard for low-grade injuries, the management of American Association for the Surgery of Trauma (AAST) Grade III and IV injuries, specifically those involving the main pancreatic duct, remains controversial. Evidence is currently divided between conservative strategies, endoscopic interventions, and early surgical resection or reconstruction.

Case Presentation: This report describes two cases of high-grade pancreatic trauma (Grade IV) in adolescent males resulting from bicycle handlebar injuries. Both patients presented with epigastric pain and significantly elevated serum pancreatic enzymes. Initial imaging (CT and MRI) confirmed near-full or complete-thickness parenchymal lacerations at the head-body or body-tail junctions.

In **Case 1**, a 10-year-old boy underwent endoscopic retrograde cholangiopancreatography (ERCP) with pancreatic duct stenting three days post-injury. He was successfully managed with a conservative regimen including total parenteral nutrition (TPN) and was discharged on day 24, although long-term follow-up revealed persistent ductal leakage requiring restenting. In **Case 2**, a 15-year-old boy also underwent ERCP and stenting; however, his course was complicated by the development of infected peripancreatic fluid collections and clinical deterioration. He subsequently underwent a delayed surgical reconstruction (Roux-en-Y pancreaticojejunostomy) on day 27, resulting in a rapid recovery and complete resolution of ductal leakage.

Conclusions: Management of high-grade pediatric pancreatic trauma requires a highly individualized approach. While ERCP-guided stenting can facilitate successful non-operative management in selected cases, it does not guarantee the avoidance of surgery. These cases demonstrate that while a "watch-and-wait" strategy is feasible, clinicians must maintain a low threshold for surgical intervention if conservative measures fail. Furthermore, the persistence of ductal leakage in asymptomatic patients highlights the necessity of rigorous, long-term follow-up to optimize functional outcomes.

Key message

- High-grade pancreatic trauma in children remains rare and lacks standardized management guidelines.
- Comparable injuries may require different treatment strategies depending on clinical evolution.
- Conservative management can be successful in selected cases even with severe pancreatic injury.
- Early surgical intervention may reduce complications in patients with clinical deterioration.
- Case-based comparisons contribute valuable evidence in rare pediatric trauma scenarios.

Introduction

Blunt abdominal trauma in the pediatric population is rare but clinically significant problem. The most frequently injured solid organs in these patients are the spleen, liver, kidneys, and pancreas. Pancreatic trauma ranks fourth in terms of incidence, accounting for approximately 0.2–9% of all pediatric abdominal injuries. (1) Although relatively uncommon, pancreatic injury carries a high mortality rate ranges from 5% to 20%.(2) Therefore, accurate diagnosis and an appropriate treatment strategy are crucial when managing patients with suspected pancreatic trauma.

Currently, computed tomography (CT) is the primary imaging modality used to assess the pancreas after trauma.(3, 4) CT is a valuable tool for identifying and grading pancreatic injuries according to the Organ Injury Scale (OIS), a five-level clinical classification system (grades I–V) that assists in evaluating severity, predicting outcomes, and determining the optimal therapeutic approach. (5) In addition to CT, ultrasound (US), MRI and endoscopic retrograde cholangiopancreatography (ERCP) may be useful, particularly in patients with negative CT findings or in those managed non-operatively who require evaluation for potential complications (3, 4)

The management of pancreatic trauma remains complex and continues to be the subject of considerable debate. Treatment options include non-operative management (NOM) and surgical intervention. As with most abdominal solid-organ injuries, NOM is generally considered effective for grade I and II pancreatic injuries.(2)

However, optimal management for injuries grade III and higher remains controversial. Due to the overall rarity of pediatric pancreatic trauma and the limited volume of high-quality data, clear evidence-based guidelines are lacking, and the literature presents conflicting recommendations. Many studies do not provide definitive conclusions—some support conservative treatment, while others advocate for early operative management.

In this report, we present two clinical cases that, despite many similarities, differed in their management approaches and ultimately in their clinical outcomes.

Case Presentation

Case 1

A previously healthy 10-year-old boy presented to the Emergency Department after sustaining a blunt abdominal trauma caused by a bicycle handlebar. On admission, he reported epigastric pain and a single episode of emesis. Physical examination revealed a well-circumscribed, circular contusion consistent with a handlebar imprint without skin disruption. The abdomen was soft, with no guarding or peritoneal signs. No other abnormalities were noted.

Initial laboratory tests showed mildly elevated WBC and neutrophiles (14,15x10^3/micl, 11,79 x10^3/micl) and a significantly increased serum lipase level of 515 U/L; all remaining parameters were

within normal ranges. Abdominal ultrasonography demonstrated mild thickening of the pancreatic tail without visible intraparenchymal fluid collections and no free intraperitoneal fluid.

Contrast-enhanced CT revealed mild thickening and heterogeneity of the pancreatic tail with a small central hematoma. A nearly full-thickness parenchymal disruption at the head–body junction was identified, accompanied by a small amount of peripancreatic fluid. No free intraperitoneal fluid or other organ injuries were present. [Figure 1]

MRI performed the following day confirmed a near–full-thickness pancreatic parenchymal injury at the head–body junction (Grade IV) and a small amount of fluid tracking along the anterior pararenal fascia and into the pelvis.

Given the imaging findings, three days after injury, the patient was qualified for ERCP with pancreatic duct stenting. Contrast injection demonstrated a large contrast extravasation at the body–tail junction, confirming main pancreatic duct disruption. Inflammatory changes in the duodenum were noted. A 5 Fr × 7 cm pancreatic stent was placed into the proximal ductal segment.

The patient was managed conservatively with fasting, total parenteral nutrition (TPN), analgesia and observation. His abdominal symptoms gradually improved, and serum amylase and lipase levels decreased. Follow-up ultrasound on day 6 revealed a small amount of free intraperitoneal fluid, mild enlargement of the pancreatic head, and an organizing hematoma at the body–tail transition.

On day 8, the patient developed fever (38.4°C) and a mild deterioration of general condition. Physical examination revealed a soft abdomen with tenderness in the epigastrium but no peritoneal signs. Laboratory tests showed a modest increase in inflammatory markers. Ultrasound demonstrated small peripancreatic fluid strands but no organized collections. Local erythema around the central venous catheter and clinical course suggested catheter-related infection, which resolved with targeted antibiotic therapy.

Repeat abdominal MRI on day 14 showed complete regression of fluid collections behind the pancreatic tail, with only minimal residual fluid strands. A small intraparenchymal fluid collection persisted at the site of injury. The pancreatic duct was not dilated, and the previously noted edema showed marked improvement.

Oral feeding was initiated on day 15 and was well tolerated. Serial ultrasonography showed no recurrent fluid collections. The patient was discharged home in good condition on day 24.

At follow-up examination on day 79 after injury, endoscopic evaluation was performed, and the pancreatic duct stent was removed, followed by catheterization and contrast injection. Contrast extravasation was observed; therefore, a new pancreatic duct stent was reinserted. On ultrasound examination, the distal portion of the pancreas appeared thickened and slightly heterogeneous, without visible fluid collections.

Long-term follow-up is ongoing.

Case Presentation

Case 2

A previously healthy 15-year-old boy presented to the Emergency Department 24 hours after sustaining a bicycle handlebar injury. He reported progressive abdominal pain and vomiting. Physical examination showed an abrasion over the epigastrium and a tense, tender abdomen with muscular guarding.

Initial laboratory evaluation demonstrated substantially increased serum pancreatic enzymes (lipase 1135 U/L, pancreatic amylase 851 U/L), as well as WBC and neutrophiles (17,65x10^3/micl, 14,96 x10^3/micl). Ultrasonography revealed free fluid in the pelvis, perihepatic space, perisplenic region and around the pancreas, as well as a heterogeneous hypoechoic area within the pancreatic body.

Contrast-enhanced CT showed a complete-thickness laceration extending across the body–tail junction (Grade IV injury), with mild thickening and heterogeneity of the pancreatic tail. No other intra-abdominal organ injuries were observed. [Figure 2]

Three days after injury the patient was referred for ERCP. Contrast extravasation was seen along the left paravertebral region, confirming a main pancreatic duct disruption. The distal duct segment could not be cannulated; a 5 Fr × 7 cm stent was placed into the proximal duct.

Conservative management (fasting, TPN, analgesia, and observation) was continued. Enzyme levels gradually decreased, and the patient reported diminishing pain. Ultrasound on day 6 demonstrated free intraperitoneal fluid and an organizing hematoma at the body–tail junction.

On day 12, the patient again developed epigastric pain. CT revealed multiple fluid collections extending from the mid-abdomen to the splenic hilum, the largest at the site of pancreatic injury. Additional findings included significant stenosis of the celiac trunk and focal thickening of the anterior-left aortic wall.

Given the patient’s clinical stability, conservative management was prolonged. Oral intake was introduced on day 18 with initial tolerance. On day 21, he experienced recurrent abdominal pain with accompanying increases in lipase, amylase, bilirubin, leukocyte count, and CRP. Ultrasound raised suspicion of infected peripancreatic fluid collections. Antibiotic therapy was initiated, but due to lack of clinical improvement, surgical intervention was planned.

On day 27, the patient underwent laparotomy with a Roux-en-Y pancreaticojejunostomy. Postoperatively, his symptoms improved rapidly and the recovery was uneventful. Oral fluids were started on postoperative day 8 (day 35 after injury), and full oral feeding on postoperative day 10 (day 37). Follow-up ultrasound revealed no residual peripancreatic fluid collections. The patient was discharged home on day 41 in good condition.

At follow-up examination on day 50 after injury, endoscopic evaluation was performed. The pancreatic duct stent was removed, followed by catheterization and contrast injection. The pancreatic duct in both the tail and head regions appeared smooth-walled, with no evidence of contrast leakage outside the ductal lumen. Ultrasound examination revealed no abnormal peripancreatic fluid collections.

Long-term follow-up is ongoing.

Discussion

Pancreatic injuries in children, although rare, remain a significant diagnostic and therapeutic challenge. Despite their low incidence, these injuries are associated with substantial morbidity and may contribute to mortality, particularly in resource-limited settings. Although the number of studies addressing pediatric pancreatic trauma has increased, the development of clear, evidence-based clinical guidelines is still limited by small sample sizes, heterogeneity of study methodologies, variable clinical outcomes, and considerable differences in institutional practice patterns.

Most available evidence indicates that for AAST grade I–II injuries, non-operative management remains the preferred strategy. (3) This approach—based on hemodynamic monitoring, adequate analgesia, nutritional support when needed, and periodic laboratory and imaging reassessment—yields consistently favorable outcomes.

The management of grade III and IV injuries, particularly those involving disruption of the main pancreatic duct, is substantially more complex and continues to generate debate. In these higher-grade injuries, treatment decisions often depend on the child's clinical condition, the experience of the treating team, and the availability of diagnostic and interventional techniques. While many authors emphasize that high-grade pancreatic trauma frequently requires operative management, the optimal timing and type of intervention remain controversial. (1, 6) In our patients, we initially adopted a watch-and-wait strategy, hoping for a favorable outcome. In the first case, this approach proved successful; however, in the second case, surgical intervention ultimately became necessary.

Across studies comparing operative (OM) and non-operative management (NOM), mortality rates do not significantly differ between the two strategies. However, complications and overall clinical trajectories show considerable variability. Some reports suggest that NOM may be associated with shorter hospital stays (7, 8) whereas others show the opposite trend.(6, 9) Similar inconsistencies are noted with regard to duration of parenteral nutrition. (6, 7, 8, 9)Pseudocyst formation is markedly more common following NOM—reported in 40–60% of cases and increasing with injury grade—compared with 1–7% after operative treatment(1, 6, 10, 11).

Importantly, up to half of pseudocysts resolve spontaneously without intervention.(10) The incidence of postoperative pancreatic fistulas has been reported as lower in NOM cohorts, yet this difference becomes insignificant when analyzing injuries of grade III or higher.(6) Operative complications are infrequently described in the literature, likely reflecting both their rarity and underreporting. In our cases,

we did not observe any complications following either surgical or conservative management. However, in the patient treated conservatively, long-term follow-up revealed persistent contrast leakage outside the pancreatic duct, which resulted in prolonged treatment and extended duration of pancreatic duct stenting. Unfortunately, we are unable to compare this finding with the existing literature, as most published studies do not report such long-term follow-up or related late complications. Nevertheless, this issue warrants further investigation in future studies, as it may represent an important prognostic factor influencing treatment selection in patients with grade III or higher pancreatic injuries.

Interpretation of operative outcomes is further complicated by variability in the timing of surgery. In many reports, the interval between trauma and operative intervention differs widely or is not reported at all. In some studies surgery management was stared after NOM failure, what made OM delayed(1, 7, 10), similar to our case.

Delayed surgery is believed to worsen outcomes because progressive enzymatic autodigestion and inflammation within the peritoneal cavity create technically challenging operative conditions.(12) Several studies highlight the importance of early intervention—some demonstrating improved outcomes when pancreatic resection is performed within 72 hours of injury (13, 14), while others report increased morbidity, mortality, and prolonged hospitalization in patients with grade III–V injuries treated conservatively.(15)

Most comparative studies evaluating NOM versus OM focus primarily on distal pancreatectomy as the operative approach. However, multiple alternative reconstructive techniques have been described, including the Letton–Wilson procedure (Roux-en-Y pancreatojejunostomy), end-to-side pancreaticogastrostomy, end-to-end pancreatic duct anastomosis, and transpapillary stenting. Although promising, these techniques remain supported by limited evidence, precluding definitive recommendations.(16)

Minimally invasive approaches—particularly laparoscopic techniques—may represent an important future direction in the management of pediatric pancreatic trauma. Reported advantages include faster recovery, reduced morbidity, and preservation of abdominal wall integrity. However, data remain sparse and further research is urgently needed.(15, 17, 18)

Endoscopic retrograde cholangiopancreatography (ERCP) is another key diagnostic and therapeutic modality. ERCP plays a crucial role in cases where the extent of ductal injury is uncertain, with reported sensitivity of approximately 97% for detecting pancreatic duct leakage. Furthermore, ERCP allows for therapeutic stent placement, which can yield clinical improvement in selected patients. (3, 5, 19) Despite these benefits, ERCP remains technically demanding, particularly in severely injured pancreas, and requires highly specialized expertise. Its therapeutic success rate remains around 50%, and complications—including post-ERCP pancreatitis and pancreatic fistula—are relatively common.(7, 20)In our first case we perform ERCP, but as we can see later our patient still have a contrast leaking in control USG after 80 days since injury. Notably, in some series, up to half of patients who underwent ERCP-

guided stenting ultimately required surgery, exactly like our second patient. Nevertheless, in carefully selected cases, ERCP may serve as a valuable alternative to operative management.

Laboratory monitoring can also contribute to clinical assessment. Although a single elevated serum amylase at presentation demonstrates poor sensitivity and specificity, sequential measurements may correlate with injury severity.(3) Aydogdu et al. demonstrated that a rise in amylase levels can predict pseudocyst formation, a trend also observed in our patient, whose amylase was initially normal but progressively increased during the first week, preceding pseudocyst development.(21) But we can't conclude that without more research, because elevation of amylase in second patient wasn't connected with pseudocyst formation. [Figure 3][Figure 4]

Computed tomography remains the primary imaging modality, offering good sensitivity (around 91%) and specificity for detecting parenchymal injury. In equivocal cases, magnetic resonance imaging or ERCP can further delineate ductal involvement and guide the choice between operative and non-operative strategies.(6)

Conclusions

Pediatric pancreatic trauma, particularly high-grade injuries involving the main pancreatic duct, remains a complex clinical entity requiring individualized decision-making. Our cases illustrate that an initial non-operative, watch-and-wait strategy supported by endoscopic ductal stenting may be effective in selected patients. However, in some cases surgery should be the first choice. Failure of conservative management should prompt timely surgical intervention, which can lead to definitive resolution and favorable outcomes when appropriately indicated. These observations highlight the importance of close clinical, laboratory, and imaging surveillance, as well as the need for long-term follow-up, in guiding management strategies for grade III–IV pancreatic injuries. Further prospective studies with standardized methods, reporting of long-term outcomes and with precise diagnostic to evaluate treatment are needed to better define prognostic factors and optimize treatment algorithms in this challenging patient population.

Abbreviations

CT - Computed tomography
ERCP - Endoscopic retrograde cholangiopancreatography
MRI - Magnetic resonance imaging
NOM - Non-operative management

OM - operative
OIS - Organ Injury Scale
TPN - Total parenteral nutrition

USG - Ultrasonography
WBC - White blood cell count
CRP - C-reactive protein

Declarations

Ethics approval and consent to participate

Ethical approval was waived for this case report according to institutional policies, as it describes a single patient and does not constitute research involving human participants. Written informed consent was obtained from the patient's legal guardian.

Consent for publication

Written informed consent for publication of clinical details and any accompanying images was obtained from the patient's legal guardian.

Data Sharing Statement:

The datasets supporting the conclusions of this article are included within the article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors contributed equally to the conception, data collection, manuscript preparation, and approved the final manuscript.

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Clinical trial number:

Not applicable.

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Figures



Figure 1

Computed tomography scan of Patient 1

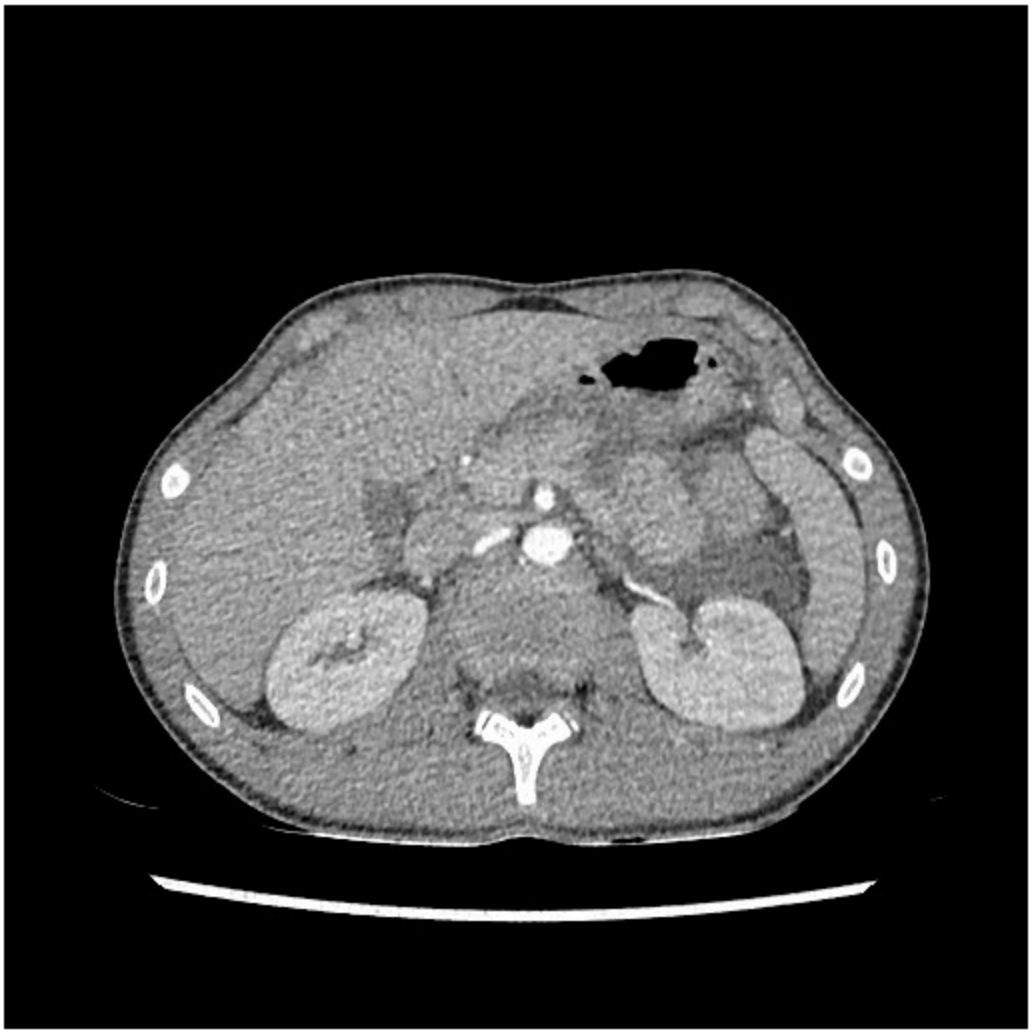


Figure 2

Computed tomography scan of Patient 2

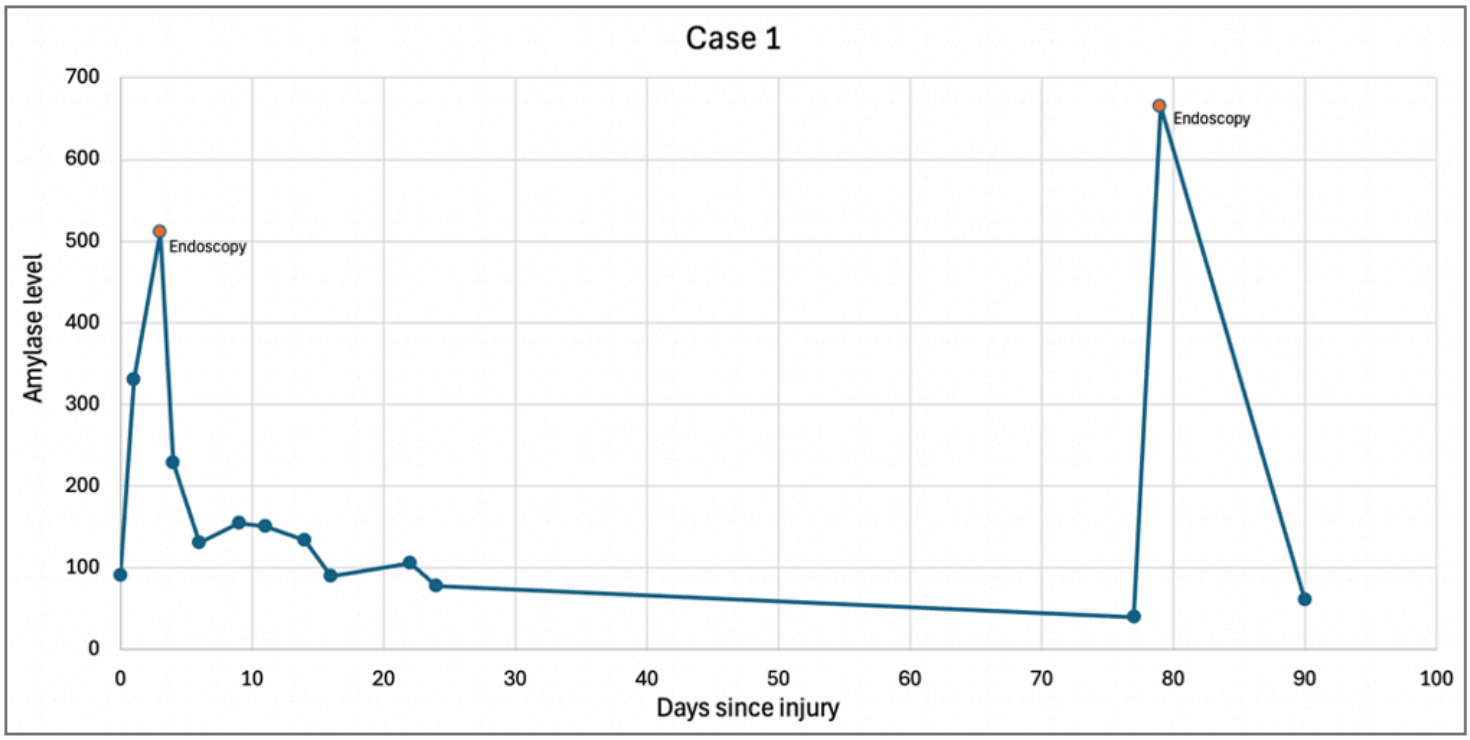


Figure 3

Serum amylase levels over time during hospitalization (days since injury). Two pronounced peaks are observed, both temporally associated with endoscopic interventions (days 3 and 79). Between these events, amylase levels gradually decrease and stabilize within near-normal ranges.

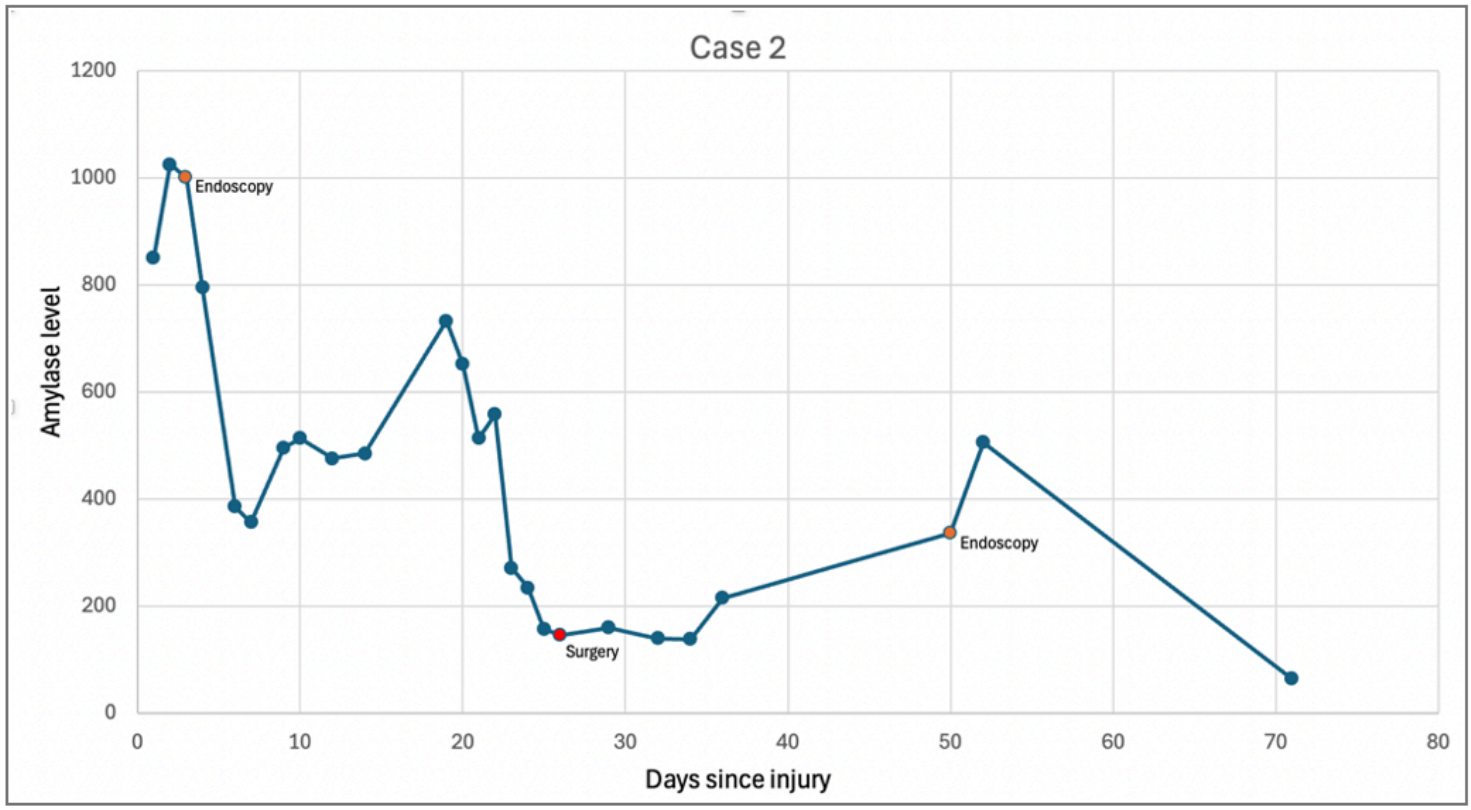


Figure 4

Serum amylase levels over time during hospitalization (days since injury). An initial marked elevation is observed with a peak around day 2, followed by fluctuating but gradually decreasing levels. A significant decline occurs after surgical intervention (day 25). A subsequent moderate increase is noted around day 50, coinciding with endoscopy, followed by a final decrease toward near-normal levels.