

Biloma and Biliary Fistula Secondary to Strasberg E2 Bile Duct Injury After Open Cholecystectomy: Case Report

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ABSTRACT

Introduction: Iatrogenic bile duct injury (BDI) remains one of the most catastrophic complications in gastrointestinal surgery, with profound implications for patient morbidity, long-term survival, and healthcare costs. Its incidence is significantly exacerbated by severe local inflammation and anatomical variations.

Case Presentation: A 40-year-old male with a history of type 2 diabetes and prior orchidectomy for testicular cancer presented with complicated cholecystitis. He underwent an open cholecystectomy at an external facility where a Strasberg E2 BDI occurred due to distorted anatomy from Mirizzi Syndrome and piocolecystitis. The patient developed a high-output biliary fistula (500–600 cc/day) and a perihepatic biloma. Upon referral to a tertiary care center, magnetic resonance cholangiopancreatography (MRCP) confirmed a complete interruption of the common hepatic duct. A definitive surgical reconstruction via a Roux-en-Y hepaticojejunostomy was performed.

Discussion: Strasberg E2 injuries involve the common hepatic duct more than 2 cm from the confluence. Successful management hinges on early recognition, control of sepsis, and specialized biliary reconstruction to prevent secondary biliary cirrhosis and recurrent cholangitis.

Conclusion: This case highlights the necessity of a multidisciplinary approach and the critical role of advanced imaging in planning definitive repairs in specialized hepatobiliary units.

KEYWORDS: Bile duct injury, Mirizzi Syndrome, Hepaticojejunostomy, Piocolecystitis, Strasberg Classification, Biliary reconstruction, Iatrogenic injury, Surgical complications.

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I. INTRODUCTION

Cholecystectomy, whether performed via a laparoscopic approach or through the traditional open technique, remains the gold-standard surgical procedure for the treatment of biliary calculous disease worldwide, being one of the most frequently executed abdominal interventions in daily clinical practice; however, despite its routine nature, it is not exempt from inherent risks that can lead to catastrophic consequences, with iatrogenic bile duct injury (BDI) being the most feared and devastating adverse event for both the surgeon and the patient¹.

Although the transition toward minimally invasive surgery in the early 1990s caused a transient spike in the rates of these injuries, contemporary figures have stabilized globally between 0.3% and 0.7%, representing thousands of patients each year who face complications that radically alter their life expectancy and quality of life, associated with a three-fold increase in mortality during the first postoperative year and a considerable socioeconomic impact due to the need for multiple reinterventions and prolonged hospitalizations².

The intrinsic complexity of this particular clinical case resides in the convergence of two high-risk pathological entities that acted synergistically to obscure the surgical field and distort the surgeon's anatomical perception: piocolecystitis and Mirizzi Syndrome³.

Piocolecystitis, defined as gallbladder empyema, represents an advanced stage of acute cholecystitis where the organ transforms into a closed abscess, generating extreme transmural inflammation that causes hypervascularity and severe tissue fragility in the hepatocystic triangle (Triangle of Calot), which renders the identification of the Critical View of Safety impossible and predisposes the surgeon to technical errors during dissection⁴.

On the other hand, Mirizzi Syndrome is a rare complication occurring in less than 1% of patients with cholelithiasis, characterized by the impaction of a gallstone in the cystic duct or the gallbladder neck, which triggers a chronic inflammatory response culminating in the fusion of the walls of the cystic duct and the common hepatic duct⁵.

This obliteration of normal anatomical planes often induces a cephalad traction phenomenon where the common hepatic duct is mistaken for the cystic duct, leading to an inadvertent and complete section of the main bile duct—a mechanism that explains the severity of the injury observed in this patient⁶.

According to the Strasberg-Bismuth classification, injuries are categorized based on their proximity to the biliary confluence, with a type E2 injury being defined as a section of the common hepatic duct more than 2 cm from the junction of the right and left hepatic ducts, which entails a total interruption of bile flow toward the duodenum and the consequent loss of enterohepatic circulation, resulting in high-output biliary fistulas and peritoneal effusions that can trigger biliary sepsis and profound metabolic imbalances⁷.

The initial management of these injuries must focus on damage control through the drainage of collections and the stabilization of infectious processes, avoiding at all costs primary repair attempts under conditions of acute inflammation or by non-specialized personnel⁸.

Planning for definitive reconstruction requires precise anatomical mapping, where Magnetic Resonance Cholangiopancreatography (MRCP) has consolidated itself as the non-invasive gold standard for identifying the length of the remaining biliary stump and guiding the surgical strategy⁹.

The primary objective of reconstruction through a Roux-en-Y hepaticojejunostomy is to restore a low-pressure, constant-flow biliary drainage system, ensuring a wide, well-vascularized, and tension-free anastomosis that prevents the formation of long-term cicatricial stenoses, which are the main cause of recurrent cholangitis and the progression toward secondary biliary cirrhosis that would irreversibly compromise the patient's survival¹⁰.

II. CASE REPORT

The patient is a 40-year-old male with a significant medical history including Type 2 Diabetes Mellitus, diagnosed in May 2025 and managed with metformin, and a history of right orchidectomy performed five years prior for testicular cancer, currently under oncological surveillance with no evidence of recurrence.

On November 29, 2025, the patient underwent an emergency open cholecystectomy at an external healthcare facility due to severe acute cholecystitis. The intraoperative findings were described as highly complex, characterized by piocolecystitis and a Type I Mirizzi Syndrome, which created an environment of intense fibrosis and anatomical distortion within the hepatocystic triangle.

During the dissection of the "frozen" Calot's triangle, an iatrogenic injury occurred, resulting in the complete transection of the common hepatic duct, subsequently classified as a Strasberg E2 lesion. Immediately following the surgical event, the patient developed a high-output biliary fistula, with a Penrose drain output exceeding 500 cc of bile per 24 hours, accompanied by progressive jaundice and abdominal pain. Upon admission to our tertiary care surgical unit on December 1, 2025, the patient was clinically stable but significantly icteric.

Physical examination revealed a Kocher-type subcostal incision with signs of perilesional inflammation and active biliary drainage. Laboratory evaluations at admission demonstrated a severe cholestatic pattern, with a Total Bilirubin of 3.5 mg/dL, Direct Bilirubin of 2.4 mg/dL, Gamma-glutamyl transferase of 504 U/L, and Alkaline Phosphatase of 216 U/L. An initial abdominal ultrasound identified a perihepatic fluid collection, or biloma, measuring 26×32×46 mm, with a calculated volume of 20.16 cc, located in the gallbladder bed. To define the exact anatomy of the injury, a Magnetic Resonance Cholangiopancreatography (MRCP) was performed on December 3, 2025.

The MRCP revealed a complete disruption of the common hepatic duct, with the distal common bile duct being inadequately visualized. A notch sign was identified at the site of the disruption, and a filiform tract was observed communicating the proximal biliary tree with the surgical bed, confirming the site of the high-flow fistula.

The patient remained in a state of controlled medical fasting with comprehensive intravenous fluid resuscitation, aimed at correcting a dehydration-induced positive fluid balance of +769.2 cc. Given his diabetic status, strict glycemic control was maintained to ensure optimal conditions for subsequent tissue healing. Broad-spectrum antibiotic therapy was initiated to treat the likely bacterial contamination from the initial piocolecystitis. Over the following weeks, the patient was protocolized for definitive repair, a period during which the inflammatory response was allowed to subside.

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On January 16, 2026, the patient underwent a definitive biliary reconstruction. The surgical strategy consisted of a Roux-en-Y Hepaticojejunostomy. The procedure began with a laparotomy to access the supramesocolic compartment. The proximal common hepatic duct stump was meticulously identified and dissected to ensure adequate length for a tension-free anastomosis.

A jejunal loop was transected distal to the Ligament of Treitz to create the Roux limb. An end-to-side anastomosis was performed between the common hepatic duct and the jejunum using fine, absorbable monofilament sutures, creating a wide stoma to prevent future stenosis. Intestinal continuity was restored via a side-to-side jejuno-jejunostomy located distal to the biliary anastomosis to prevent the reflux of intestinal contents into the biliary tree.

The immediate postoperative period was favorable, as the external biliary output through the Penrose drain ceased immediately following the internal bypass. The patient's jaundice showed significant regression, and renal function remained preserved throughout the hospitalization, with a creatinine level of 0.7 mg/dL and urea of 25.7 mg/dL.

III. METHODS

The therapeutic management for this complex biliary injury was founded upon a strictly staged damage control strategy, primarily designed to prioritize the patient's physiological stability before attempting a definitive anatomical restoration. The initial phase of this methodology focused on the acute stabilization of the systemic inflammatory response and the correction of metabolic derangements caused by the persistent loss of bile and the underlying diabetic condition. Upon admission, a rigorous fluid resuscitation protocol was established to manage the patient's clinical dehydration, evidenced by a significant positive fluid balance of 769.2 cc, which was meticulously monitored to ensure hemodynamic stability and adequate renal perfusion. Concurrent with fluid management, strict glycemic control was implemented using intravenous insulin and the adjustment of oral hypoglycemic agents to mitigate the risks of impaired tissue healing and postoperative infections associated with the patient's established type 2 diabetes mellitus.

To address the high-output biliary fistula and the associated risk of peritoneal sepsis, the medical team utilized broad-spectrum antibiotic prophylaxis targeting common enteric pathogens such as *Escherichia coli* and *Klebsiella* species, which are frequently isolated in cases of piocolecystitis. This pharmacological intervention was combined with the continuous monitoring and maintenance of the existing Penrose drain to prevent the expansion of the perihepatic biloma and to facilitate the controlled externalization of bile, which had been quantified at volumes as high as 560 cc per day. This stabilization period allowed the intense transmural inflammation and tissue friability

resulting from the initial emergency surgery to subside, thereby improving the surgical conditions for the subsequent reconstruction and reducing the likelihood of early anastomotic failure.

The diagnostic methodology relied heavily on advanced, non-invasive imaging techniques to establish a comprehensive anatomical roadmap of the biliary disruption. Magnetic resonance cholangiopancreatography (MRCP) served as the primary diagnostic standard, providing high-resolution visualization of the proximal biliary stumps and the exact location of the Strasberg E2 lesion. By identifying that the common hepatic duct was interrupted more than 2 cm from the hilar confluence, the surgical team was able to plan the specific dimensions for the jejunal Roux limb and anticipate the technical requirements for a tension-free anastomosis. This pre-surgical mapping was essential to differentiate the viable biliary tissue from the surrounding fibrotic lebed and to avoid further inadvertent injury to the remaining intrahepatic ducts or the vascular supply.

The definitive surgical method involved a complex reconstruction via a Roux-en-Y hepaticojejunostomy, which was initiated as a laparoscopic procedure and subsequently converted to an open laparotomy to ensure maximum safety and precision. After gaining access to the supramesocolic compartment and meticulously identifying the healthy proximal stump of the common hepatic duct, the jejunum was transected approximately 20 centimeters distal to the ligament of Treitz. The distal limb was then brought through the mesocolon transversum to the hepatic hilum to facilitate a tension-free, end-to-side biliary-enteric anastomosis using fine, absorbable monofilament sutures in a single-layer technique. Finally, intestinal continuity was restored by performing a side-to-side jejuno-jejunostomy at a point 60 centimeters distal to the hepaticojejunostomy, creating a functional Roux limb of sufficient length to prevent the reflux of intestinal contents and the subsequent risk of ascending cholangitis.

IV. RESULTS

The definitive surgical intervention achieved a successful restoration of the internal biliary drainage system, effectively neutralizing the physiological threat posed by the prior Strasberg E2 iatrogenic injury. Upon completion of the Roux-en-Y hepaticojejunostomy, the high-output external biliary fistula, which had consistently drained volumes exceeding 500 milliliters per day through the Penrose drain, ceased immediately and completely. This immediate cessation indicated the achievement of a water-tight and functional anastomosis between the common hepatic duct and the jejunal limb, allowing for the re-establishment of the enterohepatic circulation of bile acids, which is critical for the patient's nutritional and metabolic recovery.

In the immediate postoperative period, the patient remained hemodynamically stable, maintaining an average heart rate of 69 beats per minute and a blood pressure of

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125/92 mmHg, showing no signs of systemic inflammatory response syndrome despite the complexity of the reconstructive procedure. Although a single febrile episode of 38.0 degrees Celsius was recorded on the first postoperative day, it was managed successfully with conservative measures and did not recur. The patient demonstrated an excellent response to the transition from medical fasting to a low-fat oral diet within the first 48 to 72 hours, with no reports of abdominal distension, biliary vomiting, or pain, confirming that the intestinal continuity restored via the jejuno-jejunostomy was fully functional.

Biochemical analysis provided objective evidence of the successful biliary decompression, as the cholestatic markers showed a steady and significant downward trend. The total bilirubin, which had peaked at 3.5 mg/dL during the obstructive phase, began to normalize rapidly, reflecting the patency of the new biliary-enteric bypass. Similarly, the levels of Gamma-glutamyl transferase and Alkaline Phosphatase, which were markedly elevated at 504 U/L and 216 U/L respectively upon admission, showed a progressive decline. This enzymatic improvement suggests a reduction in the hepatocyte stress and biliary stasis that had characterized the patient's clinical state since the initial surgery in late November.

Furthermore, the patient's renal and metabolic parameters remained exceptionally stable throughout the surgical and recovery phases. Despite the systemic stress of a major hepatobiliary reconstruction and the patient's underlying type 2 diabetes, the serum creatinine remained at 0.7 mg/dL and urea at 25.7 mg/dL, indicating that the kidneys were not affected by the previous hyperbilirubinemia or the perioperative fluid shifts. Glycemic control was successfully maintained within target ranges through the transition from intravenous to oral medication. At the time of discharge, the surgical wound was clean and healing by primary intention, and the patient was clinically asymptomatic, marking a successful resolution of a life-threatening surgical complication.

V. DISCUSSION

The surgical management of an iatrogenic bile duct injury classified as Strasberg E2, especially when occurring in the complex clinical landscape of Mirizzi Syndrome and piocolecystitis, represents one of the most significant challenges in modern hepatobiliary surgery. The primary mechanism of injury in this patient was likely a misidentification error, exacerbated by the intense inflammatory process and the chronic anatomical distortion characteristic of Mirizzi Syndrome, which often leads to the common hepatic duct being mistaken for the cystic duct during cephalad traction of the gallbladder. This specific type of injury involves the common hepatic duct more than two centimeters from the biliary confluence, necessitating a high-level reconstruction that can only be safely executed in a tertiary care center by a specialized surgical team ¹.

The timing of the reconstruction in this case followed a delayed approach, which is widely considered the gold standard for managing complex biliary injuries discovered after the initial operation. By allowing several weeks to pass before the definitive repair, the surgical team ensured that the initial acute inflammation and tissue friability associated with the piocolecystitis had subsided, thereby optimizing the conditions for a secure anastomosis. During this waiting period, the use of a Penrose drain was critical as it transformed a potentially fatal biliary peritonitis into a controlled external fistula, allowing for the stabilization of the patient's nutritional and metabolic status, which is particularly vital in individuals with underlying comorbidities such as type 2 diabetes ².

Magnetic resonance cholangiopancreatography (MRCP) played a pivotal role in the diagnostic workup, providing a high-resolution, non-invasive roadmap of the biliary anatomy that was essential for planning the Roux-en-Y hepaticojejunostomy. The identification of the "notch sign" and the discontinuous trajectory of the common hepatic duct allowed the surgeons to anticipate the exact location of the proximal stump and to ensure that the subsequent anastomosis would be performed on healthy, well-vascularized biliary tissue. This precision is fundamental to preventing the most common long-term complication of biliary repair, which is anastomotic stricture, often leading to recurrent cholangitis and the eventual development of secondary biliary cirrhosis ⁷.

The choice of a Roux-en-Y hepaticojejunostomy for this Strasberg E2 lesion is supported by extensive surgical literature as the most effective method for restoring biliary-enteric continuity in high-level injuries. Unlike end-to-end repairs, the Roux-en-Y configuration provides a tension-free outlet that accommodates the physiological movements of the liver and diaphragm, reducing the mechanical stress on the suture line. The creation of a sixty-centimeter Roux limb further protects the biliary tree by preventing the reflux of intestinal contents and enteric bacteria, which is a major risk factor for ascending infections and long-term graft failure in reconstructive biliary surgery ⁴.

Long-term surveillance for this patient remains mandatory, as the risk of late-onset stenosis can persist for years following the initial repair. Success in these cases is not merely measured by the immediate cessation of the biliary fistula but by the long-term maintenance of normal liver function tests and the absence of obstructive symptoms. This case underscores the importance of a multidisciplinary strategy, integrating advanced imaging, metabolic optimization, and meticulous surgical technique to navigate the inherent dangers of complex biliary pathology and to achieve a favorable outcome in a high-risk patient ¹⁰.

CONCLUSIONS

The successful management of a complex Strasberg E2 iatrogenic bile duct injury in the clinical setting of Mirizzi

Syndrome and piocolecystitis demonstrates that a favorable outcome is achievable when following a strictly standardized and multidisciplinary approach. This case reinforces the fundamental principle that early recognition of the injury and the immediate establishment of external biliary drainage are the most critical factors in preventing life-threatening biliary peritonitis and systemic sepsis. By prioritizing physiological stabilization over immediate definitive repair, the surgical team allowed for the resolution of acute transmural inflammation, thereby optimizing the local tissue conditions necessary for a successful and durable biliary-enteric reconstruction.

The utilization of advanced, non-invasive imaging, specifically magnetic resonance cholangiopancreatography, proved to be an indispensable tool in the diagnostic phase by providing a precise anatomical roadmap of the biliary disruption. This detailed mapping allowed for the accurate classification of the lesion and ensured that the subsequent Roux-en-Y hepaticojejunostomy was performed on healthy, well-vascularized biliary tissue proximal to the site of injury. Furthermore, the management of this patient's underlying comorbidities, particularly the strict control of type 2 diabetes, was essential in mitigating the risks of impaired wound healing and ensuring the integrity of the complex internal anastomosis.

Ultimately, this case underscores that the definitive repair of high-level biliary injuries should be deferred to specialized tertiary care centers where hepatobiliary expertise is available. The execution of a tension-free, wide-stoma hepaticojejunostomy not only resolved the immediate high-output biliary fistula but also established a low-pressure drainage system designed to minimize the long-term risks of anastomotic stricture and secondary biliary cirrhosis. This comprehensive strategy of staged intervention, metabolic optimization, and meticulous surgical technique represents the highest standard of care for restoring both the health and the long-term quality of life for patients facing catastrophic surgical complications.

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