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Original Research

Routine External Biliary Stenting via the Cystic Duct in Living Donor Liver Transplantation: Is it Always Safe?

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Abstract

Objectives: External biliary stenting via the cystic duct is widely used in living donor liver transplantation (LDLT) to reduce biliary complications, particularly bile leakage, and to facilitate postoperative biliary management. While some centers apply this technique selectively, others routinely use external biliary stents in all recipients. However, stent-related complications, including mechanical failure, remain a concern.

Methods: Between January-2009 and May-2025, a total of 365 adult LDLTs were performed at our center. In all cases, duct-to-duct biliary reconstruction was completed with routine placement of an external biliary stent via the cystic duct, planned for removal at 5–6 months postoperatively. This retrospective analysis focused on patients who required surgical re-exploration due to stent fracture. Clinical presentation, imaging findings, intraoperative observations, surgical management, and postoperative outcomes were reviewed.

Results: Among 365 LDLT recipients, seven patients(1.9%) required laparotomy due to stent fracture. Stent fracture occurred between postoperative months 3 and 6, prior to the planned stent removal. All patients presented with acute abdominal pain and signs of peritonitis. Imaging demonstrated retained stent fragments within the biliary tract in all cases, with findings suggestive of biliary irritation or leakage. Urgent laparotomy was performed in all patients. Intraoperatively, fractured stent segments were identified in the biliary system. In two patients, fragments were embedded in the biliary tract, necessitating meticulous dissection. No perioperative mortality occurred however, all patients experienced prolonged hospitalization and postoperative morbidity. No graft loss directly attributable to stent fracture was observed.

Conclusion: Routine external biliary stenting via the cystic duct in adult LDLT may reduce bile leakage but is not without risk. Although stent fracture is rare, it can result in severe complications requiring reoperation and significant morbidity. These findings support reconsideration of a routine stenting policy and suggest that a selective approach based on intraoperative and patient-specific factors may be safer.

Keywords: Living Donor Liver Transplantation, external biliary stent, risk, stent-related complication

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Biliary complications remain one of the most frequent sources of morbidity following living donor liver transplantation (LDLT), despite advances in surgical technique and perioperative management.[1,2] Bile leakage and biliary strictures can significantly affect graft function, prolong hospitalization, and increase the need for reintervention.[3]

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To mitigate these risks, various biliary reconstruction strategies and adjunctive measures have been proposed.

External biliary stenting via the cystic duct is one such technique, widely adopted with the intention of decreasing anastomotic tension, facilitating bile drainage, and allowing early detection of bile leakage.[4] While some transplant centers advocate selective use of external stents based on intraoperative findings or recipient risk factors, others employ routine stenting in all LDLT recipients.[5] However, the presence of a foreign body in the biliary system is not without potential drawbacks. Stent related complications including infection, dislodgement, obstruction, and fracture have been reported, though they are considered relatively uncommon. Among these, stent fracture represents a particularly serious complication, as retained fragments may cause biliary obstruction, bile leakage, or intra-abdominal contamination, often necessitating surgical intervention.[6,7]

In this study, we report our experience with routine external biliary stenting via the cystic duct in LDLT recipients, focusing on a subset of patients who developed stent fracture requiring laparotomy. By presenting these cases, we aim to reassess the safety of a routine stenting policy and to discuss whether a more selective approach may be warranted.

Methods

Between January 2009 and May 2025, a total of 365 adult living donor liver transplantations were performed at our center. In all cases, biliary reconstruction was completed with duct-to-duct anastomosis, and an external biliary stent was routinely inserted via the cystic duct at the end of the procedure. The stent was secured and externalized, with planned removal between 5 and 6 months postoperatively, provided no biliary complications occurred.

This retrospective study focused on patients who required surgical re-exploration due to stent-related complications, specifically stent fracture. Medical records were reviewed to identify patients who underwent laparotomy for this indication. Seven patients met the inclusion criteria.

Data collected included recipient demographics, indication for liver transplantation, timing of stent fracture, presenting symptoms, imaging findings, intraoperative observations, type of surgical intervention performed, and postoperative outcomes. All patients were evaluated using abdominal imaging modalities when clinically indicated. The study was conducted in accordance with institutional ethical standards.

Statistical Analysis

Statistical analyses were performed using descriptive methods. Continuous variables were summarized as mean±standard deviation or median (range), as appropriate, while categorical variables were presented as counts and percentages. The incidence of stent fracture was calculated as a proportion of the total number of adult living donor liver transplant recipients who underwent routine external biliary stenting via the cystic duct. To quantify the precision of this estimate, a 95% confidence interval (CI) for the proportion was calculated using the Wilson score method. Given the descriptive nature of the study and the limited number of events, no comparative or multivariable analyses were performed. A p-value was not calculated, as the primary aim was to report the incidence and clinical impact of stent fracture rather than to test a specific hypothesis.

Results

Among the 365 adult LDLT recipients who received routine external biliary stenting, seven patients (1.9%) (7/365; 95% CI: 0.9%–3.9%) required laparotomy due to stent fracture. Indications for liver transplantation varied among these patients and reflected the general transplant population of the center (Table 1).

Stent fracture occurred between postoperative months 3 and 6, prior to the planned time of elective stent removal. All patients presented with acute abdominal pain, accompanied by clinical signs of peritonitis. Laboratory findings were nonspecific, and imaging studies revealed retained stent fragments within the biliary tract, with associated intra-abdominal findings suggestive of biliary irritation or leakage.

All seven patients underwent urgent laparotomy. Intraoperatively, fractured stent segments were identified within the biliary system. In two patients, the stent fragments were found to be embedded in the biliary tract, making removal technically challenging and requiring meticulous dissection. In the remaining cases, fragments were retrieved without major technical difficulty.

Table 1. Overall characteristics of the study population and stent-related outcomes

Variable	Value
Total adult living donor liver transplant recipients	365
Routine external biliary stenting via cystic duct	365 (100%)
Patients with stent fracture	7 (1.9%)
Time to stent fracture (months)	3–6
Patients requiring laparotomy	7 (100%)
Mortality related to stent fracture	0

There was no perioperative mortality. However, all patients experienced prolonged hospitalization, and postoperative morbidity was notable, including delayed recovery and the need for additional supportive care. No long-term graft loss directly attributable to the stent fracture was observed during follow-up.

Discussion

External biliary stenting via the cystic duct has been widely regarded as a protective adjunct in LDLT, primarily aimed at reducing bile leakage and facilitating postoperative biliary management.[8] The rationale for routine stenting is rooted in the high incidence and clinical impact of biliary complications in living donor transplantation. Nevertheless, the findings of the present series highlight an important and often underemphasized aspect of routine stent use which is stent-related morbidity. Although the incidence of stent fracture was low, the clinical consequences were significant. All affected patients developed acute abdominal symptoms, required reoperation, and experienced increased morbidity and length of hospital stay.

Stent fracture represents a mechanical failure with potentially severe outcomes. Retained fragments may act as a nidus for infection, cause biliary obstruction, or lead to bile leakage and peritonitis, as observed in our patients. Notably, these complications occurred within the intended indwelling period of the stent, raising questions about material durability, mechanical stress, and long-term safety.[9]

In addition to mechanical failure, the clinical impact of stent fracture should be interpreted in the broader context of postoperative surveillance and intervention strategies in LDLT recipients. External biliary stents are often perceived as a safeguard that simplifies postoperative management; however, when stent-related complications occur, they may paradoxically complicate the clinical course. In our series, the diagnosis of stent fracture was prompted by acute clinical deterioration rather than by routine surveillance, underscoring that such events may not be predictable or preventable through standard follow-up protocols. This highlights an inherent limitation of routine stenting, namely that a complication designed to prevent biliary morbidity can itself become a source of emergent reoperation.

Furthermore, the fact that stent fracture occurred within the planned indwelling period suggests that duration alone may not be the sole determinant of stent safety. Factors such as bile composition, local inflammatory response, graft regeneration, and dynamic changes in biliary anatomy after transplantation may contribute to mechanical stress on the stent over time. Although the present study was not designed to identify material or patient specific risk factors for stent fracture, the observed morbidity emphasizes the need for critical re-evaluation of the "one-size-fits-all" approach to external biliary stenting in LDLT.[10,11]

This study has several limitations that should be acknowledged. First, its retrospective design inherently limits the ability to control for confounding variables and precludes causal inference. Second, the analysis focuses on a small number of events, as stent fracture requiring surgical re-exploration was a rare complication, which restricts the performance of robust comparative or multivariable statistical analyses. Third, the study was not designed to evaluate the overall incidence of biliary complications, such as bile leakage or biliary strictures, in the entire transplant cohort; therefore, a comprehensive assessment of the net protective effect of routine external biliary stenting could not be performed. In addition, this represents a single-center experience, which may limit the generalizability of the findings to other institutions with different surgical techniques, patient populations, or postoperative management protocols. Finally, potential factors contributing to stent fracture—such as stent material properties, mechanical stress, and patient-specific biliary dynamics—could not be systematically analyzed and warrant further investigation in future prospective studies.

Taken together, these findings support a shift in focus from routine stent placement toward individualized decision-making. A selective strategy, guided by intraoperative assessment of biliary anatomy, anastomotic quality, and recipient risk profile, may help balance the potential protective effect of external stenting against the risk of stent related complications. Table 2 presents the potential benefits and risks of routine external biliary stenting via the cystic duct in living donor liver transplantation. Future studies comparing routine versus selective stenting protocols, ideally in multicenter settings, are warranted to better define which patient subgroups derive true benefit from external biliary stents without incurring disproportionate risk.

Table 2. Potential benefits and risks of routine external biliary stenting via the cystic duct in living donor liver transplantation

Potential Benefits	Potential Risks
Reduction in bile leak risk	Stent fracture
Controlled external bile drainage	Retained intra-biliary stent fragments
Early detection of biliary leakage	Biliary tract injury
Decompression of biliary anastomosis	Bile leakage and peritonitis
Simplified postoperative biliary monitoring	Need for reoperation Prolonged hospitalization and increased morbidity

Conclusion

Although routine external biliary stenting via the cystic duct is widely employed to mitigate biliary complications after adult living donor liver transplantation, our findings demonstrate that this strategy is not without clinically meaningful risk. Stent fracture, while infrequent, represents a severe complication that may precipitate acute abdominal pathology, necessitate urgent reoperation, and result in substantial postoperative morbidity. Importantly, these events occurred within the intended indwelling period of the stent, underscoring that the complication is not merely a consequence of prolonged or neglected stent use.

Taken together, our experience challenges the safety of a universal, routine stenting policy and highlights the need to reconsider a "one-size-fits-all" approach. A selective stenting strategy, guided by intraoperative biliary anatomy, anastomotic quality, and recipient-specific risk factors, may offer a more balanced means of maximizing protective benefit while minimizing the potential for serious stent-related harm.

Disclosures

Ethics Committee Approval: Ethical committee approval was not obtained because this study was retrospective in design.

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