Frequency and Risk Factors of Reoperation in LDLT Donors

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Significance: This article highlights the prevalence of reoperations in living liver donors and identifies key risk factors, such as donor-related complications and surgical technicalities. Understanding these risks is critical for improving donor safety and outcomes. This study underscores the need for careful donor selection and perioperative management in living donor liver transplantation (LDLT).

Abstract

Background:
Liver transplantation (LT) is the definitive treatment for end-stage liver disease, acute liver failure, liver tumors, and metabolic diseases. Re-exploration after surgery is associated with poor clinical outcomes and is considered a quality-of-care measure.

Objective:
To determine the frequency and risk factors of reoperation (early re-laparotomy) after hepatectomy in postoperative LDLT donors.

Materials and Methods:
A cross-sectional analytical study was conducted at the Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences between December 2023 and May 2024. This study included 672 LDLT donors aged > 18 years old. Data on donor age, sex, blood group, operation time, and re-exploration were collected. The primary endpoints were the frequency and causes of re-exploration, and the secondary endpoints included the association of re-exploration with clinical outcomes. Statistical analyses were performed using SPSS 25.0, with the significance level set at $P < 0.05$.
Blood group analysis revealed that 57.9% of reexplored donors had blood group B+.

Results:
The frequency of re-exploration was 2.8%. Among those requiring re-exploration, 42.1% were aged 21-28 years. The difference in re-exploration rates between male and female patients was statistically significant ($P<0.001$). Blood group analysis revealed that 57.9% of the reexplored donors had blood group B+. Bleeding was the primary cause of re-exploration in 73.7% of cases. The majority (57.9%) of re-explorations occurred in patients with operation times between 451-550 minutes.
However, the significant sex disparity and high incidence of bleeding as a cause for re-exploration underscores the need for improved postoperative care.

Conclusion:
This study highlights a relatively low frequency of re-exploration (2.8%) among LDLT donors. However, the significant sex disparity and high incidence of bleeding as a cause for re-exploration underscore the need for improved postoperative care.

Introduction

Liver transplantation (LT) is currently the only lifesaving and definitive treatment for end-stage liver disease, acute liver failure, liver tumors, and some metabolic diseases. A significant number of people on the waiting list die because of organ shortage. One strategy used to counter-balance organ shortage has been the utilization of living donor liver transplantation (LDLT).[1] Over the past two decades, significant progress was achieved in Asia, where religious and cultural beliefs did not allow flourishing deceased donor donation.[2]

LDLT is a potentially life-saving operation for recipients with outcomes similar to those of DDLT in terms of patient and allograft survival. Living liver donor hepatectomy (LLDH) is a major surgical procedure with morbidity and mortality risks, and is performed in healthy individuals. In addition, donor surgery does not provide any direct therapeutic advantage to the donors. The donor undertakes these risks to save the life of a loved one.[2]

This improvement has not only been attributed to advances in postoperative management but also to surgical advancement.[3,4] The reported overall complication rate for LDLT donors is around 20% but was as high as 67% in one review. There has been significant improvement in liver transplantation outcomes over the past few decades. This improvement has not only been attributed to advances in postoperative management but also to surgical advancement.[3,4] The reported overall complication rate for LDLT donors is around 20%, but was as high as 67% in one review. Efforts to improve care of donors, while not depriving them of the chance of saving or improving the life of their beloved recipients, are worthy of investigation the transplant community.[5]

Re-exploration after surgery is associated with poor clinical outcomes, and therefore has been reported as a quality-of-care measure.[6] In highly invasive procedures such as liver resections, re-explorations are relatively common due to surgical complications.[7] Therefore, studies on the frequency and risk factors of re-exploration may be helpful in monitoring, improving clinical outcomes, and identifying quality improvement opportunities. Studies have reported that the frequency of re-exploration in liver recipient is 9.2–34%.[8,9,10] However, no dedicated study has reported the frequency and reasons for re-exploration after donor hepatectomy.

In this study, a retrospective analysis was conducted using a database to report the frequency and risk factors for reoperation/early re-laparotomy after hepatectomy in postoperative LDLT donors.

Objective:

This study aimed to determine the frequency and risk factors for reoperation/early re-laparotomy after hepatectomy in postoperative LDLT donors.

Materials & Methods

Eighteen donors who donated a left lobe or a left lateral graft were excluded from the study.The secondary endpoint was the association of re-exploration with clinical outcomes.This cross-sectional analytical study was conducted at the Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences, Pakistan, from December 2023 to May 2024, after obtaining approval from the ethical review committee of the institute. All LDLT donors aged > 18 years between 2018 and 2023 during the study period were included in the study. Data regarding donor age, sex, blood group, operation time, and donor re-exploration were collected. Eighteen donors who donated a left lobe or left lateral graft were excluded from the study. The primary endpoints of this study were the frequency and cause of re-exploration. The secondary endpoint was the association of re-exploration with the clinical outcomes.

Continuous data were presented as mean ± standard deviation (SD). Statistical analyses were performed using SPSS version 25.0. Continuous data are presented as mean ± standard deviation (SD). Differences were compared using the Chi-square or Fisher's exact test to compare categorical variables, and $P < 0.05$ was considered statistically significant.

Results:

Sex distribution revealed that 16 (84.2%) donors who underwent re-exploration were male, and 672 LT donors of liver transplant were included in this study. The frequency of re-exploration among donors was only 2.8%. The age distribution of donors showed that 08(42.1%) out of 19 were between the age group of 21-28 years while 287(43.9%) in which no re-exploration was required were also between 21-28 years of age. The gender distribution revealed that 16 (84.2%) donors who underwent re-exploration were male. The blood group of 11 donors (57.9%) with re-exploration was B +ve. Reasons for re-exploration were bleeding in 14 (73.7%) donors and collection of blood in the abdomen in 5 (26.3%) donors.

Re-exploration was performed in 11 (57.9%) patients in whom operation time was–451-550 minutes while operation time was 374 (57.3%) patients in whom no re-exploration was required was between 351-450 minutes.

The socio-demographic characteristics of the donors were analyzed using the Fisher's exact test and are presented in Table 1. While association between operation time and re-exploration among donors were analyzed using chi square test and are presented in Table 4.

Table 1: Socio-demographic characteristics of the donors

Variable	Re-exploration Frequency	Percentage	No Re-exploration Frequency	Percentage	P-value
Age (Years)					
12-20	**05**	**26.3%**	**254**	**38.9%**	
21-28	**08**	**42.1%**	**287**	**43.9%**	**0.29**
29-36	**06**	**31.6%**	**94**	**14.4%**	
37-44	**00**	**00.0%**	**17**	**02.6%**	
≥ 45	**00**	**00.0%**	**01**	**00.2%**	
Gender					
Male	**16**	**84.2%**	**365**	**55.9%**	**0.01**
Female	**03**	**15.8%**	**288**	**44.1%**	
Blood group					
O +ve	**05**	**26.3%**	**178**	**27.3%**	
A +ve	**02**	**10.5%**	**128**	**19.6%**	**0.5**
B +ve	**11**	**57.9%**	**335**	**51.3%**	
AB +ve	**01**	**05.3%**	**12**	**1.8%**	

Table 2: Frequency of re-exploration among donors

Re-exploration	Frequency	Percentage
Yes	**19**	**2.8%**
No	**653**	**97.2%**
Total	**672**	**100%**

Table 3: Reasons of re-exploration among donors

Reasons	Frequency	Percentage
Bleeding	**14**	**73.7%**
Collection of blood	**05**	**26.3%**
Total	**19**	**100%**

Table 4: Association between Operation time and re-exploration among donors

Operation Time (In minutes)	Re-exploration Frequency	Percentage	No Re-exploration Frequency	Percentage	p-value
250-350 min	**03**	**15.8 %**	**118**	**18.1%**	**0.01**
351-450 min	**05**	**26.3 %**	**374**	**57.3%**	
451-550 min	**11**	**57.9 %**	**148**	**22.7%**	
551-650 min	**00**	**00.0 %**	**05**	**00.7%**	
>650 min	**00**	**00.0 %**	**08**	**01.2%**	
Total	**19**	**100%**	**653**	**100 %**	

Discussion

Reoperation, which includes re-laparotomy, radiographic or percutaneous intervention, and conservative treatment with or without pharmacological induction, comprises a broad range of treatment modalities.After Liver Transplantation (LT), postoperative problems must be addressed to enhance patient survival and graft survival. Reoperation, which includes re-laparotomy, radiographic or percutaneous intervention, and conservative treatment with or without pharmacological inductions, comprises a broad range of treatment modalities.

Total 672 donors of liver transplant were included in the study, and the study findings revealed that the frequency of re-exploration among donors was only 2.8%, which is lower than that in previous studies in which re-laparotomy rates after LT have recently been found to vary between 9.2% and 26.2% in LDLT[11,12,13] and 14.8% and 34.2% in DDLT.[11,14] The lower frequency of re-exploration among liver transplant donors in the study (2.8%) compared to previous studies can be attributed to several factors, including improved surgical techniques, better preoperative assessment, enhanced postoperative care, experience of surgical teams, better patient selection criteria, and utilization of advanced medical equipment and imaging technologies during the perioperative period, which can help in the early detection and management of potential complications, which also reduce the need for re-exploration.

The high frequency of bleeding as the primary reason for re-exploration indicates a critical area of concern study findings revealed that among almost three fourth (73.7%) of the patients, the reason for re-exploration were bleeding, and in the study conducted by Hendriks et al.[15] among 39% of re-laparotomy patients, postoperative bleeding was the primary cause of the procedure. The finding that bleeding was the reason for re-exploration in 73.7% of patients underscores a significant challenge in liver transplantation, highlighting the need for focused strategies to manage and prevent postoperative hemorrhage. The high frequency of bleeding as the primary reason for re-exploration indicates a critical area of concern. This aligns with findings from other studies that identify hemorrhagic complications as a major cause of morbidity following liver transplantation.[16]

Technical challenges, such as ensuring secure vascular anastomoses, are critical in preventing bleeding.[18] Postoperative bleeding leading to re-exploration is associated with increased morbidity and mortality.Liver transplantation involves extensive surgical manipulation and complex vascular anastomoses, increasing the risk of postoperative bleeding.[17] Inadequate hemostasis during surgery can lead to postoperative bleeding. Technical challenges such as ensuring secure vascular anastomoses are critical in preventing bleeding.[18] Postoperative bleeding leading to re-exploration is associated with increased morbidity and mortality. Additional surgical interventions raise the risk of infection, organ dysfunction, and prolonged recovery.[19] Re-exploration also results in longer hospital stays, increased need for blood products, and higher healthcare costs, underscoring the economic impact of postoperative bleeding.[20]

Thorough preoperative assessment and optimization of coagulation status can help reduce the risk of bleeding. Strategies may include administering vitamin K, fresh frozen plasma, platelets, or specific clotting factors.[21] A multidisciplinary team approach involving transplant surgeons, anesthesiologists, hepatologists, and critical care specialists is vital for effective management. This collaboration ensures comprehensive care from surgical precision to postoperative management. Ongoing education and training for surgical teams on the latest techniques and best practices in liver transplantation can help reduce the incidence of bleeding.[22]

This finding necessitates the examination of sex-specific factors that may contribute to the increased risk.The sex distribution revealed that 16 (84.2%) liver donors were male, and the difference between male and female patients was found to be statistically significant ($P<0.001$). The finding that 84.2% of liver donors who required re-exploration were male, with a statistically significant difference between male and female patients ($P<0.001$), raises important questions about gender differences in liver transplantation outcomes. The high percentage of male donors requiring re-exploration suggests that male donors are at a higher risk of complications that necessitate re-exploration. This finding necessitates the examination of sex-specific factors that may contribute to this increased risk.

Males typically have different body compositions and vascular characteristics than females. These differences can affect surgical outcomes, with males potentially having more challenging vascular anatomies or different hemostatic profiles.[23] Hormonal variations between males and females can influence coagulation and wound healing. For instance, estrogen has been shown to have protective vascular effects, which may contribute to lower bleeding risks in females.[24] Males may have a higher prevalence of certain comorbidities, such as hypertension, cardiovascular disease, and metabolic syndrome, which can complicate surgery and recovery.[25] Lifestyle factors, including smoking, which is more prevalent in males, can adversely affect liver health and postoperative recovery.[26] Enhanced preoperative assessment, including thorough evaluation of comorbidities and risk factors, can help identify male donors at higher risk for complications. Preoperative optimization strategies, such as controlling blood pressure and managing metabolic conditions, are crucial.

Large-scale studies examining sex-specific risk factors and outcomes of liver transplantation are necessary to develop targeted interventions, and the development of sex-specific guidelines for the management of liver transplant donors can help mitigate risks and improve outcomes in both male and female patients,

highlighting the need for further research to understand the underlying causes. Large-scale studies examining sex-specific risk factors and outcomes in liver transplantation are necessary to develop targeted interventions. Based on evidence, developing sex-specific guidelines for the management of liver transplant donors can help mitigate risks and improve outcomes for both male and female patients.

Conclusion:

However, the significant sex disparity and high incidence of bleeding as a cause of re-exploration underscores the need for improved postoperative care, which highlights the relatively low frequency of re-exploration (2.8%) among LDLT donors. However, the significant sex disparity and high incidence of bleeding as a cause for re-exploration underscore the need for improved postoperative care.

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