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Original Research Article

Combined liver-kidney transplant: a single centre experience

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ABSTRACT

Background: End-stage liver disease (ESLD) often coexists with chronic kidney disease (CKD), creating a need for combined liver-kidney transplantation (CLKT). While widely practiced in the West, Indian experience is limited. Aim was to evaluate the demographic profile, etiologies, peri-operative complications, and short-term in-hospital outcomes of patients undergoing CLKT.
Methods: We retrospectively reviewed adults (>18 years) who underwent CLKT at our centre from January 2019 to February 2025. Records were analysed for demographics, etiology, peri-operative complications and outcomes. CKD was diagnosed by clinical features, imaging, and renal biopsy where indicated; liver disease was confirmed with serology, autoimmune markers, and imaging.
Results: Twenty-three patients underwent CLKT, including 16 males (69.5%). All received live-related donor grafts after regulatory approval. Diabetes (71%) and hypertension (60.8%) were frequent comorbidities. CKD etiology included diabetic kidney disease (60.8%), chronic interstitial nephritis (21.7%), primary hyperoxaluria (8.6%), and chronic glomerulonephritis (8.6%). Liver disease was attributed to non-alcoholic steatohepatitis (NASH) (52.1%), hepatitis B (21.7%), and hepatitis C (17.3%); two hyperoxaluria patients received liver grafts for enzyme deficiency despite structurally normal livers. Postoperative complications included bile leak in 6 patients (23%), bleeding in 1 (4.3%), and prolonged hospitalization in 7 (30.4%). One patient died of sepsis on day 25. At discharge, mean creatinine was 1.0±0.2 mg/dl and bilirubin 1.3±0.7 mg/dl.
Conclusions: CLKT is feasible and safe in the Indian living-donor setting, with results comparable to international reports. Optimal outcomes require careful selection, thorough evaluation, and meticulous perioperative care. Establishing national registries and uniform CLKT guidelines will help standardize practice and ensure equitable allocation.

Keywords: Combined liver-kidney transplantation, End-stage liver disease, Chronic kidney disease, Living donor transplantation, Liver transplant

INTRODUCTION

End-stage liver disease (ESLD) frequently coexists with chronic kidney disease (CKD), creating a growing need for combined liver–kidney transplantation (CLKT). Cirrhosis-associated circulatory dysfunction, with portal hypertension and reduced effective circulating volume, predisposes patients to renal injury.[1] Approximately 16% of adult liver transplant candidates meet CKD criteria, with many requiring dialysis.[2] The global rise of metabolic liver disease, particularly non-alcoholic fatty liver disease (NAFLD) and NASH, has accelerated this trend; NAFLD/NASH is now among the leading indications for liver transplantation and an increasingly common reason for CLKT.[3,4]

The introduction of the model for MELD score, which incorporates serum creatinine, has indirectly increased CLKT rates worldwide. In the United States, CLKT rose from ~2% of all liver transplants in the early 1990s to ~8-9% by 2015-2016.[5] Similar increase is reported in Europe.[6] In India, where living-donor liver transplantation predominates, deceased donor programs are expanding as well; a series from Tamil Nadu reported 11 adult CLKTs among 331 liver transplants, with one-year survival of 87%.[7]

Indications

CLKT is indicated when irreversible dual-organ failure is present. Accepted criteria include ESLD with CKD stages 4-5 for ≥3 months or prolonged dialysis-dependent acute kidney injury (typically ≥6 weeks).[8] Other indications include autosomal dominant and autosomal recessive polycystic kidney and liver disease, and certain metabolic disorders like primary hyperoxaluria, complement mediated atypical hemolytic uremic syndrome (aHUS).

Advantages

Compared with isolated liver transplantation in patients with advanced CKD, CLKT improves survival and graft outcomes. Registry studies report 5-year survival of 64-76% after CLKT, significantly better than liver-alone transplant in patients with irreversible renal failure.[9,10] Kidney graft outcomes in CLKT are comparable to or better than kidney-alone transplantation, largely attributed to the immune-protective effect of the liver.[11]

Immunological rationale

The liver exerts a tolerogenic effect, lowering the risk of renal allograft rejection in CLKT. Mechanisms include adsorption and clearance of donor-specific antibodies and secretion of soluble human leukocyte antigen (HLA) antigens.[12] As a result, CLKT can be performed even in sensitized or crossmatch-positive patients, with many centres using reduced-intensity immunosuppressive regimens.[13]

Aim

Aim of the study was to evaluate the demographic profile, etiologies, peri-operative complications, and short-term in-hospital outcomes of patients undergoing CLKT at a single tertiary centre in the India between January 2019 and February 2025.

METHODS

This was a retrospective, cross-sectional study conducted at Indraprastha Apollo Hospital, New Delhi. The medical records of all patients who underwent CLKT between January 2019 and February 2025 were reviewed. Patients included were adults aged >18 years who fulfilled internationally accepted criteria for CLKT. The 2017 OPTN/UNOS policy outlines that CLKT is indicated for (i) patients with CKD with GFR ≤30 ml/min for >90 days, (ii) patients with sustained acute kidney injury requiring dialysis or with GFR ≤25 ml/min for ≥6 weeks, and (iii) certain metabolic disorders such as primary hyperoxaluria and atypical hemolytic uremic syndrome.[5] Patients excluded were those <18 years of age, acute liver failure with acute kidney injury and those who did not fulfil the internationally accepted criteria for CLKT. Demographic details, comorbidities, etiologies of liver and kidney disease, perioperative events, complications, and outcomes were recorded for the duration of patient's hospital stay. Etiology of CKD was established clinically, supported by imaging, and by renal biopsy where indicated, while liver disease was diagnosed using clinical features, serological markers, autoimmune markers and imaging. Institutional ethical committee approval was taken.

Statistical analysis

All analyses were done using IBM statistical package for social sciences (SPSS) version 20.0 software (Chicago, Illinois, USA).

RESULTS

A total of 23 combined liver kidney transplants were done at our centre from January 2019 to February 2025, out of which 16 (69.5%) were males and 7 (30.5%) were females. All patients received live related donor organs after the committee clearance.

Out of these 23 patients, 15 patients (71%) had diabetes and 14 patients (60.8%) patients had hypertension (Table 1).

Etiology of CKD was made clinically and by biopsy as per the need. Out of 23 patients, 14 patients (60.8%) had diabetic kidney disease, which was diagnosed clinically as per proteinuria, USG findings of kidneys and fundus examination which was suggestive of diabetic retinopathy. Two patients (8.6%) had genetically proven primary hyperoxaluria, 5 patients (21.7%) had features of chronic interstitial nephritis and 2 patients had features of chronic glomerulonephritis with USG showing small shrunken kidneys (Table 2).

In patients with primary hyperoxaluria, the liver was normal but the liver transplant was done due to enzyme deficiency. NASH was cause of CLD in 12 patients (52.17%), whereas HBV related cirrhosis was the cause in 5 patients (21.7%) and HCV related cirrhosis in 4 patients (17.3%) (Table 3).

Six patients (23%) had post-op complication of bile leak, out of which 2 required intervention by endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy and 1 had to undergo re-exploration. One patient (4.3%) had post op bleed in the form of perinephric

hematoma and had to be re-explored. Seven patients (30.4%) had prolonged hospital stay and all of them were discharged stable condition. One patient who expired on post-operative day (POD)-25, had post-op complication of bile leak which was managed with ERCP. The patient developed sepsis followed by septic shock with acute renal and liver graft dysfunction and needed continuous renal replacement therapy (CRRT) support. He succumbed on POD-25 (Table 4).

Mean nadir creatinine achieved was 1±0.2 mg/dl in all patients and mean bilirubin was 1.3±0.7 mg/dl.

Table 1: Baseline comorbidities of patients, (n=23).

Comorbidity	N	Percentage (%)
Diabetes mellitus	15	71.0
Hypertension	14	60.8

Table 2: Etiology of CKD, (n=23).

Etiology of CKD	N	Percentage (%)
Diabetic kidney disease*	14	60.8
Primary hyperoxaluria (genetically proven)	2	8.6
Chronic interstitial nephritis	5	21.7
Chronic glomerulonephritis with small shrunken kidneys (USG)	2	8.6

*Diagnosed clinically based on proteinuria, ultrasonography findings, and fundus examination suggestive of diabetic retinopathy.

Table 3: Etiology of CLD, (n=23).

Etiology of CLD	N	Percentage (%)
NASH	12	52.17
Hepatitis B virus (HBV)-related cirrhosis	5	21.7
Hepatitis C virus (HCV)-related cirrhosis	4	17.3
Other causes	2	8.7

Table 4: Post-operative complications and outcomes, (n=23).

Post-operative event	N	Percentage (%)
Bile leak	6	23.0
Managed with ERCP±sphincterotomy	2	-
Required re-exploration	1	-
Post-operative bleeding (perinephric hematoma)	1	4.3
Prolonged hospital stay	7	30.4
Post-operative mortality	1	4.3

DISCUSSION

Global and Indian outcomes

CLKT is now established as a safe and effective therapy for selected patients with dual organ failure. Registry data demonstrates 1 and 5-year patient survival of ~85-90% and ~64-76%, respectively.[9,14] In metabolic disorders such as polycystic disease, survival can exceed 85% at 5 years.[15] Indian experience, though limited, mirrors global results, with 5-year survival of ~77%.[7] Importantly, renal allograft rejection rates are lower in CLKT than kidney-alone transplantation.[11]

Indications and patient selection

Appropriate patient selection is critical for optimizing outcomes. The 2017 OPTN/UNOS policy outlines that CLKT is indicated for patients with CKD with GFR ≤30 mL/min for >90 days, patients with sustained acute kidney injury requiring dialysis or with GFR ≤25 mL/min for ≥6 weeks, and certain metabolic disorders such as primary hyperoxaluria and atypical hemolytic uremic syndrome.[5]

The ASTS/ASN/ILTS consensus further emphasizes excluding potentially reversible causes of renal dysfunction, such as hepatorenal syndrome, before listing for CLKT.[8]

The EASL/ELITA guidelines recommend CLKT when kidney damage is irreversible and biopsy or imaging confirms chronic changes.[6] In India, the NOTTO framework has no specific CLKT guidelines; decisions are made case by case, but the principles mirror international recommendations. Thus, stringent pre-transplant evaluation, including renal biopsy in ambiguous cases is essential to avoid unnecessary dual-organ allocation. Three of our patients underwent kidney biopsy to establish the cause of nephropathy. Interstitial fibrosis and tubular atrophy (IFTA) >30% were documented in 2 patients and they underwent CLKT whereas 1 patient did not show chronic kidney changes and had liver transplant alone. He had good renal recovery post-transplant.

Surgical advances and donor selection

Standard practice is sequential transplantation, i.e. liver followed by kidney. Use of extended-criteria donors (ECD) and donation after circulatory death (DCD) grafts is increasing. Recent reports show comparable patient and graft survival with DCD and brain-death donors in CLKT, provided ischemia is minimized.[16] Organ preservation using hypothermic machine perfusion (HMP) or hypothermic oxygenated perfusion (HOPE) has reduced delayed graft function in marginal kidneys and decreased biliary complications in liver.[17,18] Some centres now delay kidney implantation while maintaining it on HMP after liver transplant to improve hemodynamic stability.[19]

Immunosuppression and outcomes

The tolerogenic properties of the liver allow minimized immunosuppression regimens in CLKT. Several studies confirm lower incidence of acute rejection and comparable kidney graft survival to kidney-alone recipients.[11,12] Ongoing trials are assessing steroid-sparing and calcineurin inhibitor minimization strategies in CLKT.

Ethical and allocation considerations

Allocation of two organs to a single patient remains controversial. The OPTN/UNOS introduced formal listing criteria for CLKT in 2017, including a "safety net" policy for liver recipients who later develop renal failure.[5] The European Liver Transplant Registry (ELTR) provides similar guidance.[6] In India, organ allocation follows the Transplantation of Human Organs and Tissues Act (THOTA), overseen by the National Organ and Tissue Transplant Organization (NOTTO), though no specific CLKT policy exists.[20]

Innovations

Machine perfusion, donor-derived cell-free DNA monitoring, and refined perioperative care protocols are reshaping practice.[17,18] Personalized risk stratification using biomarkers to distinguish reversible from irreversible renal dysfunction could reduce inappropriate CLKT listing.

Future directions

Challenges remain in organ shortage, precise patient selection, and long-term outcomes. Expanding donor utilization (ECD, DCD), multi-centre registries, and collaborative trials will refine practice. In India, strengthening deceased donor programs and harmonizing CLKT criteria are key priorities.

Limitations

As this is a retrospective cross-sectional *study* based solely on in-hospital records without follow-up, detailed post-discharge data such as long-term patient/graft survival, rejection rates, and complication grading (Clavien classification) is not available. Only in-hospital outcomes could be analyzed within the limitations of the existing dataset. Our study mainly emphasizes on the etiology of ESKD and liver disease, indications for CLKT, its peri-operative complications and short outcomes during the hospital stay. We acknowledge that future prospective studies with longer follow-up and comprehensive complication assessment are warranted.

CONCLUSION

In summary, CLKT offers excellent survival and graft outcomes when carefully indicated. Recent guidelines underscore the importance of rigorous renal assessment and strict listing criteria, ensuring fair allocation and optimal use of scarce organs.

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