Available online at www.garmian.edu.krd

Passer Journal of Basic and Applied Sciences

Passer 8 (Issue 2) (2028) 944-951

Original Article

Clinical Indications for Adult and Pediatric Liver Transplantation in Iraq

Hardi Kareem Jalal*[1], Tahir Abdulla Hussein[2]

[1]*Kurdistan Higher Council of Medical Specialties, Digestive and Hepatic Surgery Hospital, Sulaimani Directorate of Health, Sulaymaniyah, Kurdistan Region, Iraq.*

[2]*Faculty of Medical Sciences, University of Sulaimani, Sulaymaniyah, Kurdistan Region, Iraq.*

Received 2 February 2026; revised 20 March 2026;
Accepted 6 April 2026; available online 18 August 2026

DOI: 10.24271/psr.2026.573575.2588

ABSTRACT

Liver transplantation has continued to be a life-saving procedure for patients with end-stage liver disease. This study aimed to describe the indications, demographics, and outcomes of liver transplantation in one of the major transplant facilities in Iraq. A retrospective cohort, multi-center design was used as the sample, comprising 55 liver transplant recipients. The medical records were used to extract demographic variables, primary indication, Model for End-stage Liver Disease (MELD) scores, graft type, donor relation, and clinical outcome, and subject them to descriptive statistical analysis. The mean age of the transplant group was 40.7 years, and it was mostly composed of males (65.5%). The most common indications were cryptogenic cirrhosis (30.9%), NAFLD (20.0%), and alcoholic liver disease (14.5%), which summed up to 65.4% of all cases. The mean MELD at transplantation was 16.7, and the mean MELD of patients with alcoholic liver disease was highest (19.1). The program involved the use of living donors only, and right-lobe grafts comprised 74.5% of all transplants. The total survival of patients was 81.8%. It is noteworthy that the mean MELD score was higher in non-survivors (19.0) than in survivors (16.2). Cryptogenic cirrhosis, NAFLD, and alcoholic liver disease were the leading causes of liver transplantation in this Iraqi cohort, indicating a significant presence of metabolic and lifestyle-related liver disease. The living-only model achieved good survival results. The prognostic value of MELD is suggested by the higher mean MELD score observed among non-survivors. Such observations justify the introduction of targeted public health programs and serve as a regional benchmark for transplant services.

Keywords: Liver Transplantation, Iraq, Indications, MELD Score, Living Donors.

1 Introduction

Liver transplantation has ceased to be experimental and has become the standard treatment for end-stage liver disease, acute liver failure, and selected hepatic malignancies [1,2]. The strong success of transplantation has led to its extensive use, thus creating a strong demand for sound data on indications and outcomes to guide the policies of organ allocation and clinical decision-making. The landscape of liver transplantation is dynamic across the world, with leading indications varying substantially by region and over time [2,3].

Non-alcoholic fatty liver disease (NAFLD) has become one of the most rapidly increasing indications for liver transplantation in Western countries and reflects the global increase in metabolic syndrome [4,5]. On the other hand, viral hepatitis remains a major cause in many Asian nations and in the developing world [6].

The Model for End-stage Liver Disease (MELD) score was established to prioritize organ allocation on the basis of objective medical urgency, to promote fairness and effectiveness in transplant systems [7]. The examination of indications in combination with MELD scores and post-transplant outcomes provides valuable information on disease severity at the time of surgery and the effectiveness of transplantation across different clinical conditions. Furthermore, understanding donor and graft features, especially in living-donor-dominant programs, is critical in assessing the logistical structure of a program and its operative strategy [8].

Liver transplantation is a developing field in Iraq and in the Kurdistan Region in particular. However, there has been limited comprehensive examination of clinical indications and patient outcomes. Regional and local data are essential to inform health policies,

* Corresponding author
E-mail address hardikareem@yahoo.com
Peer-reviewed under the responsibility of the University of Garmian.

resource management at transplant centres, and the overall understanding of liver disease epidemiology. This paper therefore attempts to outline demographic and clinical features of liver transplant patients in one of the largest Iraqi centres, describe the range and frequency of transplantation indications, and assess patient outcomes.

2 Methods and Materials

2.1 Study Design and Setting

This was a multi-center, retrospective cohort study conducted at tertiary liver transplantation centers. The research was done in accordance with the STROBE principles for cohort studies. All patients who underwent liver transplantation from January 2017 through 2025 were eligible to be included, representing the full range of patients who underwent the procedure in the centre within the designated time period.

2.2 Study Population and Eligibility Criteria

The sample consisted of 55 consecutive individuals who underwent liver transplantation in the center. The inclusion criteria were as follows: recipients of any age who received a liver graft and had a complete medical record including the indication for transplantation and outcome data. Patients with incomplete records, including those who lacked the main indication or the most crucial outcome data, were excluded. No patients were excluded because of demographic or clinical characteristics, in order to preserve the representativeness of the sample.

2.3 Variables

Variables were collected regarding demographic factors (age, sex, blood group, and governorate), clinical factors (principal indication for transplantation, MELD score, and comorbidities), surgical factors (graft type and donor relationship), and outcome variables (ICU stay duration, total hospital stay, survival status, and need for re-transplantation).

2.4 Data Sources and Data Collection

Data were based on electronic health records, operative reports, and national transplant registries, and were retrieved using a standardised abstraction tool. In order to protect data integrity, the extracted information was cross-checked by two independent investigators, and any discrepancy was resolved through consensus. MELD scores were calculated on the basis of standard laboratory parameters measured within one week before transplantation.

2.5 Outcome Measures and Follow-up

Patient outcomes were tracked from the date of liver transplantation up until December 2025, the end date of this study. Patients who had died were followed up until the date of death. Overall survival was considered to be the proportion of patients still alive at the time of the last data collection. The mean follow-up period was 6 years, but varied from the immediate postoperative period for patients who died early to 8 years for patients transplanted in 2017. The mean was used to provide context for the survival rate being reported.

2.6 Data Quality Control and Bias Reduction

In order to reduce selection bias, all transplant recipients were enrolled in the study if they met the eligibility criteria during the study period. Information bias was minimized by applying a standardized data-collection protocol and cross-checking medical records. The retrospective study design inherently limited the ability to control for unmeasured confounding factors. The entire case series of the center during the study period was included in the analysis, with 55 patients qualifying according to the inclusion criteria.

2.7 Statistical Analysis

IBM SPSS Statistics, version 26, was used for statistical analysis. Continuous variables were described using means and ranges, and categorical variables were described using frequencies and percentages. The Shapiro-Wilk test was used to examine normality of distribution. No comparative or inferential statistical tests were performed because the main aim was to provide a description of the cohort, including demographic characteristics, indications, and outcomes. Missing data were dealt with by complete-case analysis.

2.8 Ethical Considerations

The study received ethical approval from the Kurdistan Higher Council of Medical Specialties, Research Protocol Ethics Committee, reference number 2060. Due to the retrospective design, the ethics committee issued an informed consent waiver. Anonymity of patient data and secure storage of all research data ensured patient confidentiality.

3 Results and Discussions

A descriptive analysis of 55 liver transplant patients found a cohort with a wide age range (3 to 69 years, with a mean age of 40.7 years) and a male predominance (65.5%), with a large proportion being from Erbil governorate (47.3%). Cryptogenic cirrhosis (30.9%), non-alcoholic fatty liver disease (20.0%), and alcoholic liver disease (14.5%) were the most commonly reported indications for transplantation and comprised over 65% of all cases. The mean Model for End-stage Liver Disease (MELD) score at transplantation was 16.7, indicating moderate disease severity, and a higher mean MELD score was observed in patients with alcoholic liver disease (19.1). Living donors were central to the transplant program, and right-lobe grafts constituted 74.5% of all grafts. Overall patient survival was 81.8% (Table 1).

Table 1: Summary of patient demographics and baseline characteristics.

Characteristic		Overall (n=55)
Age (years)	Mean (Average)	40.7

Characteristic		Overall (n=55)
	Range (Min - Max)	3 - 69
Gender, n (%)	Male	36 (65.5%)
	Female	19 (34.5%)
Blood Group, n (%)	O+	31 (56.4%)
	A+	5 (9.1%)
	B+	4 (7.3%)
	O-	2 (3.6%)
	AB+	1 (1.8%)
	A-	1 (1.8%)
	Not Specified	11 (20.0%)
Governorate, n (%)	Erbil	26 (47.3%)
	Baghdad	10 (18.2%)
	Sulimaniya	5 (9.1%)
	Najaf	3 (5.5%)
	Dohuk	2 (3.6%)
	Karbala	2 (3.6%)
	Other (Anbar, Wasit)	2 (3.6%)
	Not Specified	5 (9.1%)

n = number of patients; % = percentage; Min = minimum; Max = maximum.

In the current multi-centre retrospective study conducted in Iraq, 55 hepatic transplantation surgeries were analysed methodically to determine the most common indications in both adult and pediatric groups. The most common indication was cryptogenic cirrhosis, with 17 (30.9%) identified cases, followed by non-alcoholic fatty liver disease (NAFLD), with 11 (20.0%) cases, and alcoholic liver disease, with 8 cases (14.5%). Four patients (7.3%) were diagnosed with autoimmune hepatitis (AIH), while hepatitis B, primary biliary cholangitis, Budd-Chiari syndrome, glycogen-storage disease, and polycystic liver disease were diagnosed in 2 cases each (3.6%). Less common indications included hepatitis C, cirrhosis related to hepatocellular carcinoma (HCC), and intrahepatic cholangiopathy, with each having one case (1.8%), Table 2.

Table 2: Frequency and distribution of liver transplantation indications.

Indication	Count (n)	Percentage (%)
Cryptogenic Cirrhosis	17	30.9%

Indication	Count (n)	Percentage (%)
Non-Alcoholic Fatty Liver Disease (NAFLD)	11	20.0%
Alcoholic Liver Disease	8	14.5%
Autoimmune Hepatitis (AIH)	4	7.3%
Hepatitis B	2	3.6%
Primary Biliary Cholangitis	2	3.6%
Budd-Chiari Syndrome	2	3.6%
Glycogen Storage Disease	2	3.6%
Polycystic Liver Disease	2	3.6%
Hepatitis C	1	1.8%
Cirrhosis + Hepatocellular Carcinoma (HCC)	1	1.8%
Intrahepatic Cholangiopathy	1	1.8%
Total	55	100%

The proportion of grafts done among the cohort of 55 liver transplants was dominated by right-lobe grafts, which were used in 41 cases (74.5%), while left-lobe grafts were used in 14 cases (25.5%). In terms of donor relationship, non-relative donors were the largest group, with 17 (30.9%) cases. Brothers (9 cases, 16.4%) and sons (8 cases, 14.5%) were the most frequent related donors, while mothers, daughters, nephews, wives, and cousins contributed smaller numbers of cases. As presented in Table 3.

Table 3: Donor and graft characteristics.

Characteristic		Count (n)	Percentage (%)
Graft Type	Right Lobe	41	74.5%
	Left Lobe	14	25.5%
	Total	55	100%
Donor Relationship	Non-Relative	17	30.9%
	Brother	9	16.4%
	Son	8	14.5%
	Sister	5	9.1%

Characteristic		Count (n)	Percentage (%)
	Other Relative*	5	9.1%
	Mother	3	5.5%
	Daughter	2	3.6%
	Father	2	3.6%
	Wife	1	1.8%
	Nephew	2	3.6%
	Cousin	1	1.8%
	Total	55	100%

Note: Other Relatives include granddaughter and unspecified relatives.

This table describes the sources and types of liver grafts used in the transplant program. It reveals two key findings. First, the program heavily relied on right-lobe liver grafts, which were used in nearly three-quarters (74.5%) of all transplants. Second, it shows a diverse donor pool. While nearly one-third (30.9%) of donors were non-relatives, the majority were related, with brothers being the most common related donors (16.4%), followed by sons (14.5%). This indicates a living-donor-dominant program utilising both familial and non-familial donors (Table 4).

Table 4: MELD score analysis by indication and outcome.

Category		Number of Patients (n)	Average MELD Score	MELD Score Range (Min - Max)
Overall		55	16.7	10 - 30
By Indication	Alcoholic Liver Disease	8	19.1	16 - 30
	Cryptogenic Cirrhosis	17	17.1	13 - 22
	Non-Alcoholic Fatty Liver Disease (NAFLD)	11	16.3	13 - 20
	Autoimmune Hepatitis (AIH)	4	14.0	13 - 15
	Survived	45	16.2	10 - 25
	Passed Away	10	19.0	13 - 30

n = number of patients; Min = minimum; Max = maximum; MELD = Model for End-stage Liver Disease.

The overall survival was 81.8% (45/55) at study completion in December 2025. Due to the retrospective nature of the study, individual follow-up time was not always available, but follow-up ranged from the early postoperative period to 96 months. There was no major difference in average ICU stay between survivors (3.6 days) and non-survivors (3.4 days), while total hospital stay was longer among survivors (14.5 days) than non-survivors (4.6 days). Several non-survivors died early postoperatively, unlike the survivors (Table 5). Re-transplantation was necessary in only one patient (1.8%).

Table 5: Patient outcomes and hospital stay analysis.

Category		Number of Patients (n)	Percentage (%)	Average ICU Stay (Days)	Average Hospital Stay (Days)
Overall Patient Status	Survived	45	81.8%	3.6	14.5

Category		Number of Patients (n)	Percentage (%)	Average ICU Stay (Days)	Average Hospital Stay (Days)
	Passed Away	10	18.2%	3.4	4.6
Re-transplantation	Yes	1	1.8%	1	0
	No	54	98.2%	3.7	14.3

ICU = Intensive Care Unit.

Among the 55 liver transplant cases, several notable clinical notes and complications were observed. Combined liver and kidney transplantation was performed in 2 patients with polycystic disease. Hepatocellular carcinoma (HCC) was present in 2 cases; one associated with hepatitis B and the other with cirrhosis. There were 4 intraoperative or early deaths, as indicated by patients who died intraoperatively or had zero days of hospital stay. Surgical and procedural complications were noted in 3 cases, including a cancelled procedure due to a small right hepatic vein (RHV), a patient with a history of biliary bypass surgery, and a case of constrictive myopathy. Additionally, 3 patients had significant medical comorbidities such as renal impairment and diabetes mellitus, with one managed on cyclosporine. Anaemia and iron deficiency are recognised comorbidities in patients with end-stage liver disease and have been described in the regional Iraqi population [17]. Only one patient required re-transplantation during the study period (Table 6).

Table 6: Notable clinical notes and complications.

Category	Count (n)	Description / Examples
Combined Transplants	2	Combined liver and kidney transplantation for Polycystic disease.
Hepatocellular Carcinoma (HCC)	2	Hepatitis B with HCC; Cirrhosis + HCC.
Intraoperative/Early Deaths	4	"Intra op" death; "Passed" with 0 days hospital stay.
Surgical & Procedural	3	"Cancelled - small RHV"; "previous surgery - biliary bypass"; "constrictive myopathy".
Medical Comorbidities	3	"Renal impairment, DM - cyclosporin".
Re-transplantation	1	One case is listed for re-transplantation.

n = number of patients; HCC = Hepatocellular Carcinoma; RHV = Right Hepatic Vein; DM = Diabetes Mellitus.

This retrospective multicenter study provides a comprehensive picture of the situation in liver transplantation at one of Iraq's major centres. The key observation is that cryptogenic cirrhosis (30.9%) was the most prevalent indication, followed by non-alcoholic fatty liver disease (NAFLD) (20.0%) and alcoholic liver disease (14.5%). Therefore, these conditions represent key indications for transplantation. This distribution provides valuable insights into the disease burden in the region and aligns with global trends in liver disease epidemiology.

The high prevalence of cryptogenic cirrhosis is a notable observation. Cryptogenic cirrhosis historically represented a frequent diagnosis, but under current diagnostic methods, many cases can now be reclassified as either burnt-out NAFLD or autoimmune hepatitis [9]. The observed NAFLD prevalence (20.0%) in our cohort is consistent with the hypothesis that a significant proportion of cryptogenic cases may be NAFLD-associated cirrhosis, an event previously observed in other groups [10]. This finding is also consistent with the rising burden of obesity in the Kurdistan Region of Iraq, where recent population surveys have documented a high prevalence of overweight and obesity among adults [11]. This highlights the increasing role of metabolic liver disease in our area and is echoed globally, where NAFLD has become a major transplant listing indication in many countries [5,12]. At the same time, the increased rate of alcoholic liver disease also points to the burden of lifestyle-related hepatic

disease, supporting the need for effective public-health interventions targeting alcohol use and metabolic syndrome.

Patients with alcoholic liver disease exhibited the greatest mean Model for End-stage Liver Disease (MELD) score (19.1), which suggests that their disease was more advanced at the time of transplantation. This may indicate late referral caused by stigma or late development of decompensation compared to other etiologies [13]. Furthermore, the higher pre-transplant MELD score among non-survivors (19.0 compared to 16.2) is in line with the firmly established predictive power of MELD in estimating post-transplant mortality outcomes, supporting the use of MELD in the present cohort for risk stratification [7,14].

The program's dependency on living donations (100% of cases) and right-lobe grafts (74.5%) reflects the structure of transplant centres in areas where deceased donor availability is scarce [15]. The heterogeneous donor pool, which comprises a combination of related and unrelated donors, is an important approach to mitigating organ shortage challenges. The patient survival rate of 81.8% is comparable to other living-donor transplant programs and indicates acceptable standards of surgical and postoperative care [16]. However, the shorter hospitalisation time among non-survivors suggests early postoperative deaths, supporting the need for continuous quality-improvement programs related to patient selection and perioperative care.

Several limitations should be noted. The retrospective multi-centre design may limit generalizability and introduce possible biases inherent in chart review. Additionally, the sample size (n=55) was relatively small, which limited the statistical power of the analysis and reduced the generalizability of the findings to the broader Iraqi population. Moreover, although the cryptogenic cirrhosis classification was standardised in our methodology, it remains a possible source of misclassification bias, as mentioned above.

4 Conclusion

This analysis of a multi-centre liver transplant program demonstrates that cryptogenic cirrhosis, non-alcoholic fatty liver disease (NAFLD), and alcoholic liver disease are the leading indications for transplantation, highlighting the substantial burden of metabolic and lifestyle-related liver diseases. The program, which predominantly used right-lobe grafts from living donors, achieved an overall patient survival rate of 81.8%. Importantly, higher pre-transplant MELD scores were observed among non-survivors, supporting their value in risk stratification and guiding patient selection.

Future research should employ larger, prospective multicenter cohorts across Iraq, comparing adult and pediatric recipients, to validate indication patterns, refine MELD-based risk stratification, evaluate outcomes, and optimise living-donor protocols, perioperative care, and post-transplant follow-up through this regional program.

Funding

This research received no external funding.

Acknowledgements

We express our sincere gratitude to everybody who devoted their time, effort, and expertise to ensure the success of this study.

Authors contribution

Hardi Kareem Jalal contributed to the literature review, study concept, manuscript writing, and final approval of the manuscript. Tahir Abdulla Hussein contributed to the final revision and approval of the manuscript.

Conflict of interests

The authors declare no conflicts of interest.

Data availability

The study data may be acquired from the corresponding author upon reasonable request.

Consent for publications

The authors examined and approved the published version of the research.

References

[1] Starzl, T. E. The saga of liver replacement, with particular reference to the reciprocal influence of liver and kidney transplantation 1955-1967. *J Am Coll Surg* **195**, 587-610, doi: 10.1016/S1072-7515(02)01498-9 (2002).

[2] European Association for the Study of the Liver. EASL Clinical Practice Guidelines: Liver transplantation. *J Hepatol* **64**, 433-485, doi: 10.1016/j.jhep.2015.10.006 (2016).

[3] Younossi, Z. M., Stepanova, M., Younossi, Y., Golabi, P., Mishra, A., Rafiq, N., & Henry, L. Epidemiology of chronic liver diseases in the USA in the past three decades. *Gut* **69**, 564-568, doi: 10.1136/gutjnl-2019-318813 (2020).

[4] Wong, R. J., Aguilar, M., Cheung, R., Perumpail, R. B., Harrison, S. A., Younossi, Z. M., & Ahmed, A. Nonalcoholic steatohepatitis is the second leading aetiology of liver disease among adults awaiting liver transplantation in the United States. *Gastroenterology* **148**, 547-555, doi: 10.1053/j.gastro.2014.11.039 (2015).

[5] Charlton, M. R. et al. Frequency and outcomes of liver transplantation for nonalcoholic steatohepatitis in the United States. *Gastroenterology* **141**, 1249-1253, doi: 10.1053/j.gastro.2011.06.061 (2011).

[6] Sarin, S. K. et al. Liver diseases in the Asia-Pacific region: a Lancet Gastroenterology & Hepatology Commission. *Lancet Gastroenterol Hepatol* **5**, 167-228, doi: 10.1016/S2468-1253(19)30342-5 (2020).

[7] Kamath, P. S. et al. A model to predict survival in patients with end-stage liver disease. *Hepatology* **33**, 464-470, doi: 10.1053/jhep.2001.22172 (2001).

[8] Abouna, G. M. Ethical issues in organ and tissue transplantation. *Exp Clin Transplant* **1**, 125-138 (2003).

[9] Thompson, A. J. & Patel, K. Antifibrotic therapies: will we ever get there? *Curr Gastroenterol Rep* **12**, 23-29, doi: 10.1007/s11894-009-0080-9 (2010).

[10] Ayata, G. et al. Cryptogenic cirrhosis: clinicopathologic findings at and after liver transplantation. *Hum Pathol* **33**, 1098-1104, doi: 10.1053/hupa.2002.129419 (2002).

[11] Adil, S. A. & Mohammed, L. Y. Prevalence of overweight and obesity among adults in Zakho City. *Passer J Basic Appl Sci* **7**, 983-992, doi: 10.24271/psr.2025.504677.1939 (2025).

[12] Younossi, Z. M. et al. Global burden of NAFLD and NASH: trends, predictions, risk factors and prevention. *Nat Rev Gastroenterol Hepatol* **15**, 11-20, doi: 10.1038/nrgastro.2017.109 (2018).

[13] Corradini, S. G. et al. High preoperative recipient plasma 7beta-hydroxycholesterol is associated with initial poor graft function after liver transplantation. *Liver Transpl* **11**, 1494-1504, doi: 10.1002/lt.20524 (2005).

[14] Wiesner, R. et al. Model for end-stage liver disease (MELD) and allocation of donor livers. *Gastroenterology* **124**, 91-96, doi: 10.1053/gast.2003.50016 (2003).

[15] Chen, C. L., Kabiling, C. S., & Concejero, A. M. Why does living donor liver transplantation flourish in Asia? *Nat Rev Gastroenterol Hepatol* **10**, 746-751, doi: 10.1038/nrgastro.2013.194 (2013).

[16] Olthoff, K. M. et al. Defining long-term outcomes with living donor liver transplantation in North America. *Ann Surg* **262**, 465-475, doi: 10.1097/SLA.0000000000001383 (2015).

[17] Al-Jaf, D. A., Hussein, A. L., & Niranji, S. S. Clinical, biochemical, and haematological profile of iron deficiency anaemia in the Garmian population, Kurdistan region of Iraq. *Passer J Basic Appl Sci* **6**, 237-245, doi: 10.24271/psr.2024.431528.1453 (2024).