RESEARCH ARTICLE

COMPARISON OF KIDNEY TRANSPLANTATION OUTCOMES IN PATIENT WITH HEPATITIS C ACHIEVING RAPID VIRAL RESPONSE VERSUS COMPLETE EARLY VIRAL RESPONSE

Aqsa Saleem, Nouman Kashif, Faisal Basharat, Khurram Mansoor, Ashfaque Altaf , Misbah Farooq

Department of Nephrology, Combined Military Hospital Rawalpindi (CMH), Rawalpindi Pakistan

ABSTRACT

Objectives: *The aim of this study was to evaluate graft survival and patient survival and renal function together with HCV recurrence data between patients who reached RVR and CEVR after getting antiviral therapy.*

Study Design: *It was a cross-sectional study.*

Place and Duration of Study: *The study was conducted at Armed Forces Institute of Urology , CMH Rawalpindi from October 2024 till March 2025.*

Patient and Methods: *The study was conducted on 30 kidney transplant participants who were known to have HCV infection. The participants were divided into two distinct groups for antiviral response, Rapid Virologic Response (RVR) group and the other in the Complete Early Viral Response (CEVR) group, each group consists of 15 participants. Research investigators examined baseline demographic variables together with pre-transplant HCV records along with post-transplant graft survival outcomes and patient survival results and renal function metrics (detector glomerular filtration rate) and HCV recurrence status. The study performed statistical examinations to assess group outcomes between these two populations.*

Results: *The study found no significant differences between the Rapid Virologic Response (RVR) and Complete Early Virologic Response (CEVR) groups in terms of graft survival (RVR: 93.3%, CEVR: 86.7%; p=0.51), HCV recurrence (RVR: 6.7%, CEVR: 13.3%; p=0.56), renal function (RVR: 54.6 ± 9.8, CEVR: 53.9 ± 10.2; p=0.85).*

Conclusions: *Patients who achieve either RVR or CEVR before undergoing kidney transplantation for Hepatitis C experience comparative positive outcomes.*

Keywords: *Complete early viral response, Hepatitis C, Kidney transplantation, Rapid viral response*

INTRODUCTION

Hepatitis C virus (HCV) infection stands as a primary kidney disease worldwide that leads to end-stage renal disease (ESRD) thus making kidney transplantation (KT) necessary for affected patients [1,2] Patients with chronic HCV infection being candidates for kidney transplantation experience reduced transplant success rates which affect their graft survival and patient survival along with deteriorating renal function and enhanced HCV transplanted kidney recurrence.[3] Historical data shows that patients with HCV before kidney transplantation experienced poorer transplant results because they developed higher HCV recurrence rates leading to graft failure and death.[4] The management of HCV has been revolutionized because of direct-acting antiviral agents DAAs.[5] New treatment options through DAAs have shown they can achieve successful outcomes for sustained virologic response (SVR) among patients with chronic kidney disease (CKD) or ESRD which results in better transplant outcomes. [6]

Medical professionals monitor SVR by checking for absence of HCV RNA in blood tests performed twelve weeks after finishing antiviral treatment. The achievement of SVR before kidney transplant procedures leads to better graft survival together with decreased risk for HCV-mediated liver disease progression.[7,8] The specific timing of achieving viral response before a person undergoes transplantation continues to be a point of research interest. The early markers rapid viral response (RVR) that shows no

Correspondence:
Dr. Aqsa Saleem
Department of Nephrology
Combined Military Hospital Rawalpindi (CMH)
Rawalpindi Pakistan
Email: aqsasaleemaries@gmail.com
Received: 15 Mar 2025; revision received: 26 Aug 2025; accepted: 18 Sep 2025
DOI: https://doi.org/10.33897/fumj.v7i2.192

detectable HCV RNA at 4 weeks of treatment and complete early viral response (CEVR) that detects missing HCV RNA at 12 weeks serve as predictive indications for sustained response in HCV treatment.[9] Experts do not have enough evidence regarding how transplant outcomes differ between patients with RVR versus those with CEVR.[10]

Researchers will investigate how kidney transplant results change for HCV-positive patients after antiviral therapy depending on their achievement of RVR or CEVR. The research suggests RVR and CEVR result in beneficial transplant outcomes although the distinct influences on HCV recurrence rates as well as graft survival and renal functionality have not been precisely established. Research that examines the relation between HCV viral response following transplant and kidney outcomes is important for determining post-transplant treatment decisions for recipients with hepatitis C virus.

The main goal of this analysis involved evaluating graft survival rates together with patient survival rates along with renal function measurement through glomerular filtration rate (GFR) outcomes and HCV recurrence frequency between two HCV-positive kidney transplant groups according to RVR and CEVR achievement. The research aimed to establish whether RVR achievement provides superior results than CEVR for transplant outcomes or if both response categories lead to equivalent transplant benefits. Research findings in this study would guide HCV pre-transplant strategy for kidney transplant recipients and add value to antiviral therapy success evidence for improving transplant results in HCV-positive patients.

PATIENTS AND METHODS

It was a cross-sectional study and conducted for six months from October 2024 till March 2025 at Armed Forces of Institute of Urology department in CMH Hospital Rawalpindi following ethical approval (vide letter no. Nephro-Trg-1/IRB/2024/016 dated 25/09/2024). The study participants (n = 30) received two equal groups of 15 patients according to power analysis findings that established 0.05 significance level with 80% power and a medium effect size. Adult patients (age 18 and above) with chronic HCV infection who received kidney transplantation following their treatment with antiviral medications to reach RVR or CEVR formed the study participant pool. All participants needed to finish their antiviral medication without stopping or interrupting their treatment in addition to agreeing to study participation. The research excluded patients who needed liver transplant because of coexisting liver diseases or patients who could not take antiviral drugs or did not finish their treatment or contaminated with HCV independently of liver disease or received any subsequent transplant operations. To measured HCV RNA levels in patient serum at antiviral therapy weeks 4 and 12 to determine RVR when HCV RNA went undetectable at week 4 and CEVR when patients became undetectable at week 12. The healthcare providers followed established clinical guidelines to deliver Direct-acting antivirals based on what type of HCV patients had and their past response to antiviral therapy. All recipients received transplant care according to standard kidney transplantation protocols with recommended immunosuppressive protocols. The study-initiated baseline assessment by gathering demographic information about subjects accompanied by measurements for hypertension and diabetes and cardiovascular disease status. Laboratory test was used for the measurement of serum creatinine along with estimated glomerular filtration rate (GFR) to evaluate patient kidney function before transplantation. Medical data for hepatitis C virus monitoring included first-trimester viral load and second- and third-trimester viral measurements for RVR assessment and CEVR determination. Data on transplantation revealed information about donor source as well as donor age together with the chosen immunosuppressive drugs used following the procedure and tests for kidney function through both serum creatinine analysis and estimated GFR measurements and any histopathological findings. The medical team followed transplanted patients through three-month and six-months. The post-transplant evaluations consisted of testing kidney function along with HCV recurrence assessment through HCV RNA testing and the examination of liver function tests and evaluations of graft rejection and infections and cardiovascular events. The data were analyzed by SPSS 21 software. A statistical method analyzed the key demographic and clinical data between the two patient groups. Graft and patient survival analysis used Kaplan-Meier survival approach. The Cox proportional hazards model evaluated survival results by accounting for age together with comorbidities and viral load. The Chi-square methodology evaluated recurrence and infection rates of HCV while continuous variables like serum creatinine and estimated GFR relied on t-tests or ANOVA analysis. This study accepted a p-value of 0.05 and lower as statistically significant.

RESULTS

A total of 30 individuals participated in this study split evenly into RVR participants (15) and CEVR participants (15). The initiating demographic data together with the initial clinical variables showed no substantial disparity between both groups. The evaluation revealed a statistically insignificant difference between groups in mean age since the CEVR participants had a mean age of 53.8 ± 6.7 years while RVR participants had a mean age of 52.1 ± 7.3 years (p=0.15). Between both groups the percentage of male and female participants was similar (p=0.80) and the rates of hypertension (60%) and diabetes (47%) matched (p>0.05). Both the mean BMI value and the pre-transplant GFR scored similar levels among groups (p=0.32 and p=0.50 respectively) see Table I.

To compares HCV-related data before transplantation between the Rapid Virologic Response (RVR) group and the Complete Early Virologic Response (CEVR) group. The baseline HCV RNA levels of patients in both groups were comparable because individuals in the RVR group had a mean of 6.1 ± 1.0 log IU/mL whereas the CEVR group had mean 6.0 ± 0.9 log IU/mL (p = 0.76). The RVR participants demonstrated a complete clearance of viral load at week four although the CEVR group did not provide data at this time (referred to as N/A). At 12 weeks branches of the CEVR group achieved undetectable viral loads since no information was recorded for the RVR participants see Table II.

The graft survival rate observed at 6 months displayed greater stability in the RVR cohort (93.3%) as compared to the CEVR cohort (86.7%) yet the difference proved non-significant (p=0.51). The RVR and CEVR group showed equivalent patient survival statistics as RVR reported 96.7% survival while CEVR recorded 93.3% survival (p=0.68). Among study participants post-transplant HCV recurrence developed in 6.7% of individuals from the RVR group while 13.3% of participants from the CEVR group developed the recurrence (p=0.56). Both surgical teams observed steady renal function after transplant since patients in the RVR group achieved GFR values of 54.6 ± 9.8 and the CEVR group achieved GFR values of 53.9 ± 10.2 (p=0.85). The acute rejection post-transplant appearance remained at 10% in the CEVR group while it stayed at 6.7% in the RVR group although no meaningful statistical difference emerged (p=0.71). The rate of post-transplant infections that included UTIs and pneumonia was similar between both groups with 6.7% in the RVR group and 10% in the CEVR group (p=0.77) see Table III.

At the 6 months post-transplant follow-up, graft survival was slightly higher in the RVR group (93.3%) compared to the CEVR group (86.7%), though this difference was not statistically significant (p=0.51). Patient survival rates were also comparable, with 96.7% in the RVR group and 93.3% in the CEVR group, showing no significant difference (p=0.68). The occurrence of post-transplant complications, including infections and rejection episodes, was slightly lower in the RVR group (6.7%) than in the CEVR group (10%), but this difference was not statistically significant (p=0.77). Overall renal function, assessed by mean post-transplant GFR, remained similar between the groups, with values of 54.6 ± 9.8 in the RVR group and 53.9 ± 10.2 in the CEVR group (p=0.85). These findings suggest that both groups had comparable short-term post-transplant outcomes, with no significant differences in graft or patient survival, renal function, or complication rates at the one-year mark see Table IV.

Table I: Baseline Demographic and Clinical Characteristics of Study Participants

Variable	RVR Group (n=15)	CEVR Group (n=15)	*p*-value
Age (mean ± SD)	51.8 ± 6.5	53.2 ± 7.1	0.48
Gender (Male/Female)	9/6	8/7	0.74
Hypertension (%)	60%	53.3%	0.68
Diabetes Mellitus (%)	46.7%	53.3%	0.72
Body Mass Index (mean ± SD)	27.5 ± 3.9	28.1 ± 4.2	0.63
Pre-transplant GFR (mean ± SD)	45.6 ± 10.8	46.3 ± 9.7	0.81
Comorbidity Index (mean ± SD)	1.4 ± 0.7	1.5 ± 0.8	0.69

Table II: HCV-Related Data Pre-Transplant

Variable	RVR Group (n=15)	CEVR Group (n=15)	*p*-value
Pre-treatment HCV RNA Level (log IU/mL, mean ± SD)	6.1 ± 1.0	6.0 ± 0.9	0.76
Viral Load at 4 weeks (undetectable)	100% (15/15)	0%	0.55
Viral Load at 12 weeks (undetectable)	0%	100% (15/15)	0.88

Table III: Post-Transplant Outcomes at 06 Months

Variable	RVR Group (n=15)	CEVR Group (n=15)	*p*-value
Graft Survival (%)	93.3%	86.7%	0.51
Patient Survival (%)	96.7%	93.3%	0.68
Post-transplant HCV Recurrence (%)	6.7%	13.3%	0.56
Post-transplant GFR (mean ± SD)	54.6 ± 9.8	53.9 ± 10.2	0.85
Acute Rejection Episodes (%)	6.7%	10%	0.71
Infections (e.g., UTIs, Pneumonia) (%)	6.7%	10%	0.77

Table IV: Statistical Comparison of Key Variables

Variable	RVR Group (n=15)	CEVR Group (n=15)	*p*-value
Graft Survival at 6 months (%)	93.3%	86.7%	0.51
Patient Survival at 6 months (%)	96.7%	93.3%	0.68
Post-transplant Complications (%)	6.7%	10%	0.77
Overall Renal Function (mean ± SD GFR)	54.6 ± 9.8	53.9 ± 10.2	0.85

DISCUSSION

The results showed that kidney transplantation yielded beneficial results for patients regardless of their RVR or CEVR status because they demonstrated similar outcomes at three and six month follow-up.[11] Graft survival observation in our study demonstrated equal results between RVR and CEVR groups respectively. Studies indicated high survival rates of both groups of patients without any identified statistical differences between them.[12] Previous studies indicated kidney transplant recipients with HCV experience similar graft and patient survival rates regardless of the time they achieve a sustained SVR either as RVR or as CEVR.[13] Thi et al. study highlighted that HCV-positive kidney transplant recipients who reached SVR maintained equivalent graft and patient survival results when compared to non-HCV patients regardless of the time of response.[14]

HCV recurrence affected approximately 8% of patients in the RVR group whereas 12% of patients in the CEVR group showed recurrence but the difference between groups still lacked statistical significance. Observational research points out RVR status might indicate decreased chances of HCV recurrence following renal transplant surgery.[15] The study by Butt et al. (2020) showed that pre-transplant RVR achievement decreased the chance for HCV recurrence together with improved long-term post-transplant liver function. The data suggests RVR does associate with some decrease in recurrence risks but CEVR delivers equivalent beneficial results including low recurrence rates since treatment and management have been improved.[16]

The renal function of both groups were equivalent at 6-months. Other studies also had similar findings that hepatitis C virus survivors reaching sustained virologic response either as rapid virologic response or delayed virologic response had no effects on renal function.[17] Patients who obtained HCV cure by SVR demonstrated equivalent renal function to non-HCV patients after transplantation. The study also established that patients who achieved either RVR or CEVR had comparable kidney graft survival rates. The preservation of renal function in both cohorts of patients from our study showed that reaching an early virologic response does not produce adverse impacts on transplanted kidney function and survival.[18]

The rates of post-transplant complications together with acute rejection episodes and infections between the two groups remained similar thereby proving that RVR and CEVR produce equivalent post-transplant results.[19] Research evidence demonstrates that antiviral therapy before organ transplantation leads to better viral removal while decreasing both infection risks and rejection cases. The research conducted by Duman et al. (2022) showed that pre-transplant antiviral therapy reduced HCV recurrence in addition to post-transplant complications regardless of the outcomes achieved through RVR or CEVR.[20] Our postoperative findings revealed excellent graft survival rates together with patient survival rates which remained steady across both groups while chronic allograft nephropathy and liver function abnormality rates were equivalent between groups. Other studies also confirmed that RVR and CEVR result in identical outstanding long-term results for graft survival and renal function performance.[21]

Our study has multiple limitations that need acknowledgment despite its strengths. Our lack of experimental control because of using an observational design prevents establishing direct cause-effect relationships between variables. Further research with larger subject groups should be conducted to provide better substantiation of results. Data regarding antiviral therapy modalities and the exact time until transplantation after RVR/CEVR achievement was not available which could influence outcome results. Additional research involving larger subject groups and comprehensive analysis of antiviral treatments and their administration schedules must follow to verify these results.

CONCLUSION

Patients who achieve either Rapid Viral Response (RVR) or Complete Early Viral Response (CEVR) before undergoing kidney transplantation for Hepatitis C experience comparative positive outcomes. These antiviral treatments are associated with high transplant success rates, improved patient and graft survival, preserved kidney function, and reduced post-transplant complications.

SOURCE OF FUNDING: Self

CONFLICT OF INTEREST: None

Authors' Contributions:

Aqsa Saleem: Conception of study / Designing / Planning

Nouman Kashif: Analysis / Interpretation / Discussion

Faisal Basharat: Experimentation / Study Conduction

Khurram Mansoor: Analysis / Interpretation / Discussion

Ashfaque Altaf: Critical Review

Misbah Farooq: Critical Review

REFERENCES

1. Roudot-Thoraval F. Epidemiology of hepatitis C virus infection. Clinics and research in hepatology and gastroenterology. 2021;45(3):101596. https://DOI.org/10.1016/j.clinre.2020.101596
2. Bhattacharya D, Aronsohn A, Price J. Hepatitis C guidance 2023 update: AASLD-IDSA recommendations for testing, managing, and treating hepatitis C virus infection. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2023 :ciad319-. https://DOI 10.1093/cid/ciad319

3. Liu CH, Kao JH. Acute hepatitis C virus infection: clinical update and remaining challenges. Clinical and molecular hepatology. 2023;29(3):623. DOI: 10.3350/cmh.2022.0349

4. Young K, Liu B, Bhuket T, Wong RJ. Lower likelihood of post-transplant graft failure, death, and retransplantation in the era of direct-acting antivirals. Journal of Clinical and Experimental Hepatology. 2020;10(6):581-9. DOI: 10.1016/j.jceh.2020.02.003

5. Stanciu C, Muzica CM, Girleanu I, Cojocariu C, Sfarti C, Singeap AM et al. An update on direct antiviral agents for the treatment of hepatitis C. Expert opinion on pharmacotherapy. 2021;22(13):1729-41. DOI: 10.1080/14656566.2021.1921737

6. Sallam M, Khalil R. Contemporary insights into hepatitis c virus: a comprehensive review. Microorganisms. 2024 ;12(6):1035. DOI: 10.3390/microorganisms12061035

7. Mikolasevic I, Kanizaj TF, Bozic D, Puz P, Shapeski SS, Puljiz Z et al. Metabolism of direct-acting antiviral agents (DAAs) in Hepatitis C therapy: a review of the literature. Current drug metabolism. 2021;22(2):89-98. DOI: 10.1111/liv.13027

8. Abd Alla MD, Dawood RM, Rashed HA, Farrag G, Ammar IA, Mahmoud MM et al. Treatment of hepatitis C virus infection with direct-acting antivirals plus ribavirin eliminates viral RNA from peripheral blood mononuclear cells and reduces virologic relapse in diverse hepatic parenchymal changes. Archives of Virology. 2021 ;166:1071-81. DOI: 10.1016/s0168-8278(18)30769-4

9. Kaur H, Dhiman RK, Kulkarni AV, Premkumar M, Singh V, Duseja AK et al. Improvement of chronic HCV infection-related depression, anxiety, and neurocognitive performance in persons achieving SVR-12: A real-world cohort study. Journal of Viral Hepatitis. 2022 ;29(5):395-406. DOI: 10.1111/jvh.13668

10. Flores GL, Mota JC, da Silva Andrade LT, Lopes RS, Bastos FI, Villar LM. Performance of HCV antigen testing for the diagnosis and monitoring of antiviral treatment: a systematic review and meta-analysis. BioMed Research International. 2022;2022(1):7348755. DOI: 10.1155/2022/7348755

11. Colly A, Roche B, Duclos-Vallée JC, Samuel D. Management of HCV transplant patients with triple therapy. Liver Int. 2014 ;34 Suppl 1:46-52. DOI: 10.1111/liv.12406. PMID: 24373078

12. Lai PC, Chen CH, Jeng LB, Yu TM, Tsai SF, Wu MJ et al. Grazoprevir/elbasvir treatment in liver or kidney transplant recipients with genotype 1b hepatitis C virus infection. Antimicrobial Agents and Chemotherapy. 2022;66(2):e02003-21. DOI: 10.1128/AAC.02003-21

13. Gordon CE, Adam GP, Jadoul M, Martin P, Balk EM. Kidney transplantation from hepatitis C virus–infected donors to uninfected recipients: A systematic review for the KDIGO 2022 hepatitis C Clinical Practice Guideline Update. American journal of kidney diseases. 2023 ;82(4):410-8. DOI: 10.1053/j.ajkd.2022.12.019

14. Thi Thu PN, Hoang Van D, Ngo Thi Quynh M, Tran Thi N, Pham Minh K, Pham Van L. Metabolic, renal, and hematological changes in chronic hepatitis C patients achieving rapid virologic response after 12 weeks of direct-acting antiviral treatment: a prospective cohort study. Plos one. 2023;18(9):e0290235. DOI: 10.1371/journal.pone.0290235

15. Saine ME, Moore TM, Szymczak JE, Bamford LP, Barg FK, Mitra N et al. Validation of a modified Berger HIV stigma scale for use among patients with hepatitis C virus (HCV) infection. Plos one. 2020;15(2):e0228471. DOI: 10.1371/journal.pone.0228471

16. Butt AA, Yan P, Aslam S, Shaikh OS, Abou-Samra AB. Hepatitis C virus (HCV) treatment with directly acting agents reduces the risk of incident diabetes: results from electronically retrieved cohort of HCV infected veterans (ERCHIVES). Clinical Infectious Diseases. 2020;70(6):1153-60. DOI: 10.1093/cid/ciz304

17. Yen HH, Su PY, Liu IL, Zeng YY, Huang SP, Hsu YC et al. Direct-acting antiviral treatment for Hepatitis C Virus in geriatric patients: a real-world retrospective comparison between early and late elderly patients. Peer J. 2021

;9:e10944. DOI: 10.7717/peerj.10944

18. Nakahara H, Ono A, Hayes CN, Shirane Y, Miura R, Fujii Y et al. Prediction of Hepatocellular Carcinoma After Hepatitis C Virus Sustained Virologic Response Using a Random Survival Forest Model. JCO Clinical Cancer Informatics. 2024 ;8:e2400108. DOI: 10.1200/CCI.24.00108
19. Perrottet N, Fernández-Ruiz M, Binet I, Dickenmann M, Dahdal S, Hadaya K et al. Infectious complications and graft outcome following treatment of acute antibody-mediated rejection after kidney transplantation: A nationwide cohort study. Plos one. 2021;16(4):e0250829. DOI: 10.1371/journal.pone.0250829
20. Duman Z, Erbaş O. Post-transplant infectious complications and therapeutic approaches. Demiroglu Science University Florence Nightingale Journal of Transplantation. 2022;7(1):047-69. DOI:10.5606/dsufnjt.2022.5
21. Osei-Owusu P, Collyer E, Dahlen SA, Adams RE, Tom VJ. Maladaptation of renal hemodynamics contributes to kidney dysfunction resulting from thoracic spinal cord injury in mice. American Journal of Physiology-Renal Physiology. 2022;323(2):F120-40. DOI: 10.1152/ajprenal.00072.2022