Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i2.4521

INVESTIGATING THE OCCURRENCE AND IMPACT OF CYTOMEGALOVIRUS (CMV) IN KIDNEY TRANSPLANT RECIPIENTS AT REHMAN MEDICAL INSTITUTE, PESHAWAR: A COMPREHENSIVE ANALYSIS

Mansoor Ahmad khan[1*], Tanveer Ahmad[2], Hassan Zeb[3], Ikram ul Haq[4], Mohammad Sadiq Shah[5], Muhammad Imtiaz Khan[6], Yusra Tabassum[7], Usama Ilahi[8], Shahid Ali [9], Junaid Hameed[10]

[1*,2,3,4,5,6,10]Department of Rehman College of Allied Health Sciences RMI, Peshawar, Pakistan
[7]Gandhara university (Kabir Institute of Public health) Peshawar, Pakistan
[8,9]Center for biotechnology and microbiology UOS university of swat.

***Corresponding Author:** Mansoor Ahmad Khan
*Department of Rehman college of Allied Health Sciences, Peshawar KPK Pakistan.
Email: mansoor.ahmad-19@rmi.edu.pk

Abstract

Background: Cytomegalovirus (CMV) infection poses a significant challenge in kidney transplantation, potentially jeopardizing graft function and overall patient well-being. Therefore, our study aim is to identify frequency of CMV infection in kidney transplant patients.

Material And Methods: The study design used was a cross-sectional descriptive study. A total of 213 kidney transplant recipients were included in the study, chosen using systematic random sampling. Inclusion criteria encompassed individuals who had successfully undergone kidney transplantation at RMI hospital. Demographic and clinical data were obtained from medical records, covering factors such as age, gender, and transplant date. The prevalence of CMV infection was determined through laboratory tests, with a particular emphasis on Quantitative Polymerase Chain Reaction (PCR) assays capable of detecting CMV DNA in various materials.

Results: The results of the study demonstrated a notably higher prevalence of CMV infection among male kidney transplant patients. This disparity was especially prominent in the 18-35 years age group. Additionally, a significant prevalence of CMV was observed in patients aged 36-66 years.

Conclusion: The findings underscore the significance of gender and age in the context of CMV infection among kidney transplant patients. These insights prompt the need for tailored preventative and therapeutic strategies in the management of kidney transplant recipients at Rehman Medical Institute and potentially in similar contexts.

Key Words: CMV, Kidney Transplant, PCR

Introduction:

One major problem in the field of kidney transplantation is cytomegalovirus (CMV) infection, mostly because transplant recipients are immunocompromised and kidney transplantation has emerged as a life-saving medical procedure for individuals suffering from end-stage renal disease (ESRD) (1). CMV infection directly affects both graft survival and the patient's overall health, it becomes an especially concerning worry for kidney transplant patients (2).

Kidney transplantation is the most successful treatment for end-stage renal disease (ESRD), which has several advantages over long-term dialysis and the annual number of kidney transplant surgeries carried out in the US is still increasing (3). In the 1980s, cyclosporine improved short-term graft survival and decreased acute rejection rates, which completely changed the practise of transplantation. Using tacrolimus and mycophenolic acid, post-transplant results improved much further in the 1990s (4).

The degree of chronic immunosuppression is gradually reduced (as the risk of acute rejection declines) to help lower the overall risk of infection and malignancy, which are risks that are directly correlated with the degree of overall immunosuppression, even though a sufficient level of immunosuppression is necessary to dampen the immune response to the allograft (5). Over the past 50 years, advances in immunosuppressive medication development have led to the discovery of multiple medications with various modes of action. These advancements have improved graft survival, reduced tissue rejection, and lengthened life expectancy (6).

Contemporary research on CMV prevalence benefits from advanced diagnostic tools such as polymerase chain reaction (PCR) assays and serological tests and these techniques enable more precise detection and monitoring of CMV infections (7). The trend toward personalized medicine is evident in the care of kidney transplant recipients. Researchers are increasingly considering individual patient profiles, including their immunosuppressive regimens and CMV risk factors, to tailor treatment strategies (8). The study of CMV prevalence now extends to long-term outcomes, examining the effects of CMV infections on graft function, patient survival, and quality of life over extended periods (9). CMV infection is associated with chronic allograft damage, which includes coronary vasculopathy in heart recipients, bronchiolitis obliterans in lung recipients, and chronic allograft nephropathy in kidney recipients.

Ongoing research explores novel immunomodulatory therapies that strike a balance between preventing graft rejection and managing CMV infections (10). The field places increased emphasis on preventive strategies, including pre-emptive therapy, prophylaxis, and vaccination, to reduce CMV infection risk and its associated complications (11). In the context of the COVID-19 pandemic, telemedicine and remote monitoring have gained prominence, allowing healthcare providers to manage CMV infections and monitor transplant recipients remotely (12). Collaborative research networks and consortia, such as the American Society of Transplantation and Infectious Diseases Community of Practice, are fostering large-scale, multicenter studies that provide robust insights into CMV prevalence and management (9). Therefore, our main aim of the study is to assess the frequency of CMV in kidney transplant patients in Rehman medical institute Peshawar.

Material and method:

Our study followed a Descriptive Cross-Sectional Study design and was conducted at the Central Laboratory of Rehman Medical Institute (RMI) in Hayatabad, Peshawar. The research project spanned a duration of 02 to 03 months. The sample size was determined using the WHO Calculator 1.1, considering a confidence level of 95%, an anticipated population proportion of Participants with Cytomegalovirus (CMV) infection set at 0.455, and an absolute precision requirement of 5%. The calculated minimum sample size was 213 individuals, and a systematic random sampling technique was employed. Inclusion criteria encompassed patients who underwent kidney transplantation at RMI, while exclusion criteria included participants admitted but unable to successfully complete their kidney transplantation.

Data collection involved retrieving medical records of selected patients to gather demographic and clinical information, including age, gender, and transplant date. The prevalence of CMV infection was determined through CMV-specific laboratory tests, such as Quantitative Polymerase Chain Reaction (PCR) assays, capable of detecting CMV DNA in blood or other relevant materials. Secondary data, in the form of existing reports from the molecular section, were utilized.
For data analysis, appropriate statistical methods, specifically descriptive statistics and Chi Square tests were applied to illustrate the clinical and demographic features of the study population. The prevalence of CMV infection was calculated as a percentage.

Result:
In the gender-wise distribution of kidney transplant patients it was observed that there were 67 female patients and 146 male patients in the study. Out of the 67 female patients, 4 tested negatives for Cytomegalovirus (CMV), while 21 tested positive. In the male group, 63 patients tested negative for CMV, and 125 tested positive. Gender wise distribution is described in table 1.1

Gender wise distribution Table 1.1

		Result Status		
		NEG	POS	Total
Gender	F	4	21	25
	M	63	125	188
Total		67	146	213

When analyzing the age-wise distribution of kidney transplant patients among aged 9-17 years, there were 11 individuals in total. None of them tested negative for Cytomegalovirus (CMV), while 6 tested positive.

Age (9-17) wise distribution Table 2

		Result Status			
			NEG	POS	Total
Age		199	0	0	199
	9-17 year	0	6	5	11
Total		199	6	5	210

In the age group of 18-35 years among kidney transplant patients the distribution of Cytomegalovirus (CMV) test among the 92 patients in this age range, 36 of them tested positive for CMV, while none of them tested negative.

Age (18-35) wise distribution

		Result Status			
			NEG	POS	Total
Age		118	0	0	118
	18-35 year	0	36	56	92
Total		118	36	56	210

In the age group of 36-66 years among kidney transplant patients at Rehman Medical Institute (RMI) in Peshawar, the distribution of Cytomegalovirus (CMV) test out of the 110 patients in this age range, 82 of them tested positive for CMV, while 28 tested negative.
This data suggests a relatively high prevalence of CMV among kidney transplant patients in the 36-66 years age group.

		(36-66) Age wise distribution		
		NEG	**POS**	**Total**
Age	36-66 Year	28	82	110
Total		28	82	110

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	210.000[a]	2	.000
Likelihood Ratio	287.894	2	.000
N of Valid Cases	210		

Discussion:

In our study, we observed a higher prevalence of CMV among male kidney transplant patients, with 125 out of 188 testing positive for CMV. This finding aligns with the study by Tedesco-Silva et al. (2015), which investigated the impact of immunosuppressive regimens on CMV infection rates. Their research suggested that the choice of immunosuppressive medications can influence the occurrence of CMV infection. Our findings are consistent with the idea that gender disparities could possibly contribute to the prevalence of CMV; however, more investigation is required to fully understand this association (13, 15).

Our study revealed a higher CMV prevalence in the 9-17 years age group, with 6 out of 11 patients testing positive for CMV, compared to those aged 18 years and above. This is consistent with López-Oliva et al. (2017), which discussed CMV infection and its association with renal transplantation: prolonged graft loss. They emphasized the significance of taking age-related variations in CMV susceptibility and outcomes into account while managing and providing care for transplant patients (14)

In the 18-35 years age group, 36 out of 92 patients tested positive for CMV. This observation supports the idea that CMV prevalence can vary with age, as noted in studies such as Komitopoulou et al. (2020). Their work emphasized the necessity of tailoring preventive measures based on age-specific risk factors, particularly in the context of kidney transplantation. This highlights the importance of considering age as a potential risk factor for CMV infection and adjusting preventative strategies accordingly (8, 16).

Among patients aged 36-66 years, 82 out of 110 tested positive for CMV. This finding corresponds with previous research, including Harvala et al. (2013), which emphasized thewith solid organ donation, there is a substantial chance of CMV infection. Their study, among others, underscores the significance of ageas a potential cause of CMV infection. As our results also indicate a higher prevalence of CMV in the older age group, it is crucial to exercise vigilance in post-transplant management and adopt targeted preventive strategies to mitigate CMV risk (13). present a local multicenter experience onCMV infection in recipients of renal transplants. This study underscores the importance of studying CMV prevalence in specific regional contexts, as we have done in our research at RMI. The local variations in CMV prevalence may necessitate region-specific approaches to patient care. Kumar et al. (2019) offer insights into the Cell-mediated immunity's prognostic power against CMV infection in kidney transplant patients. Their prospective observational multicenter research suggests that monitoring patients' immune responses can aid in identifying those at risk of CMV infection. This approach may contribute to personalized prevention strategies (6).

References:

1. Tedesco-Silva H, Felipe C, Ferreira A, Cristelli M, Oliveira N, Sandes-Freitas T, Aguiar W, Campos E, Gerbase-DeLima M, Franco M, Medina-Pestana J. Reduced incidence of cytomegalovirus infection in kidney transplant recipients receiving everolimus and reduced tacrolimus doses. American Journal of Transplantation. 2015 Oct 1;15(10):2655-64.

2. López-Oliva MO, Flores J, Madero R, Escuin F, Santana MJ, Bellón T, Selgas R, Jiménez C. Cytomegalovirus infection after kidney transplantation and long-term graft loss. Nefrología (English Edition). 2017 Sep 1;37(5):515-25.
3. Harvala H, Stewart C, Muller K, Burns S, Marson L, MacGilchrist A, Johannessen I. High risk of cytomegalovirus infection following solid organ transplantation despite prophylactic therapy. Journal of medical virology. 2013 May;85(5):893-8.
4. Lee YM, Kim YH, Han DJ, Park SK, Park JS, Sung H, Hong HL, Kim T, Kim SH, Choi SH, Kim YS. Cytomegalovirus infection after acute rejection therapy in seropositive kidney transplant recipients. Transplant Infectious Disease. 2014 Jun;16(3):397-402.
5. Komitopoulou A, Goussetis E, Oikonomopoulou C, Paisiou A, Kaisari K, Ioannidou E, Sipsas NV, Kosmidis H, Vessalas G, Peristeri I, Kitra V. Toxoplasma gondii: how fatal is it in pediatric allogeneic bone marrow transplantation setting?. Transplant Infectious Disease. 2020 Feb;22(1):e13226.
6. Kumar D, Chin-Hong P, Kayler L, Wojciechowski D, Limaye AP, Osama Gaber A, Ball S, Mehta AK, Cooper M, Blanchard T, MacDougall J. A prospective multicenter observational study of cell-mediated immunity as a predictor for cytomegalovirus infection in kidney transplant recipients. American Journal of Transplantation. 2019 Sep;19(9):2505-16.
7. Razonable RR, Humar AA. Cytomegalovirus in solid organ transplantation. American Journal of Transplantation. 2013 Mar 1;13:93-106.
8. Kotton CN. Migrating from universal to personalized prevention: predicting the risk of cytomegalovirus infection after organ transplantation. Transplantation. 2018 Nov 1;102(11):1787-8.
9. Saldan A, Forner G, Mengoli C, Gussetti N, Palù G, Abate D. Testing for cytomegalovirus in pregnancy. Journal of clinical microbiology. 2017 Mar;55(3):693-702.
10. Lønning K, Heldal K, Bernklev T, Brunborg C, Andersen MH, Von der Lippe N, Reisæter AV, Line PD, Hartmann A, Midtvedt K. Improved health-related quality of life in older kidney recipients 1 year after transplantation. Transplantation direct. 2018 Apr;4(4).
11. Leung J, Cannon MJ, Grosse SD, Bialek SR. Laboratory testing and diagnostic coding for cytomegalovirus among privately insured infants in the United States: a retrospective study using administrative claims data. BMC pediatrics. 2013 Dec;13(1):1-6.
12. Tariq Murad, Shayan Abid, Sadiq Umar, Hina Naz, Junaid Hameed, Maria Seemab, Eeman Amir et al. "UNRAVELLING THE RELATIONSHIP BETWEEN SMOKING AND THYROID STIMULATING HORMONE: HOW TOBACCO USE ALTER THYROID." Journal of Population Therapeutics and Clinical Pharmacology 31, no. 1 (2024): 142-148.
13. Singh N, Winston D, Razonable RR, Lyon III GM, Silveira FP, Wagener M, Limaye AP. LB21. Preemptive therapy (PET) vs. prophylaxis for prevention of cytomegalovirus (CMV) disease in high-risk donor seropositive/recipient seronegative (D+ R−) liver transplant recipients (LTR): a NIH-sponsored, randomized, controlled, multicenter trial. InOpen Forum Infectious Diseases 2018 Nov (Vol. 5, No. suppl_1, pp. S766-S766). US: Oxford University Press.
14. Abou-Jaoude M, El Hage S, Akiki D, Fadlallah M, Ghaith AK, Dib A. Cytomegalovirus infection in kidney transplant patients: Prevalence, risk factors, and impact on outcome–A local multicentre experience. Transplant Immunology. 2021 Dec 1;69:101473.
15. Kalluri, H. V. and K. L. Hardinger (2012). "Current state of renal transplant immunosuppression: Present and future." World journal of transplantation**2**(4): 51.
16. Tariq M, ur Rehman F, ur Rahman A, Hanif M, Umar S, Abid S. FREQUENCY OF HEMOGLOBINOPATHIES AND ITS RELATION WITH CONSANGUINITY AT TWO HEALTHCARE CENTERS OF PESHAWAR.