Multidisciplinary

Diagnosis of human cytomegalovirus with renal failure by RT-qPCR

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Abstract

Human samples from renal failure patients were collected from July 25, 2023, to September 19, 2023. The age range of the patients was 1 to 80 years. The RT-qPCR method was used to detect Cytomegalovirus in all samples; the results showed seventy-nine positive cases for Cytomegalovirus. The population groups studied were divided into five age groups: 1-16, 17-33, 34-50, 51-67, and 68-84 years. The fourth group (51-67) had the highest number of infected cases at 29.11%, compared to the age group 1-16 at 12.65%, 17-33 at 15.18%, 34-50 at 27.84%, and the age group 68-84 at 15.18%. The samples were collected from hospitals, including Al-Nasiriyah Teaching Hospital, Dialysis Center, and Al-Hussein Hospital.

Keywords: renal failure, cytomegalovirus, qPCR

Introduction

Cytomegalovirus, part of the herpes virus family, which includes varicella-zoster, Epstein-Barr virus (EBV), and herpes simplex types 1 and 2, varies in prevalence from 50% to 85% in adults (Zuhair *et al*., 2019) [7]. The global prevalence of CMV, a widespread virus with no known seasonal predominance, varies depending on the age and immune condition of the patient and can result in a wide range of clinical symptoms. CMV infections are uncommon in immunocompetent people but typically arise as opportunistic infections in those with severe immunosuppressive conditions, such as cancer and renal failure patients (Kim & Lee, 2018).

The incubation period of sporadic cases of CMV is typically unknown despite the fact that the majority of people never exhibit symptoms following exposure. CMV remains in the body for life. Perinatal infection appears three to twelve weeks after birth. Adults who contract an iatrogenic infection typically become ill 3-6 weeks following a blood transfusion and 2-4 weeks following organ transplantation. The persistence of HCMV as a latent infection is likely due to the numerous immune evasion components the virus encodes during both lytic and latent phases of its lifecycle (Jackson *et al*., 2017; Berry *et al*., 2020) [6, 3].

Renal failure occurs when the kidneys are unable to eliminate metabolic byproducts from the blood and maintain the proper pH, electrolyte, and fluid balance of extracellular fluids (McKinley *et al*., 2021). Systemic illness, renal disease, or urologic problems not related to the kidneys could be the underlying cause (Alkhaqani, 2022) [1]. Both acute and chronic renal insufficiency are possible conditions. Acute renal failure often has a sudden onset and can be reversed with prompt diagnosis and treatment. In contrast, chronic renal failure, which often develops gradually over several years, results in irreversible kidney damage (Caplin *et al*., 2019) [4].

Materials and methods

A case-control study was designed on 100 total blood and serum samples, including 52 females and 48 males, obtained from patients with chronic renal failure. Seventy-nine of them developed Cytomegalovirus. These were compared with 100 samples from healthy controls. The ages ranged from 1 to 80 years during the interval from July 2023 until September 2023. Verbal consent was obtained from all participants before sample collection.

Real-time qPCR technique

This method was used to diagnose human Cytomegalovirus. The primers were designed based on the NCBI sequences of human Cytomegalovirus. GoTaq qPCR Master Mix (Cat. Number: 023484574400, abm, Canada) and viral DNA were extracted using the viral Nucleic Acid Extraction Kit (gSYNC DNA Extraction Kit) (Geneaid, Lot No. FA30411-GS, USA). This technique was performed at AL-Hakim Hospital for advanced research and biotechnology using an Analytik Jena Qtower3G device and in the public health laboratory using a BIO-RAD CFX96 device.

Table 1: Primers for cytomegalovirus used, design based on NCBI

Primer		Sequence	PCR product size
Human Cytomegalovirus prime	Reverse	ACAACGTGCTACGAAAGTGC	113 bp
	Forward	TCAAAACCACCGTGACAAGC	

Results

Genetic analysis for the diagnosis of Human Cytomegalovirus through RT-qPCR revealed that seventy-nine cases were positive for Cytomegalovirus out of 100 serum samples collected from different areas. Twenty-one cases were negative. As shown in Figure 1, forty-one cases of female

infections were higher compared to thirty-eight cases of male infections with Cytomegalovirus (Table 2). The age group 51-67 years had the highest incidence of Cytomegalovirus compared to other age groups (Table 3).

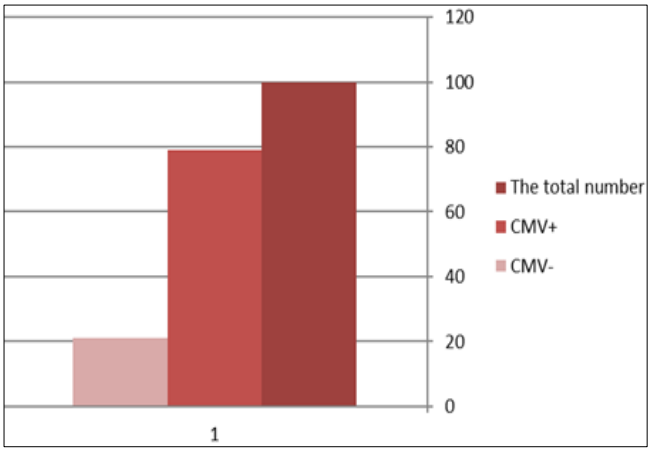

Fig 1: Postive and negative of cases of Human Cytomegalovirus

Table 2: Results of infected patients distributed by gender

Virus	The results	Percentage
CMV	33	48.1
CMV	41	51.89

Table 3: The distribution of patients according to age groups

Age group	CMV	The results
1-16 years	10	12.65
17-33 years	12	15.18
34-50 years	22	27.84
51-67 years	23	29.11
68-84 years	12	15.18

Fig 2: Real time PCR technique

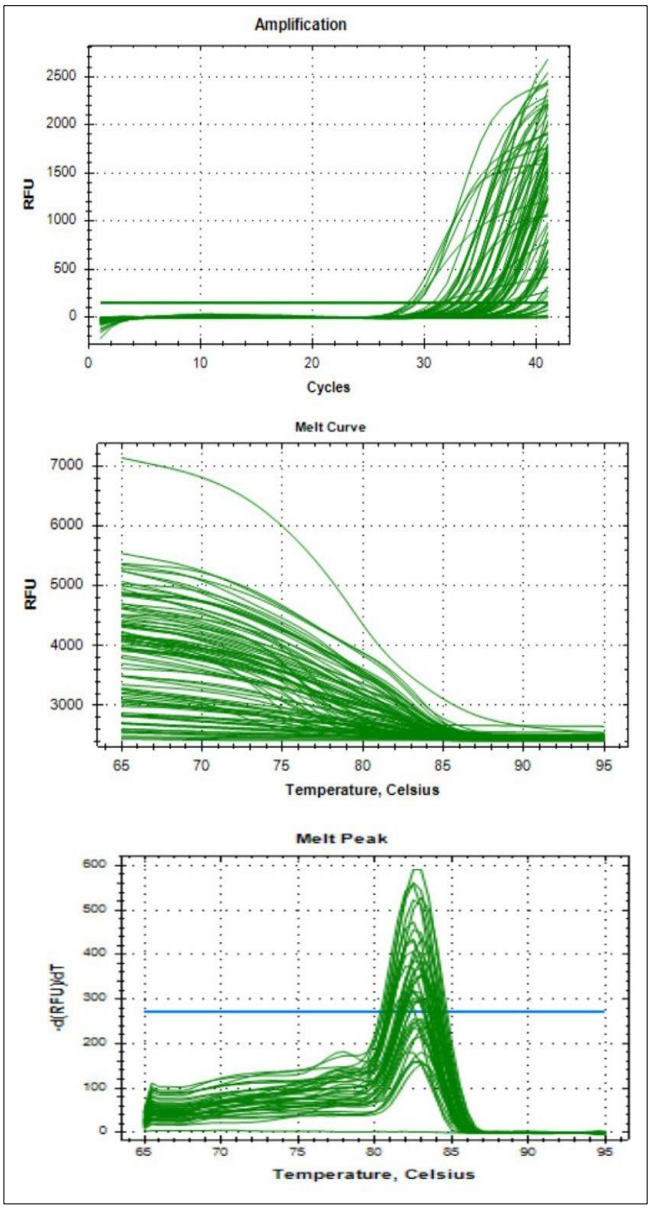

Fig 3: Detection of cytomegalovirus by RT-qPCR qPCR

Discussion

This study on the diagnosis of Human Cytomegalovirus in patients with renal failure was conducted in Dhe-Qar Governorate and across Iraq using RT-qPCR technology. A total of 100 different clinical cases with ages ranging from 1 to 80 years were arbitrarily collected, with seventy-nine cases found to be infected with Cytomegalovirus. Positive cases are shown in Figure 1. The population groups studied were divided into five age groups (1-16, 17-33, 34-50, 51-67, 68-84 years) as presented in Table 3. This study included serum samples of patients diagnosed with renal failure in hospitals during the sample collection period, similar to the study by Al-Fayyadh and Mezher (2020) [2].

Our study shows that Human Cytomegalovirus seems to have a relationship with chronic and acute renal failure and can affect a patient's immune status. This study aligns with findings by Morgantetti *et al*. (2019) and Feng *et al*. (2020) [5]. Real-time PCR was found to be a rapid, sensitive, and useful method for diagnosing CMV infection in such patients. The results indicate that Cytomegalovirus has a relationship with

chronic and acute renal failure and can affect the patient's immune status. Our results can provide advanced diagnosis of viral infections among patients in hospitals in Iraq (Mohsin *et al*., 2022).

Conclusion

- The age group 51-67 years had the highest infection rate with Cytomegalovirus.
- Females were more infected with Cytomegalovirus than males.

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