



## CASE REPORT

# A case of chronic kidney disease patient with rapid deterioration of renal function, hair loss, and spontaneous resolution of facial warts after COVID-19 infection

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## Funding information

Jiangsu Province Medical Talents Program, Grant/Award Number: QNRC2016592 and ZDRCA2016021; National Natural Science Foundation of China, Grant/Award Number: 81970638 and 82171585

## Abstract

**Background:** Individuals with pre-existing chronic kidney disease (CKD) are at an increased risk of experiencing severe symptoms if infected with COVID-19. This report presents the case of a patient with CKD who contracted COVID-19 and subsequently experienced rapid deterioration of kidney function, hair loss, and spontaneous remission of facial warts.

**Case presentation:** A 60-year-old Chinese man with a decade-long history of abnormal serum creatinine (Scr) levels and recently heightened fatigue sought treatment. The disease was previously managed and deemed resolved in 2020. However, when he contracted the novel coronavirus on December 20, 2022, he experienced persistent fatigue without other symptoms. In early January 2023, Scr levels were examined as more than 300  $\mu\text{mol/L}$ . This was followed by hair loss, including eyebrows and lashes, and the spontaneous resolution of a longstanding facial wart. During this period, although the patient received kidney-protecting drugs and a lifestyle optimization, Scr increased continuously and the disease eventually progressed to the uremic stage. As the patient still had relatively abundant urine volume, the patient chose peritoneal dialysis treatment. At a two-month follow-up, he had adhered to the CAPD protocol without complications and his hair had begun to regrow. After eight months, his hair had mostly regrown, and his Scr levels kept stable.

**Conclusion:** This case may represent the inaugural instance of CKD patients experiencing rapid deterioration of renal function, hair loss, and spontaneous remission of common warts. The underlying mechanisms of this unique phenomenon warrant further researches and debate.

## KEYWORDS

acute kidney disease, chronic kidney disease, common wart, hair loss, SARS-CoV-2

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## 1 | INTRODUCTION

COVID-19, caused by the novel coronavirus SARS-CoV-2, is a global pandemic that has affected millions of people worldwide.<sup>1</sup> The virus mainly invades the respiratory system, causing symptoms such as fever, cough, dyspnea, and pneumonia. However, COVID-19 can also affect other organs and systems, such as cardiovascular, renal, neurological, and skin. The mechanisms of multi-organ involvement are not fully understood but may involve direct viral invasion, immune-mediated damage, cytokine storm, microvascular thrombosis, and drug toxicity.

Chronic kidney disease (CKD) is a common comorbidity of COVID-19 patients and is associated with increased risk of severe illness and death. COVID-19 can also cause acute kidney injury (AKI) in patients with or without CKD, which may require renal replacement therapy (RRT). The pathogenesis of COVID-19-related AKI may involve viral entry into renal cells via the angiotensin-converting enzyme 2 (ACE2) receptor, inflammatory response, hypoxia, hemodynamic instability, and drug-induced nephrotoxicity.

COVID-19 can also affect the skin, causing various skin manifestations such as maculopapular rash, urticaria, vesicles, petechiae, livedo reticularis, and chilblains. The etiology of these skin lesions may be related to viral infection, immune response, vascular occlusion, or drug reaction. Some skin lesions, such as warts, are caused by human papillomavirus (HPV), which is a DNA virus that can infect keratinocytes and induce proliferation and dysplasia. The clearance of HPV infection depends on the host's immune system, especially the cell-mediated immunity. Hair loss, or alopecia, is another possible skin complication of COVID-19. Hair loss can be classified into several types, such as androgenetic alopecia, alopecia areata, telogen effluvium, and scarring alopecia. The causes of hair loss can be genetic, hormonal, autoimmune, infectious, nutritional, or drug-related. COVID-19 may induce hair loss by triggering telogen effluvium, which is a diffuse hair loss due to the premature transition of hair follicles from the anagen (growth) phase to the telogen (resting) phase. The possible triggers of telogen effluvium include fever, infection, stress, malnutrition, and drugs.

Here, we report a rare case of a CKD patient who developed AKI, hair loss, and spontaneous resolution of facial warts after COVID-19 infection. The purpose of this case report is to describe the clinical features and outcomes of this patient and to discuss the possible mechanisms and implications of his multi-organ and skin involvement. We hypothesize that COVID-19 infection may have triggered or exacerbated his renal damage and may have modulated his immune system to clear his HPV infection and promote his hair regrowth.

## 2 | CASE REPORT

Due to abnormal serum creatinine (Scr) over 10 years, accelerating rise with significant fatigue for 3 months, a 60-year-old male patient

was admitted to the First Affiliated Hospital of Nanjing Medical University in 8th April 2023.

In 2013, the patient was diagnosed with CKD in the Department of Nephrology of Jinling Hospital affiliated to Nanjing University for mild elevated Scr and a small amount of proteinuria. At that time, he refused kidney puncture biopsy and received Chinese traditional medicine treatment for 6 years with regular follow-up. The Scr was stable at about 150  $\mu\text{mol/L}$  and the urinary protein was controlled within 1 g/24 h in these years. Since renal function and urinary protein were stable, the patient stopped medication in 2019 and no longer goes to the hospital regularly.

At the beginning of 2021, Scr began to rise to 200  $\mu\text{mol/L}$ , and the patient visited a local Chinese traditional medicine doctor for traditional decoction treatment. In November 2021, Scr had risen to nearly 300  $\mu\text{mol/L}$ .

On 20th December 2022, the patient was confirmed to be positive for COVID-19 by multiple throat swab sampling, detected by solid phase immunochromatography using double antibody sandwich method (Nanjing Vazyme Medical Technology Co. Ltd). After the novel coronavirus infection, the patient experienced persistent fatigue, intermittent fever without edema, abdominal pain, diarrhea, cough, sputum, chest tightness, and other uncomfortable symptoms. Due to the epidemic control and personal reasons at that time, the patient had been recuperating at home, not going to the hospital to receive standard antiviral treatment, and did not take any drugs.

On 4th January 2023, when the COVID-19 pandemic had eased somewhat, the patient returned to the hospital, discovering Scr had risen to 528  $\mu\text{mol/L}$ . Meanwhile, the patient experienced alopecia, with eyebrows and beard loss, and had spontaneous resolution of facial warts. On 21st February 2023, Scr had risen to 709  $\mu\text{mol/L}$ , despite the patient again being treated with Chinese traditional medicine and chemicals (Figure 1).

On 8th April 2023, the patient was admitted to the First Affiliated Hospital of Nanjing Medical University. The patient had a history of hypertension for over 20 years, which had been controlled at around 120–130/70–80 mmHg by one tablet of calcium channel blocker per day. In 2015, the patient underwent thyroidectomy for benign thyroid tumors.

According to the admission process at that time, he was tested for novel coronavirus twice, and the results were negative. Ultrasonography indicated both kidneys had already shrunk (left kidney length, 73 mm; right kidney length, 96 mm). Laboratory tests showed hemoglobin 102 g/L, 25-hydroxyvitamin D 41.7 nmol/L, albumin 34.1 g/L, blood urea nitrogen 28.95 mmol/L, Scr 888  $\mu\text{mol/L}$ , phosphorus 2.26 mmol/L, chloride 111.3 mmol/L, serum cystatin C 5.6 mg/L, and urinary protein 3149 mg/24 hours.

During a week of admission, the patient accepted peritoneal dialysis catheterization surgery with roxycitac, febuxostat, calcitriol, nifedipine controlled-release pills, and sacubitril valsartan sodium tablets.

Two months later, the patient expertly carried out a standard protocol for CAPD. His hair was gradually growing out, and Scr

decreased to 700+  $\mu\text{mol/L}$ , urinary volume 2000–3000 mL/24 h without diuretic. Eight months later, his hair had covered almost the entire scalp, though not so dense, with Scr around 600  $\mu\text{mol/L}$  and urinary volume 2000–4000 mL/24 h without diuretic (Figure 2).

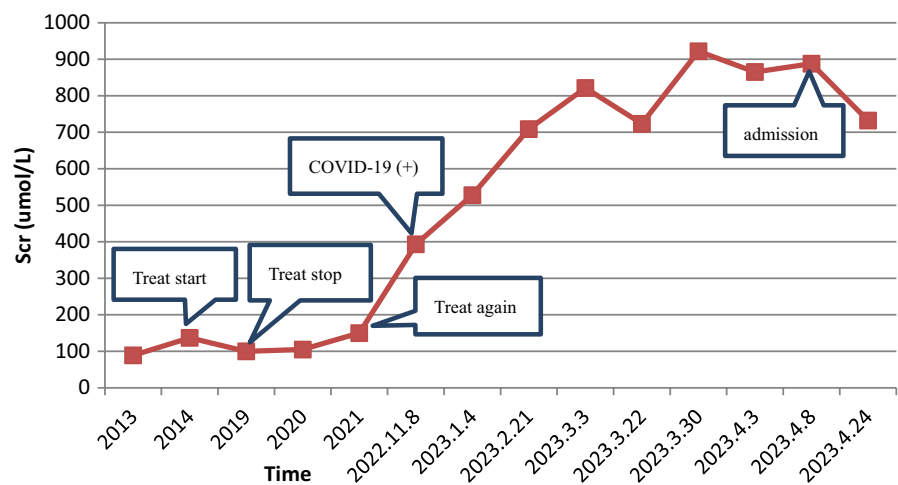
### 3 | DISCUSSION

In this case report, we present a male patient with CKD who developed AKI following COVID-19 infection. Despite medication, the patient's renal function did not improve and he ultimately required peritoneal dialysis. Interestingly, during this time, the patient experienced hair loss as well as the unexpected resolution of a facial verruca vulgaris that had been a persistent issue for him for many years.

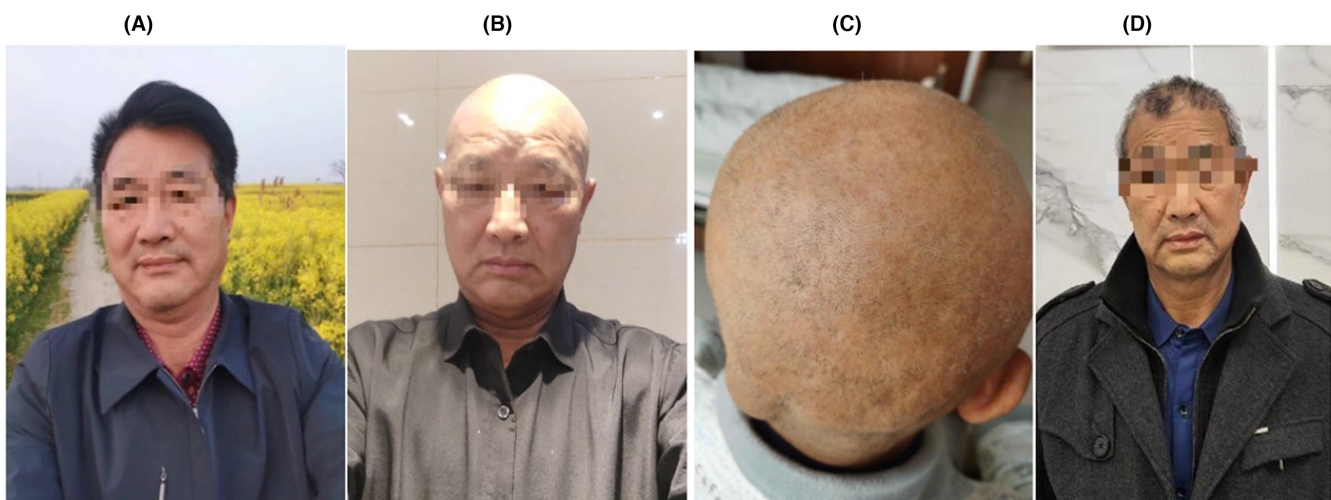
COVID-19 has had a severe impact on human health worldwide, with kidney disease patients facing even greater risks. After being infected with COVID-19, patients may suffer severe kidney damage

or even AKI. Firstly, during the pandemic, many patients suffered from kidney damage due to COVID-19 infection, including glomerular and tubular damage. This damage may lead to a decline in kidney function and even the need for kidney replacement therapy. For patients already suffering from kidney disease, COVID-19 infection may further increase the burden on the kidneys and lead to renal failure. However, the impact of COVID-19 on the kidneys was always ignored. People always pay attention to more prominent respiratory symptoms, or cardiovascular symptoms, such as fever, cough, chest tightness, asthma, etc. Until severe edema, a large amount of foam urine, or heart failure, patients or medical staff may accidentally find that the kidney has been damaged.

AKI is a common complication in patients hospitalized with COVID-19. AKI can occur both in patients with and without a previous history of kidney disease, but it has a higher incidence in critical patients.<sup>2</sup> Once COVID-19 patients are combined with AKI at the same time, their poor prognosis and mortality are significantly



**FIGURE 1** Trend of patient's serum creatinine over 10 years. This patient experienced a 10-year history of chronic kidney disease and had ever been cured in 2019. After the novel coronavirus infection on 20th December 2022, the patient's Scr increased rapidly from 393 to 922  $\mu\text{mol/L}$ .



**FIGURE 2** Hair changes before and after the novel coronavirus infection. (A) Selfie in the spring of 2022. The patient was not infected with the virus at the time and was in a good mood. (B) Selfie in January 2023. The patient quickly lost his hair after contracting the virus and was in a bad mood. (C) Selfie after 2 months of COVID-19 infection. The hair began to grow sparsely. (D) Selfie after 8 months of COVID-19 infection. The hair gradually grew dense.

increased.<sup>3</sup> Chan et al. reported that the mortality rate of COVID-19 patients with AKI was as high as 93.27%.<sup>4</sup> How does COVID-19 affect the kidneys? Why does the death rate of patients infected with COVID-19 increase significantly after kidney damage? Maybe the following factors could be considered. Firstly, the virus may directly infect and influence the kidney. Studies indicate SARS-CoV-2 uses the human angiotensin-converting enzyme 2 (ACE2) as a receptor to enter the cells,<sup>5</sup> which is expressed in proximal renal tubular cells and podocytes.<sup>6,7</sup> An autopsy analysis of 26 Chinese patients with COVID-19 revealed the presence of coronavirus particles within proximal tubular cells and podocytes, exhibiting diffuse acute proximal tubular injury and occasional vacuolation of podocytes.<sup>8</sup> In a meta-analysis of 11 studies, the urinary RNA-positive rate of SARS-CoV-2 virus in 195 COVID-19 patients was 5.74%. Additionally, SARS-CoV-2 viral particles were also detected in the serum samples of patients. Therefore, it is widely believed that SARS-CoV-2 may directly infect kidney tissues. Also, Wang and Kosugi discovered SARS-CoV-2 utilize CD147, which is highly expressed in the kidneys, as a cell surface receptor to enter the target cells.<sup>9,10</sup> As to AKI and higher lethality, sepsis is considered as the major cause of AKI occurrence in critical COVID-19 patients. Up to 20% of severe COVID-19 patients develop viral sepsis and acute respiratory distress syndrome (ARDS), with quite a high mortality. Numerous studies have confirmed that sepsis, hypoxia, and severe inflammatory response can lead to the development of AKI. This excessive inflammation is closely associated with cytokine release syndrome (CRS), which leads to an increased immune response and vascular permeability in the kidneys. The occurrence of CRS is frequently detected in COVID-19 patients, especially when IL-6 levels are elevated.<sup>11,12</sup> ARDS and its associated hypoxemia, inflammation, and mechanical ventilation both lead to changes in renal hemodynamics and deterioration of function. Annat et al. found that continuous positive pressure ventilation could reduce renal blood flow, glomerular filtration rate, and urine volume, potentially leading to AKI.<sup>13</sup>

In addition to kidney involvement, the hair changes and skin improvement in this patient are also worthy of further discussed.

Telogen effluvium is a disease characterized by extensive hair loss without scarring. It differs from normal club alopecia and can affect men and women, with a higher incidence in women. The pathophysiological mechanism of telogen alopecia involves various factors. Acute telogen alopecia (ATE) is defined as hair loss lasting less than 6 months. When more than 100 hairs are lost every 5 days, it is considered an acute rest-stop loss. Ninety-five percent of ATE can usually be self-healing, manifesting by the regeneration of forehead hair, which can be observed by dermoscopy. A prospective cohort study demonstrated that ATE after severe coronavirus infection is a foreseeable complication directly related to the disease.<sup>14</sup> Hair pain may be part of the inflammatory state in COVID-19 patients, and the latter may be the main cause of ATE.

Verruca vulgaris is a benign skin vegetation caused by HPV. In this case, the patient has suffered from verruca vulgaris for many years. He had repeatedly visited the dermatology department and accepted cryotherapy, intralional injection, and laser treatment, but

the curative effect was unsatisfied. Interestingly, about 3 weeks after the COVID-19 infection, the verruca vulgaris healed naturally. It is not clear whether this is a coincidence or relation with COVID-19. The following clinical reports and mechanism studies may help to understand the impact of COVID-19 on verruca vulgaris. Erkayman et al. reported a case of multiple refractory viral warts that resolved during COVID-19 infection but recurred 3 months later.<sup>15</sup> Saadeh et al. speculated that systemic activation of plasmacytoid dendritic cells produces type I interferons, which triggers resolution of warts.<sup>16</sup> Płaszczyńska et al. reported a case of regression of verruca vulgaris after receiving a ChAdOx1-S COVID-19 vaccine (AstraZeneca).<sup>17</sup> Indeed, it has been found that some vaccines (mumps, measles, rubella vaccine BCG) can be used to treat warts vulgaris.<sup>18</sup> Moscato et al. reported verruca vulgaris was cured after vaccination with the quadrivalent HPV vaccine. Studies have found that this may be related to the downregulation of IL-10 and the up-regulation of IL-1 and IFN- $\gamma$  levels.<sup>19</sup>

Since the course and prognosis of different subtypes of novel coronavirus are quite different, it is better to speculate the possible subtype of the virus according to the clinical detection results or epidemiological information. Therefore, we reviewed the literature and found that from October to the end of December 2022, all the viruses detected in the collected samples were BA.5.2 variant strains, and no other types of strains were found.<sup>20</sup> Since 1st December 2022, the whole genome sequencing of 1142 cases has been completed nationwide. The genome sequencing suggests that BA.5.2 and BF.7 are the absolute dominant strains in the national epidemic. So far, there has been no report of specific viral subtypes with specific pathogenicity for similar cases. Secondly, the patient did not receive antiviral treatment or other drug treatment after being infected with COVID-19, but just had a rest. Therefore, the possibility that the drug could lead to the complexity of his condition was also ruled out.

## 4 | CONCLUSIONS

This may be the first case of a CKD patient with rapid loss of renal function, alopecia, and self-healing of verruca vulgaris. Although the impact of SARS-CoV-2 on humans has already been declining, research will never stop and should not be stopped. That's why we report here.

The mechanisms of inflammation and immune activation caused by COVID-19 still need to be studied more deeply. From the diagnosis and treatment process of this case, we can see both the danger of COVID-19 causing multiple organ damage and the possibility of its curing verruca vulgaris. As the saying goes, the devil's evil may also hide some goodness. It is hoped that scientists can pay full attention to this point, eliminate the evil of COVID-19, and discover its beneficial effects.

## AUTHOR CONTRIBUTIONS

Qishun Wu: mainly writing, picture, revision; Fei Gao, Tao Zhang: assembly and editing process; Shixi Zhang, Yun Bai, Bei Zhu, Lulu Guo,

Zhenzhu Yong: data collection, draft; Weihong Zhao: evaluation and analysis; Xiaohua Pei: idealizer, revision, and supervisor.

## ACKNOWLEDGMENTS

We are very grateful for the cooperation of the patient and his family members. Their collaboration played a crucial role in conducting this study.

## FUNDING INFORMATION

National Natural Science Foundation of China (82171585, 81970638); Jiangsu Province Medical Talents Program (ZDRCA2016021, QNRC2016592).

## CONFLICT OF INTEREST STATEMENT

All the authors agree on the final text and declare that there is no conflict of interest in this study.

## CONSENT FOR PUBLICATION

The patient in this manuscript has given written informed consent to the publication. The ethics committee of the First Affiliated Hospital of Nanjing Medical University approved the study (2023-QT-08).

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**How to cite this article:** Wu Q, Gao F, Zhang T, et al. A case of chronic kidney disease patient with rapid deterioration of renal function, hair loss, and spontaneous resolution of facial warts after COVID-19 infection. *Aging Med.* 2024;7:131-135. doi:10.1002/agm2.12281