Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

19, from different centers, and found images similar to those reported in the literature (Figure 1a, e, f, and i). Consultation among renal pathologists, electron microscopists, and virologists led to the conclusion that the intracellular structures represented clathrin-coated vesicles and microvesicular bodies, whereas the extracellular structures represented extruded microvesicles from microvesicular bodies and degenerate microvilli (Figure 1c, d, and h). Examination of biopsies taken in 2019, preceding the emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), revealed identical structures (Figure 1b, g, and j). Microvesicular bodies and clathrin-coated vesicles are both part of the endosomal pathway. Microvesicular bodies may fuse with lysosomes and autophagosomes, leading to variable appearances. Clathrin-coated vesicles arise from clathrin-coated pits; their clathrin coat resembles a crown on electron microscopy. Electron microscopy has an important role to play in elucidating the pathogenesis of COVID-19, along with identification of viral RNA or proteins, but images need to show features that are clearly distinct from viral look-a-like subcellular structures.

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Am I a coronavirus?

To the editor: The paper by Su *et al.* analyzes renal pathologic findings in the kidneys of 26 patients that underwent postmortem exam to understand the anatomic basis of kidney disease in the setting of fatal coronavirus disease 2019 (COVID-19).[1] The authors report the finding of viral particles in the kidney of COVID-19 patients and speculate that direct infection of the kidney by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus causes kidney disease.

Several findings within the manuscript by Su *et al.*[1] are presented as definite evidence of specific disease processes without considering alternative explanations. For example, acute tubular injury is reported in all cases, including in patients with normal renal function. Discerning acute tubular injury from postmortem changes is notoriously problematic, as autolysis can mimic and mask acute tubular injury.[2] Infiltration of inflammatory cells in an arcuate artery is highlighted in a micrograph in which characteristic features of muscular arteries, such as elastic lamina or defined muscular layers, are not apparent (Figure 1d in Su *et al.*[1]). Distension of small blood vessels by red blood cells is referred to as obstruction, when it may simply represent congestion. Isolated fibrin clots are interpreted as evidence of severe endothelial injury but could also be due to coagulopathy. Most importantly, small vesicular structures identified by electron microscopy are described as viral particles without consideration of other interpretations.

Cells have organelles that can mimic the structure of viral particles, and accurate interpretation of electron micrographs requires integration of morphology and biology. The virus inside renal tubular epithelial cells and podocytes that Su *et al.*[1] describe is shown as free particles in the cytoplasm, and not within membrane-bound organelles as would be expected for coronavirus based on *in vitro* studies and the rare examples of *in vivo* coronavirus infections reported prior to the current pandemic.[3–5] There is no explanation for why the virus seen by Su *et al.*[1] breaks this paradigm, which raises important questions about their interpretation of the micrographs. Cells have many structures comparable in size to the coronavirus, with varying degrees of electron-dense material surrounding and inside these structures. Notable examples include coated vesicles that are responsible for moving cargo into cells and between membrane-bound organelles (e.g., clathrin-coated vesicles and coatamer-coated vesicles).

To support their interpretation of the electron micrographs, Su *et al.*[1] present immunofluorescence studies performed on sections of formalin-fixed and paraffin-embedded tissue. The distribution and quality of the positive anti-nucleocapsid protein staining bears striking resemblance to lipofuscin autofluorescence.[6] Controls were reported to stain as expected, but no images of the controls

are provided, nor is there an explanation of what was used as positive and negative controls to validate this antibody for formalin-fixed and paraffin-embedded tissue.

Therefore, in our judgment, Su and colleagues'[1] findings of small vesicular structures that are not conclusively distinguished from cellular vesicles and immunostaining that resembles lipofuscin autofluorescence without adequate controls are not sufficient to establish definitive infection of renal tubular epithelial cells and podocytes by the SARS-CoV-2. More rigorous and definitive studies are required to answer this question. SARS-CoV-2 may in fact infect the kidney and contribute to kidney disease in COVID-19 patients, but this remains an open question in search of an answer.

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Cyclosporine as a preferred calcineurin inhibitor in renal allograft recipients with COVID-19 infection

To the editor: *Kidney International* recently published 2 series of renal allograft recipients with coronavirus disease 2019 (COVID-19) infection including different approaches to maintenance immunosuppression. Although Alberici *et al.*[1] report withdrawal of baseline immunosuppression in 20 patients with COVID-19 pneumonia and mainly continuation with methylprednisolone, Banerjee *et al.*[2] pursued more-gentle reduction of immunosuppression with mainly discontinuation of the antimetabolite in 7 patients with COVID-19 infections of varying severity. However, in 2 of the 7 patients, the calcineurin inhibitor tacrolimus was additionally stopped because of severe respiratory distress syndrome. The corresponding editorial[3] suggests switching to the calcineurin inhibitor cyclosporine as a possible further approach for future exploration, as *in vitro* data report suppression of viral replication for various coronaviruses at noncytotoxic concentrations regardless of immunosuppressive effects of cyclosporine.[4] In line with this suggestion, we report the first renal allograft recipient converted to cyclosporine during COVID-19 infection. The 45-year-old male had been transplanted 16 years ago. His immunosuppression consisted of only the antimetabolite mycophenolate mofetil. On admission, the patient presented with typical symptoms of COVID-19 pneumonia including fever, cough, dyspnea, and crazy paving pattern in computed tomography scan. The main characteristics are summarized in Table 1. The therapeutic regimen consisted of withdrawal of the antimetabolite, conversion to low-dose steroid, and introduction of low-dose cyclosporine, azithromycin, and hydroxychloroquine. He required mechanical ventilation for 4 days until his general condition improved significantly, and he was able to be discharged

Table 1 | (According to Banerjee *et al.*[2]): clinical characteristics, outcome, and blood parameters of first kidney transplant patient converted to cyclosporine during COVID-19 infection

Patient	Age/ sex	Tx date	Comorbidities	Respiratory and renal involvement	Baseline creatinine (eGFR ml/min per 1.73 m^2)	Baseline immunosuppression and treatment	ACEI or ARB	Outcome
1	45 yr/M	2004	HT/ hypercholisterinemia	Yes, ARDS + AKI (without need for RRT)	124–141 (51–59)	MMF MMF stopped and switch to CyA/Pred	No	Discharged from ITU, now at home, full recovery

Cont. with patient	White cell count ($\times 10^9$ /l) (3.9–9.8)	Lymphocyte count ($\times 10^9$ /l) (1.1–3.2)	Serum CRP (mg/l) (<5)	Serum ferritin (μg/l) (30–400)	Serum D dimer (μg/l) (0–500)	Serum LDH (U/l) (<249)	Serum troponin T (ng/l) (<14)
1	7.4 (D1)	1.18 (D4)	18 (D1), 289 (D8)	2563 (D9)	600 (D2), 8800 (D10)	346 (D2), 634 (D9)	<13

ACEI, angiotensin-converting enzyme inhibitor; AKI, acute kidney injury; ARB, angiotensin receptor blocker; ARDS, acute respiratory distress syndrome; Cont., continued; COVID-19, coronavirus disease 2019; CRP, C-reactive protein; CyA, cyclosporine A; D, day after admission; D1, day of admission; eGFR, estimated glomerular filtration rate; HT, hypertension; ITU, intensive therapy unit; LDH, lactate dehydrogenase; M, male; MMF, mycophenolate mofetil; Pred, prednisolone; RRT, renal replacement therapy; Tx, treatment.