Background and Aims: Patients on HD are known to have many various adverse events associated with past COVID-19. In this cross-sectional study, we assessed the incidence of vascular access (VA) dysfunction (primary end point) and probability of successful reconstruction of preexisting permanent VA (AVF/AVG) in a case of dysfunction (secondary end point) within two months after discharge from COVID hospital.

Method: Data were obtained from Moscow region COVID-19 register database. The study includes the results of treatment of 1386 HD patients who were admitted to hospital with suspected or confirmed COVID-19 between February 2020 and November 2021. All COVID-19 positive patients were hospitalized regardless of disease severity to prevent further spread of the infection in dialysis units. The main analysis included 934 patients with known sustainable VA: AVF (N = 804, 86.3%), AVG (N = 54, 5.8%) or CVC (N = 74, 7.9%). Median duration of HD was 34 (IQR 21–69) months (from 6 to 98).

Figure: Weighted hazard ratios of all-cause hospitalization and death associated with first-line AV graft (reference: AV fistula).

Weights correspond to the patient’s inverse probability of first-line AV graft. This probability was modeled with a logistic regression. Predictors included age, sex, incident year, primary kidney disease, diabetes, heart failure, peripheral artery disease, coronary heart disease, dysrhythmias, active malignancy, respiratory disease, liver disease, and behavior disorders, walking ability, body mass index, kidney transplant waitlist status, and timing of AV access creation.

**FIGURE 1:** Need for intervention in recovered after COVID-19 HD patients with AVF (left) and AVG (right).
RESULTS: Hospital mortality among HD patients was 32.3%. The AVF/AVG/CVC ratio in recovered (N = 632) and deceased (N = 302) patients was 89.2%/5.7%/5% and 80.1%/6%/13.9%, respectively. HD via CVC was associated with an increased risk of death: RR = 1.877 (95% CI 1.472–2.302); P < 0.0001.

Most of the recovered patients with AVFs (Figure 1, left) and AVGs (Figure 1, right) needed interventions due the VA dysfunction. Even if AVF patency was successfully restored, it led to the reduction of its functional segment. In contrast, most of the recovered patients with CVCs did not receive interventions for VA dysfunction (Figure 2).

Thus, only 45.4% (287 of 632) of recovered patients did not receive interventions for VA dysfunction; the rest 54.6% showed dysfunction of VA. 23.6% (149) of patients received AVF/AVG reconstruction and retained function of the preexisting VA. In 15.3% (N = 97) patients, AVF/AVG function was completely lost and a new AVF/AVG was created. Conversion from functional AVF/AVG into CVC was performed in 14.1% (N = 89) patients. Thus, the incidence of complete loss of preexisting permanent VA function was 29.4% (N = 186).

Conversion into better vascular access was performed in only 1.7% (N = 11) patients: conversion from AVG into AVF or from CVC into AVF/AVG.

Among patients who underwent successful reconstruction of preexisting AVF, the probability of successful restore of its function within the first month was 55.3% (95% CI 48.3–62.2), during the second month—only 31.1% (95% CI 22.9–40.4). For AVG, the probability of maintaining of existing access during the first and second months was 23.8% (95% CI 9.3–45.2) and 18.2% (95% CI 3.2–48.3), respectively. Thus, reconstruction of permanent VA within the second month after discharge from COVID hospital increases the risk of complete loss of its function: RR = 1.469 (95% CI 1.22–1.762). Only 6.6% (N = 37) of patients received AVF/AVG reconstruction in COVID hospital.

Compared with 2019, in 2021 the rate of reconstructive surgeries in the Moscow region decreased from 2.771 (95% CI 2.426–3.15) to 1.375 (95% CI 1.114–1.68) per 10 patient-years (only prevalent HD patients; P < 0.0001). The number of tertiary care centers for VA creation and maintaining in the region decreased from eight to five during the pandemic.

At the same time, the rate of CVC implantations increased (outside of COVID hospitals) from 1.498 (95% CI 1.248–1.784) to 2.908 (95% CI 2.522–3.337) per 10 patient-years; P < 0.0001.

CONCLUSION: COVID-19 is associated with high incidence of VA dysfunction and complete loss of VA function. The delay in reconstruction of existing VA significantly increases the risk of its loss. This may be caused by a decrease in the number of reconstructive VA surgeries due to reducing the number of specialized centers and personnel. As a result, we observe an increase in CVC usage. Thus, over the next few years, we can expect increased prevalence of central vein stenoses and deterioration of treatment outcomes of HD patients.

FIGURE 2: Need for intervention in recovered patients with CVC.