

Cardiac Decompensation after Dilatation of an Arteriovenous Fistula Stenosis: A Case Report

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Abstract

The arteriovenous fistula (AVF) has been considered for several decades as the preferred approach for hemodialysis because of its longevity and its lower morbidity and mortality rate. However, it can be the cause of several infectious and especially cardiovascular complications. Stenosis is the most common complication of AVF. It is favored by several hemodynamic, cellular and mechanical factors. Reduced dialysis performance and thrombosis are the main risks associated with stenosis. Intervention for dilation is indicated in the presence of any pre-thrombotic stenosis or stenosis that alters the quality of dialysis. However, in patients with heart disease, an assessment of the risk of decompensation is mandatory before considering any gesture of dilation of a fistula. We report a case of acute cardiac decompensation in an 85-year-old patient with severe but stable dilated cardiomyopathy after dilatation of an AVF stenosis. This observation shows that particular attention should be given to elderly subjects with AVF stenosis, especially in the presence of underlying heart disease where closure of the AVF with placement of a tunneled catheter is an alternative that should always be discussed.

Keywords

Arteriovenous Fistula Stenosis, Hyperflow, Hemodialysis, Cardiotoxic

1. Introduction

Native arteriovenous fistula (AVF) is the vascular access of choice for chronic hemodialysis patients due to the lower incidence of complications. The latter, numerous and varied, are associated with an increase in the morbidity and mortality of patients and are dominated by stenosis, which is most often late [1].

Cardiovascular comorbidities whose common ultimate course is heart failure are frequent and of multifactorial origin in hemodialysis [2]. Heart failure impacts approximately 20% of dialysis patients [3]. Thus, a stenosis of the AVF can in these situations be a protective factor of a borderline cardiac state.

We report a case of acute decompensation in a patient with severe but stable dilated cardiomyopathy after dilatation of an AVF stenosis.

2. Presentation of the Clinical Case

This was an 85-year-old patient, on chronic hemodialysis for 4 years on a left humero-cephalic arteriovenous fistula (AVF) made in 2013 complicated by several dilated stenoses whose initial nephropathy is nephroangiosclerosis. As a history, she was a carrier of hypokinetic, hypertensive, diabetic hypertrophic cardiomyopathy (HCM) with obliterating arteriopathy of the lower limbs. She had been complaining for several sessions of general fatigue and asthenia. She was anuric, her dry weight was 38 kg with a BMI of 15.41. Examination of the fistula noted a dilation of the venous segment over 8 cm which did not collapse during the maneuver of raising the arm with a flat downstream segment. The weekly Kt/Vsp was at 2.9, the recirculation rate at 70%, the average arterial and venous pressures of the previous week of the machine were respectively at 230 and 310 mmHg for a blood flow of 250 ml/min. Heart sounds were muffled, regular without a breath. Ultrasound of the AVF found an average flow over 3 measurements at 250 ml/min with a downstream stenosis 10 cm from the anastomosis. Cardiac ultrasound noted hypokinetic HCM with left ventricular ejection fraction (LVEF) at 36%. Fistulography confirmed significant pre-thrombotic AVF stenosis (**Figure 1**) and the patient underwent successful angioplasty with a control flow rate of 490 ml/min (**Figure 2**). Six days after the operation, the patient presented to the emergency room for acute dyspnea without orthopnea. On examination, blood pressure was 99/64 mmHg, heart sounds were heard, regular with basal crackles at both lung bases. The electrocardiogram was sinus with known left bundle branch block with no sign of ischemia. At the paraclinic, NT-pro-BNP at 79,000 pg/ml and troponin I at 3335 then 3219 ng/l 4 hours later. Cardiac ultrasound showed an LVEF at 20%, a dry pericardium and a thin inferior vena cava that was not very compliant. The diagnosis of cardiac decompensation was retained and the patient managed in CICU for 24 hours with oxygen therapy, controlled increase in volume depletion on dialysis and coronary angiography indicated remotely. The evolution was stationary with a slight improvement in dyspnea with always a background of shortness of breath. A tunneled catheter was inserted 5 days later (**Figure 3**), the AVF definitively closed the day after the installation and the patient was switched to 4 sessions of 3 hours of weekly dialysis for better hemodynamic tolerance in the face of repeated intradialytic hypotension. NT-pro-BNP was at 90,104 pg/ml and troponin at 150 ng/l. A week later the patient is brought to the emergency room with a picture of cardiovascular collapse. Despite resuscitation, the patient died of cardio-respiratory arrest.



Figure 1. Tight stenosis of the draining vein (cephalic vein) of the humerocephalic fistula.



Figure 2. Result post dilation of the stenosis of the cephalic vein.



Figure 3. Chest x-ray showing the tunneled right jugular catheter in good position, cardiomegaly with cardio-thoracic index at 0.68 and moderately abundant right pleural fluid effusion. We should also note the presence in the left subclavian of a mesh stent, a witness to a previous operation.

3. Discussion

Native AVF is the vascular approach of choice for chronic hemodialysis because it is associated with a lower risk of complications and mortality [4]. Stenosis is the most common cause of AVF dysfunction. Its pathophysiology is complex including hemodynamic factors such as turbulence and blood friction at the vascular wall; cellular factors such as the activation of the endothelial cell and the production of pro-inflammatory mediators as well as the repeated aggression of the vascular wall [5] [6]. These different elements contribute to the development of two intricate stenosing histological phenomena, namely myointimal hyperplasia and fibrosis. Due to its high frequency, a well-codified strategy is necessary for appropriate monitoring. Different cumulative tools such as the clinical examination before each connection, the Kt/V, the bleeding time, the recirculation rate as well as the measurement of the flow rate of the vascular access can allow an early diagnosis. Initial physical examination by an experienced practitioner is a simple and effective way to monitor an AVF [7]. A study has shown that an experienced dialysis nurse can predict stenosis on physical examination with 80% accuracy. In our patient, the diagnosis was suggested on clinical examination in the presence of dilation not reducible to the arm lift maneuver with flattening of the downstream segment, a low weekly Kt/V and significant recirculation before ultrasound confirmation.

Most stenoses develop on the venous side away from the anastomosis. A French case series reported a 62% prevalence of distant anastomosis stenosis [8]. In our patient, the stenosis was located 10 cm from the anastomosis.

The recommendations recommend treating stenosis as soon as the flow rate prevents effective dialysis and the degree of stenosis determines the urgency of treatment in order to avoid thrombosis. For stenoses at a distance from the anastomosis, endovascular treatment is preferred to surgery because it saves the length of the vein and avoids the cumbersomeness of surgery [7]. An endovascular treatment was performed in our patient with a satisfactory result allowing to double the flow of the AVF.

As in our case, heart failure is a comorbidity very often found in dialysis patients with approximately 1/3 of deaths in this population attributable to cardiovascular disease [9]. The presence of an AVF with its currently well-described hemodynamic effects constitutes an important risk factor for deterioration of cardiac function in these patients. Heart failure may remain stable or progress insidiously over the years or may decompensate shortly after AVF surgery. This is what was observed in our patient who, despite the fact that her heart failure was stable, a minimal increase in the flow of her fistula to avoid thrombosis was the trigger for a decompensation of her heart disease. From this observation we draw the reminder of the need to always do, especially in the elderly and carriers of heart disease, the balance of a benefit of saving the fistula compared to the risk of degrading the precarious cardiac state of the patient. In some cases AVF ligation followed by placement of a tunneled catheter would be a better option.

The harmful effects of the AVF regress after closure of the latter [2]. Our patient had a significant improvement in her dyspnea immediately after the ligation of her AVF. However, the symptomatic rebound a few days later led to his death. The shorter time to AVF closure could have improved the patient's prognosis.

4. Conclusion

Stenosis is the most common complication of AVF, therefore requiring close monitoring of the approach. Early diagnosis and management can prevent progression to thrombosis. However, special attention should be paid to elderly subjects with AVF stenosis, especially in the presence of underlying heart disease. In these cases, the risk of decompensation of the heart disease must always be taken into account before intervening on the AVF because certain stenoses are protective and their dilation can lead to a decompensation of the underlying heart disease.

Conflicts of Interest

The authors declare that there is no conflict of interest.

Patient Consent

Informed consent for the case to be published was provided by the patient's daughter.

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