

## Pericardial Effusion Secondary to Central Vein Stenosis in A Chronic Kidney Disease Patient on Maintenance Hemodialysis

Vandana Admane<sup>1</sup>, Vishal Ramteke<sup>2</sup>, Piyush Kimmatkar<sup>2</sup>, Shyam Meda<sup>3</sup>, Charulata Bawankule<sup>4</sup>

### ABSTRACT

Central vein stenosis is a common complication seen in chronic kidney disease (CKD) patients with previous central vein catheterization for hemodialysis, which can manifest as swollen fistula arm, difficulty in AV fistula cannulation & ipsilateral pleural effusion. However, pericardial effusion attributable to central venous stenosis is extremely rare. We report a case of young male with CKD on maintenance hemodialysis (MHD) with previous subclavian vein catheterization who presented with central vein stenosis & massive pericardial effusion which was managed with pericardiocentesis & venoplasty.

**Key Words :** Central venous stenosis, Chronic Kidney Disease, Pericardial effusion, Venoplasty

### Introduction :

Chronic Kidney Disease stage 5 patients who are initiated on hemodialysis often do not have AV fistula constructed & require placement of temporary or tunneled hemodialysis catheters. Placement of a central vein catheter for dialysis access substantially increases the risk of central vein stenosis which jeopardizes arteriovenous fistula & arteriovenous graft access points<sup>1</sup>. Repeated trauma & inflammation due to catheter lead to the development of micro thrombi, intimal hyperplasia & fibrosis leading to subsequent stenosis<sup>2</sup>. We report a case of a young male on MHD patient who presented with chest discomfort, breathlessness on rest, swelling over right fistula arm, who on evaluation was found to have massive pericardial effusion & near-total stenosis of his right subclavian vein attributable to subclavian vein catheterization 6 months back, which was managed successfully with minimally invasive interventional treatment.

### Case Report :

A 24 year old male patient diagnosed with CKD stage 5, was on MHD since 3 months. Patient was admitted to Government Medical College & Hospital with acute shortness of breath with central chest discomfort since fifteen days. Over the last one and half months, he had noticed progressively increasing swelling of right fistula arm and recent onset orthopnea. He was diagnosed to have CKD stage 5 (Chronic glomerulonephritis) in December 2016 and was initiated on hemodialysis via temporary non cuffed double lumen catheter inserted in right subclavian vein at another center. He had this indwelling catheter for about 6 weeks' duration, while his right radiocephalic arteriovenous fistula was about to mature for cannulation. His subclavian catheter was subsequently removed and he continued to be on maintenance hemodialysis twice a week at the other center with no inter or intradialytic complications.

On examination the patient was in respiratory distress. He was afebrile with a left radial pulse 120/min regular, blood pressure in left arm sitting position of 160/100 mm Hg . He had a respiratory rate of 30/min with use of accessory muscles of respiration. There was no puffiness of the face & had no pitting pedal oedema. The right upper limb was grossly swollen with pitting edema extending up to the chest wall. The thrill and bruit over the radiocephalic AV fistula was well felt and could be elicited over the draining of veins (**Figure 1**). No

<sup>1</sup>Assistant Professor, Department of Medicine,

<sup>2</sup>Assistant Professor, Department of Nephrology,

<sup>3</sup>Junior Resident, Department of Medicine,

<sup>4</sup>Professor and Head, Dept. of Nephrology, Government Medical College & Superspeciality Hospital, Nagpur

#### Address for Correspondence -

Dr. Vandana Admane

E-mail : vandanaadmane76@gmail.com

Received on 20th December 2019

Accepted on 28th December 2019



**Figure 1 : Chest X-Ray showing cardiomegaly**

dilated superficial veins over the limb or chest wall were noted. Jugular venous pulse was raised. Cardiovascular examination showed muffled heart sounds with no pericardial rub. Respiratory examination was suggestive of decreased breath sound over right base. Abdominal and central nervous system exam was normal. Provisional diagnosis following evaluation was right subclavian stenosis with venous edema with pericardial effusion and right sided pleural effusion in a case of CKD stage 5 on MHD.

Laboratory investigations revealed Hemoglobin of 7.5g/dl; with normal WBC and platelet count. His kidney function test showed BUN of 76 mg/dl, serum creatinine 4.6 mg/dl, sodium 138 & potassium 4.1 Meq/l, with normal liver function tests. He was seronegative for HIV, HBV, HCV. ECG showed low voltage complexes with sinus tachycardia. Chest X-ray indicated right sided effusion with huge cardiomegaly (**Figure 2**). His emergency echocardiography showed LVEF of 65%, pericardial effusion of 2.1cm inferiorly & 2.6 cm laterally, no right atrium (RA) or right ventricle (RV) collapse (**Figure 3**). A right upper limb A-V Doppler sonography showed patent AV fistula & saccular dilation of axillary vein with normal phasic variation, color flow with mixed waveform with probable subclavian stenosis. Urgent cardiology



**Figure 2 : Cross right upper limb edema & comparison left upper limb (normal)**



**Figure 3 : After successful venoplasty swelling decreased within 2 days & swollen right hand appear near similar as left hand**

consult was sought in view of massive pericardial effusion, 2D ECHO guided pigtail catheter insertion & pericardiocentesis was done immediately. About 1200 ml of clear pericardial fluid was drained on day one, followed by 800 ml on next day. The pericardial fluid was sent for laboratory examination which was clear, protein & sugar values were within normal limits, with occasional lymphocytes, Adenosine deaminase (ADA) level was 6 u/ml. Gram staining & The Ziehl-Neelsen (ZN) staining smears showed no organism. The TB PCR was negative. Next day patient was dialysed via temporary non cuffed double lumen catheter inserted in right femoral vein. For confirmation of subclavian vein stenosis CT venogram was done which revealed abrupt cutoff of right subclavian vein just distal to its junction with right internal jugular vein. After Interventional radiology consult patient underwent balloon venoplasty. Complete regression of the limb swelling occurred thereafter.

#### **Discussion :**

As the number of patients who need short term & long-term installation of central venous catheters increases, the occurrence of delayed complications-including hydrothorax, hydromediastinum, and cardiac tamponade is also increasing<sup>3-5</sup>. Insertion of a CVC has been associated with both immediate & long term complications. Catheter malposition, pneumonia & hemothorax are immediate complications usually secondary to the insertion procedure. Late complications are occlusion, thrombosis, sepsis & catheter tip migration.<sup>6</sup> There have been many case reports of CVC tip migration leading to pericardial effusion & cardiac tamponade.<sup>7</sup> Various explanations have been given for the extravascular exudation of fluid. Delayed cardiac tamponade caused by central venous catheterization are found within 24 hours, 12% between 23 hours and 38 hours, 31% between 48 hours and 7 days, and 18% after 7 days<sup>8</sup>, and results from puncturing of the heart and superior vena cava by the terminal tip of the central venous catheter<sup>9,10</sup>. Some authors have hypothesized that hyperosmolar parenteral infusate, high acidity or alkalinity may have contributed to the erosion, e.g., total parenteral

nutrition, antibiotics infusion (vancomycin) & sodium bicarbonate could cause endothelial damage & subsequent increase in vascular permeability leading to an effusion.<sup>11</sup> Hydrothorax is caused by venipuncture of the central venous catheter terminal<sup>9</sup> or its placement in the mediastinum<sup>12</sup>. Symptoms of respiratory distress in our case were found few months later, which was judged as a complication due to delayed blood vessel injury. Simultaneous occurrence of hydrothorax and cardiac tamponade is very rare, and the cause is not clearly understood. Giacoia<sup>8</sup> reported a case of bilateral hydrothorax and cardiac tamponade where the terminal of the catheter was located in the right atrium. Though the cause was not certain, they assumed that the bilateral hydrothorax was caused by fluid possibly flowing out to the mediastinal and both sides of the thorax because of the destruction of the intima due to the catheter or hyperosmotic TPN. In this case report, we assume that the central venous catheter was dislocated, penetrating the blood vessel & placed in the mediastinum, eventually causing the hydrothorax and cardiac tamponade. Phlebitis as a result of the infection could have been postulated to weaken the vessel wall & led to the perforation. Also lymphatic occlusion caused by stenosis / thrombotic occlusion in the superior vena cava or the branched blood vessels could have been contributory. Therefore, in cases where unexplainable cardiorespiratory symptoms including respiratory distress or reduced blood pressure as well as pleural effusion are found in a patient with a central venous catheter installed, proper measures, such as chest radiography for diagnosis, should be taken and the possibility of abnormal catheter location and blood vessel damage should be considered. If abnormal catheter location or loop formation is found, it should be immediately corrected.

#### **Consent :**

Written informed consent was obtained from the patient for publication of this manuscript and accompanying images.

#### **Acknowledgements :**

Dept. of Cardiology, GMC SSH, Nagpur  
Dept. of Interventional Radiology, GMC, Nagpur.

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