

**CHEST RONTGEN FINDINGS IN CHRONIC KIDNEY DISEASE PATIENT WITH  
CONGESTIVE HEART FAILURE: A CASE REPORT**

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**ABSTRACT**

Chronic kidney disease is persistent abnormality or damage in kidney structure or function for more than 3 months. Prevalence of CKD is around 10 – 14% in general population and affects around more than 800 million individuals worldwide. Patients with chronic kidney disease (CKD) have higher risk of cardiovascular disease and synergistic pathological effects can speed up worsening of diseases. Radiology examination is one of the test that can be used to evaluate kidney and heart structural damage. The aim of this paper is to report chest rontgen findings in a man aged 54 years old with CKD with HF in 3 serials imaging result. Patient admitted to hospital caused by shortness of breath. Patient has history of hypertension, diabetes mellitus type 2, CKD stage V, and congestive heart failure. From physical examination, oxygen saturation was 97%, blood pressure was 154/115 mmHg, and extremity edema was found. Chest rontgen impression was bronchitis, dextra pleural effusion, and normal cardiac size. He got oxygen, Furosemide, Nicardipine, Aspirin, Irbesartan, Amlodipine, Calcium carbonate, and hemodialysis as therapies. After be hospitalized 2 days, patient's condition was better, and therapy was continued outpatient. Chest rontgen examination result a year ago showed pulmonary edema, bilateral pleural effusion, and cardiomegaly with shortness of breath as major symptom. Chest rontgen examination result 6 months ago showed bronchopneumonia and cardiomegaly with fever, cough, nausea, and loss of appetite. In conclusion, most of CKD patients particularly in late stage have cardiovascular disease and radiology examination is important to detect and evaluate structural cardiac abnormality in CKD patients.

**Keyword:** *Chest rontgen, chronic kidney disease, congestive heart failure.*

**ABSTRAK**

Penyakit ginjal kronis (PGK) adalah kerusakan atau abnormalitas persisten pada struktur atau fungsi ginjal selama lebih dari 3 bulan. Prevalensi PGK sekitar 10 – 14% pada populasi umum dan dialami oleh sekitar lebih dari 800 juta individu didunia. Penderita Chronic Kidney Disease (CKD) memiliki risiko lebih tinggi untuk mengalami penyakit kardiovaskular dan efek patologis yang sinergis dapat mempercepat perburukan penyakit. Pemeriksaan radiologi merupakan salah satu pemeriksaan yang dapat digunakan untuk mengevaluasi kerusakan

struktur ginjal dan jantung. Tulisan ini bertujuan untuk melaporkan temuan rontgen thorax pada seorang laki-laki berusia 54 tahun dengan PGK dan gagal jantung melalui 3 serial foto. Pasien masuk rumah sakit karena keluhan sesak napas. Pasien memiliki riwayat hipertensi, diabetes melitus tipe 2, Penyakit Ginjal Kronik (PGK) stadium V, dan gagal jantung kongestif. Dari pemeriksaan fisik, didapati saturasi oksigen 97%, tekanan darah 154/115 mmHg, dan edema ekstremitas. Kesan rontgen thorax mengarah pada bronkitis dengan efusi pleura dextra, dan ukuran jantung normal. Pasien mendapat terapi oksigen, Furosemid, Nikardipin, Aspirin, Irbesartan, Amlodipin, Kalsium karbonat, dan hemodialisis. Setelah 2 hari dirawat di rumah sakit, kondisi pasien membaik, dan dilanjutkan dengan terapi rawat jalan. Hasil rontgen thorax satu tahun yang lalu menunjukkan edema paru dengan efusi pleural bilateral dan kardiomegali dengan gejala utama sesak napas. Hasil rontgen thorax 6 bulan yang lalu menunjukkan bronkopneumonia dan kardiomegali dengan gejala berupa demam, batuk, mual, dan kehilangan nafsu makan. Pada kesimpulannya, sebagian besar pasien PJK terutama pada stadium akhir menderita penyakit kardiovaskular dan pemeriksaan radiologi penting untuk mendeteksi serta mengevaluasi abnormalitas struktur jantung pada pasien PJK.

**Kata kunci:** Rontgen thorax, penyakit ginjal kronis, gagal jantung kongestif.

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## INTRODUCTION

Chronic kidney disease (CKD) is persistent abnormality or damage in kidney structure or function for more than 3 months with or without decrease of eGFR (estimated glomerular filtration rate) that can lead to decrease of GFR. Prevalence of CKD is around 10 – 14% in general population and has been reported continue increasing per year.<sup>(1,2)</sup> CKD affects estimated around > 800 million individuals and become one of most common cause of mortality worldwide over the past 2 decades. The etiology of CKD is vary

globally.<sup>(2,3)</sup> This disease is classified into 5 categories and shows no symptoms in early and moderate stage. Late stage of disease shows sign and symptoms like nausea vomiting, edema, confusion, and loss of appetite.<sup>(4)</sup> CKD is a progressive irreversible nephropathies caused by progressive kidney fibrosis and destruction normal kidney architecture.<sup>(2)</sup>

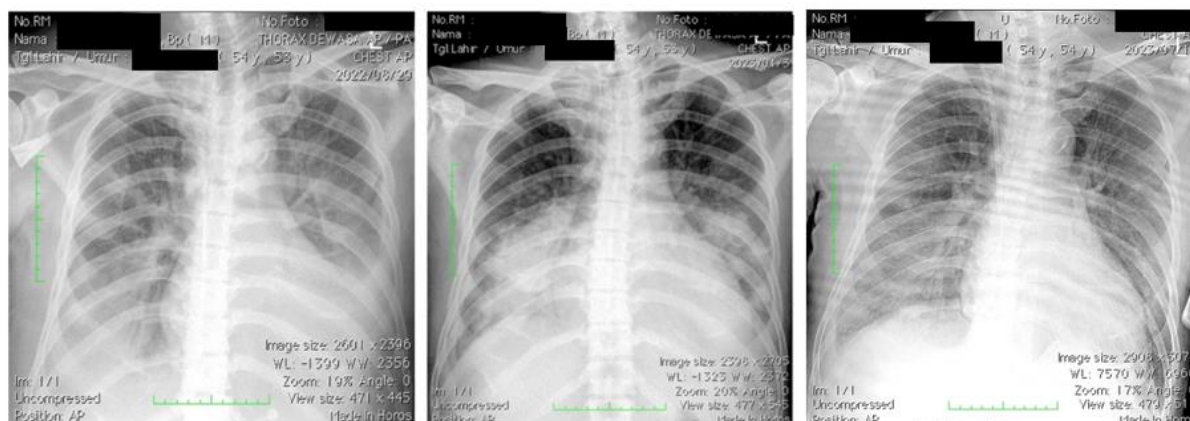
CKD has high prevalence of comorbid conditions such as cardiovascular diseases.<sup>(5)</sup> Patients with CKD have higher risk of cardiovascular disease than in the general population.<sup>(6)</sup> Cardiovascular and

renal diseases share pathogenesis pathway that can trigger one another deterioration.<sup>(7)</sup> Around 17 – 50% patients with CKD have heart failure (HF) and around 50% patients with HF have CKD as one of complication. CKD and HF have same risk factors such as hypertension and diabetes. Both diseases have synergistic effects that speed up the worsening process.<sup>(8)</sup> Radiology examination can be used to detect and evaluate structural damage of renal or heart organ.<sup>(9)</sup> The aim of this paper is to report chest rontgen findings in a man aged 54 years old with CKD with HF in 3 serials imaging result.

#### **CASE REPORT**

A man aged 54 years old admitted to hospital with shortness of breath before got HD (hemodialysis) therapy. Patient has history of hypertension, diabetes mellitus type 2, CKD stage V, and congestive heart failure. He gets HD therapy twice a week. From physical examination, oxygen saturation was 97%, blood pressure was 154/115 mmHg, and extremity edema was found. Low hemoglobin (9,6 g/dL), erythrocytopenia (3,18 milion/mm),

leukocytosis (12,29 thousand/mmk) with segment neutrophilia (82,3%), high blood sugar with POCT (185 mg/dL), very high ureum (265,4 mg/dL), very high creatinin (18,2 mg/dL), dan high kalium (6,19 mmol/L). ECG showed sinus rhythm. Chest rontgen (**Figure 1C**) showed increased bronchovascular pattern with positive air bronchogram, blunting of dextra costofrenicus sinus, and cardiothoracic ratio < 0,5. Radiology test impression was bronchitis, dextra pleural effusion, and normal cor size. Patient was given nasal oxygen 4 liter per minutes, Furosemide injection 100 mg with NaCl 0,9% 50 mL in syringe pump 2 cc per hour, Nicardipine injection 100 mg with NaCl 0,9% 50 mL in syringe pump 4 cc per hour, Aspirin tablet 80 mg once a day, Irbesartan tablet 300 mg once/day, Amlodipine tablet 10 mg once/day, Calcium carbonate capsule 500 mg three times/day, Folic acid tablet 1 mg three times/day, and HD. Patient hospitalized 2 days and the condition was better then therapies were continued outpatient.



**Figure 1.** Chest Rontgen, **A.** A year ago, **B.** 6 months ago, **C.** Latest

Patient was diagnosed with CKD stage V and CHF a year ago because he admitted to hospital with prolonged shortness of breath. From physical examination, blood pressure was 170/90 mmHg, basal wet rhonchi bilateral, and bilateral legs edema were found. He had history of hypertension and diabetes mellitus type 2. From laboratory test, low albumin (3,4 g/L), very high urea (122 mg/dL), very high creatinine (6,1 mg/dL), and estimated glomerular filtration rate (eGFR) 10 ml/min/1.73 m<sup>2</sup> were found. ECG showed sinus rhythm with anteroseptal old myocardial infarct and left ventricle hypertrophy. Chest rontgen (**Figure 1A**) showed bilateral lung opacity with inhomogeneous density, increase of bronchovascular pattern, dense of dextra hilus, blunting of bilateral costofrenicus angle, cardiothoracic ratio > 0,56, and enlarged cardiac configuration. The impression was pulmorary edema with

bilateral pleural effusion and cardiomegaly. Pulmonary edema is more suggestive to cardiogenic.

Six months ago, patient admitted to hospital because fever, cough, nausea, and loss of appetite for 6 days. Patient was desaturated with oxygen saturation 75%, blood pressure 165/98 mmHg, and multiple skin vesicle distributed generalisata. Antigen and PCR Sars-Cov-2 was negative. Chest rontgen (**Figure 1B**) showed inhomogeneous density consolidation in pericardial and perihilus area, increase of bronchovascular pattern, cardiothoracic ratio > 0,5. Radiology impression was bronchopneumonia and cardiomegaly as impression. Patient was diagnosed with bronchopneumonia and varicella zooster.

## DISCUSSION

Chronic kidney disease (CKD) is persistent abnormality or damage in kidney

structure or function for more than 3 months with or without eGFR reduce that can lead to decrease of GFR. The disease criteria include eGFR  $< 60$  mL/min/1.73 m<sup>2</sup>, albuminuria at least 30 mg/24 hours, or kidney damage markers (laboratory or imaging finding test).<sup>(1,2)</sup> CKD is one of most common cause of mortality worldwide over the past 2 decades.<sup>(3)</sup>

Most common primary diseases that lead to CKD are diabetes melitus type 2 (30 – 50%), diabetes mellitus type 1 (3.9%), hypertension (27.2%), primary glomerulonephritis (8.2%), chronic tubulointerstitial nephritis (3.6%), hereditary or cystic diseases (3.1%), secondary glomerulonephritis or vasculitis (2.1%), plasma cell dyscrasias or neoplasm (2.1%), and sickle cell nephropathy ( $< 1\%$ ).<sup>(10)</sup> Pathogenesis of CKD is molecular complex process such as immunologic reactions, tissue hypoxia and ischemic, exogenic agents like drugs, endogenous substances like glucose or paraproteins and others, and genetic defects that lead to kidney sclerosis and fibrosis.<sup>(11)</sup>

Kidney Disease Improving Global Outcomes (KDIGO) classifies CKD into 5 categories based on GFR: G1 with GFR 90 ml/min/1.73 m<sup>2</sup> and above; G2 with GFR 60 - 89 ml/min/1.73 m<sup>2</sup>; G3a with GFR 45 - 59 ml/min/1.73 m<sup>2</sup>; G3b with GFR 30 - 44 ml/min/1.73 m<sup>2</sup>; G4 with GFR 15 - 29 ml/min per 1.73 m<sup>2</sup>; and G5 with GFR  $< 15$

ml/min/1.73 m<sup>2</sup> or treatment by HD.<sup>(2)</sup> Early and moderate (I – III) stage of disease show no symptoms. Late stage of disease (IV – V) shows sign and symptoms like nausea, vomiting, edema, confusion, and loss of appetite.<sup>(4)</sup> Patients that probable have CKD need to be assessed eGFR, protein level in urine, renal imaging, and to know accurate cause of disease, biopsy can be done.<sup>(2)</sup> Therapy CKD stage V is HD and/or renal transplantation. Previous stages therapies are lifestyle modification, comorbid therapy, and nutrition management.<sup>(12)</sup>

Cardiovascular and renal diseases have pathogenesis pathway that can trigger one another deterioration.<sup>(7)</sup> Abnormal cardiac structure and function (such as left ventricular hypertrophy (LVH)) is found in 75% patient with CKD stage V.<sup>(13)</sup> CKD comorbidities can be risk factor to precipitate cardiovascular disease such as hypertension, dyslipidemia, smoking, hyperglycemia, valvular calcification, inflammation, and progressive proteinuria.<sup>(14)</sup> HF precipitates CKD with renal blood flow reduction, renal hemodynamic impairment, and resultant renal ischemic injury. Due to CKD, fluid overload, anaemia, uraemia, excessive renin–angiotensin–aldosterone (RAA) and sympathetic activation cause progressive left ventricular, remodelling, fibrosis, and cardiac dysfunction. CKD and HF have

synergistic effects that can speed up the worsening of both diseases.<sup>(7,8)</sup>

Cardiac imaging provides informative result about cardiac structure and function in patients with CKD.<sup>(15)</sup> Chest rontgen can be used as initial imaging technique to analyze patient symptoms because the modality is simple, cost-efficient, common available, and non-invasive. Most common CKD chest radiology findings are cardiomegaly, pulmonary edema, and pleural effusion, and aortic arch calcification, particularly patients on HD therapy.<sup>(16)</sup> The first of three findings are common found in CHF.<sup>(17)</sup> Chest rontgen has moderate to high specificity (76 – 83%) and lower sensitivity (67 – 68%) to diagnose HF.<sup>(18)</sup> Lower sensitivity is associated to position and gravitation during imaging procedure.<sup>(19)</sup> Echocardiography and MRI are the best choice to evaluate cardiac abnormality.<sup>(13)</sup>

Pulmonary edema with bilateral pleural effusion and cardiomegaly is found in chest rontgen when this patient was diagnosed CKD with CHF. Pulmonary edema is more suggestive to cardiogenic. Pleural effusion and cardiomegaly are usually not seen in non-cardiogenic pulmonary edema.<sup>(20)</sup> Patient's ECG result also showed LVH and support that cardiogenic disease. Cardiomegaly finding in this case is inconsistent. The latest chest

rontgen showed normal cardiac size, previous two imaging results showed cardiomegaly. It may associated with lower sensitivity of this modality. Cardiomegaly in CHF that usually due to LVH is irreversible.<sup>(17)</sup>

This patient suffered bronchopneumonia and varicella zooster 6 months ago. Latest radiology finding showed bronchitis impression. Patients with CKD and/or CHF are more vulnerable to infection. Incidence of pneumonia is 3 times higher in patient with CHF and 1,97 times higher in patient with CKD than general population.<sup>(21,22)</sup> Patient was infected by *Varicella* virus when aged 53 years old which it's not usual. Peak age of varicella zooster incidence is 10 – 19 years old.<sup>(23)</sup> Patients with CHF have natural killer cell dysfunction that the underlying mechanism is unknown and bacterial clearance disruption that caused by increase of alveolar fluid.<sup>(21,24)</sup> CKD affects cell-mediated immune system that disrupt host defense mechanism.<sup>(22)</sup>

## CONCLUSION

CKD is one of most common cause of mortality worldwide. Most of patients with CKD particularly in late stage have cardiovascular disease. Interaction between renal and cardiac synergistic pathological effects can speed up worsening process of both diseases. Radiology test is important

to detect and evaluate cardiac structure abnormality in CKD patients.

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