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PULMONARY EMBOLISM MANAGEMENT , CHALLENGES IN DIAGNOSTIC AND TREATMENT, OF 81-YEAR-OLD MAN IN THE SETTING OF RURAL AREA WITH LIMITED RESOURCES : A CASE REPORT

MANAJEMEN EMBOLI PARU, SEBUAH TANTANGAN DALAM DIAGNOSIS DAN TATALAKSANA PADA SEORANG LAKI-LAKI 81 TAHUN DI DAERAH PEDESAAN DENGAN FASILITAS TERBATAS: SEBUAH LAPORAN KASUS

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ABSTRAK

Latar Belakang: Embolisme paru- adalah keadaan darurat kardiologi dengan tingkat kematian yang tinggi dan sulit didiagnosis. Diagnosis embolisme paru membutuhkan fasilitas laboratorium dan pencitraan canggih yang tidak tersedia secara luas di Indonesia. Kurangnya fasilitas dan ketersediaan farmakologi adalah masalah penting karena dapat menunda pengobatan dan diagnosis embolisme paru dimana akan meningkatkan angka kematian. Laporan kasus ini menggambarkan pasien dengan emboli paru, yang rawat di fasilitas kesehatan terbatas, serta kesulitan dalam diagnosis dan manajemen pasien tersebut. **Ilustrasi Kasus:** Seorang pria berusia 81 tahun datang dengan dyspnea dan hemoptoe. Pemeriksaan fisik menunjukkan takikardia ringan, penurunan saturasi, dan tanda-tanda gagal jantung kanan. Elektrokardiografi (EKG) menunjukkan gelombang S yang mendalam dalam lead I, Q wave di lead III (McGinn-white sign), P pulmonary di lead II, III, aVF, *T-inverted* di lead bawah dan anterior. Diagnosis ditentukan oleh skoring klinis dan EKG. Pasien menunjukkan ketidakstabilan hemodinamik dan dimasukkan sebagai embolisme paru-paru berisiko tinggi, oleh karena itu trombolisis sistemik harus menjadi terapi sasaran untuk pasien ini namun tidak tersedia. Terapi antikoagulan sistemik menggunakan natrium fondaparinux dimulai dan memberikan dukungan hemodinamik. Pasien mengalami shock refraktif meskipun menggunakan dukungan hemodinamika dan meninggal setelah 5 hari dirawat. **Kesimpulan:** Keterbatasan alat diagnostik dan terapi adalah salah satu tantangan terbesar di rumah sakit karena dapat meningkatkan resiko kematian pasien PE. Pembelian modal diagnostik dan terapi farmakologi harus dilakukan di semua rumah sakit di Indonesia untuk memberikan manajemen terbaik bagi pasien.

Kata Kunci: antikoagulan, elektrokardiografi, emboli paru, trombolisis

ABSTRACT

Background: Pulmonary embolism is a cardiology emergency with a high mortality rate that is hard to diagnose for its symptoms. The adequate diagnosis of pulmonary embolism requires advanced laboratory and imaging facilities which are not widely available in Indonesia. The lack of facilities and pharmacological availability is an important problem for the delay of treatment and diagnosis of pulmonary embolism will increase the mortality number. This case reports on a patient with pulmonary embolism, managed in a limited healthcare facility. **Case Illustration:** A-81-year-old Man came with sudden dyspnea and hemoptoe. Physical examination showed mild tachycardia, a drop of blood saturation, and signs of right heart failure. His ECG showed deep S wave in lead I, Q wave in lead III (McGinn-white sign), P pulmonary in lead II, III, aVF, inverted T in inferior and anterior lead. Diagnosis were determined by the clinical score and the ECG pattern. The patient showed hemodynamic instability and was included as a high-risk pulmonary embolism, therefore systemic thrombolysis should be the goal therapy for this patient. Due to the unavailability of systemic thrombolysis, systemic anticoagulant therapy using fondaparinux sodium was initiated and hemodynamic support was given. The patient developed refractory shock despite the usage of the hemodynamic support and died after 5 days of hospitalization. **Conclusion:** The limitation of diagnostic tools and therapy is one of the biggest challenges in rural hospitals for it can increase the mortality rate of PE Patients. The procurement of diagnostic modalities and pharmacology therapies should be carried out in all hospitals in Indonesia to provide the best management for the patient.

Keywords: anticoagulant, electrocardiography, pulmonary embolism, thrombolysis

INTRODUCTION

Pulmonary Embolism is the blood clot in the pulmonary artery that originally comes from venous thrombosis in the lower limb or pelvis that breaks down and travels to the lung and causes blockage in the pulmonary vessel (Ma et al. 2022). Pulmonary embolism mostly happens in patients with predisposing factors for venous thrombosis such as increasing age, prolonged immobilization, chronic obstructive pulmonary disease, history of major surgery, major trauma, previous venous thromboembolic event and malignancy (McLendon et al. 2023).

Pulmonary embolism is the third leading cause of cardiovascular death, but the acknowledgment of symptoms and signs in pulmonary embolism is not widely known (McLendon et al. 2023). There are 100.000 cases of death related to pulmonary embolism in the USA and 544.000 cases of death related to pulmonary embolism in Europe.(Dalen, 2002) Pulmonary embolism mortality rate increased with age in several countries (Barco et al. 2021).

The diagnosis of pulmonary embolism is challenging because the symptoms of pulmonary embolism may mimic other cardiovascular conditions and some patients may appear asymptomatic. Pulmonary embolism must always be considered in patients presenting with dyspnea, chest pain, syncope, and haemoptysis (Duffett et al. 2020). As the signs and symptoms of pulmonary embolism are not specific, imaging becomes an important modality for the diagnosis of pulmonary embolism. Computed tomography pulmonary angiography (CTPA) is the current standard as a diagnostic-tool for pulmonary embolism (Stals et al. 2021).

In rural areas, especially in the eastern part of Indonesia, the diagnosis of pulmonary embolism is challenging due to the limitations of medical facilities. Some areas do not have the imaging facilities nor the laboratory marker examination for pulmonary embolism diagnostic tools. The case report is of the diagnostic challenges and treatment limitations of a-81-year-old man with prolonged dyspnea and refractory shock suspected as pulmonary embolism in Isolated Hospital of East Borneo.

CASE ILLUSTRATION

An 81-year-old man who came to the emergency department with shortness of breath one day before admission and the symptoms worsening several hours before admission. The patient complained that the symptoms happened continuously even when he was at rest. The shortness of breath has been accompanied by a non-productive cough for the past one week and haemoptoe one day before admission. His past medical history was COPD and hypertension with regular usage of fenoterol hydrobromide (SABA) inhalation, bisoprolol 2.5 mg, and amlodipine 5 mg. The patient's daily activities decreased for about 2 months before admission for he was having malaise.

His physical examination showed tachycardia at 120 bpm, the respiratory rate was 28 x/minutes, his initial saturation was 89% room air, and his blood pressure was 110/77 mmHg. His physical examination showed an elevated jugular vein, loud P2 sound, and oedema in his lower extremity. Neither rales nor wheezing was found during the pulmonary examination.

The laboratory examination in the emergency department showed an elevated Leucocyte level of 13.400 /uL, a thrombocyte level was 154.000/uL, a creatinine level was 0.91 mg/dL, and a ureum level was 33.1 mg/dL. His ECG Showed deep s wave in lead I, Q wave in lead III, P pulmonal in lead II, III, aVF, and inverted T in lead II, III, aVF, V1.

We did not check the D-dimer and blood gas examination due to the examination was not available in our hospital. His X-ray showed cardiomegaly, with infiltration in both parts of the lungs.

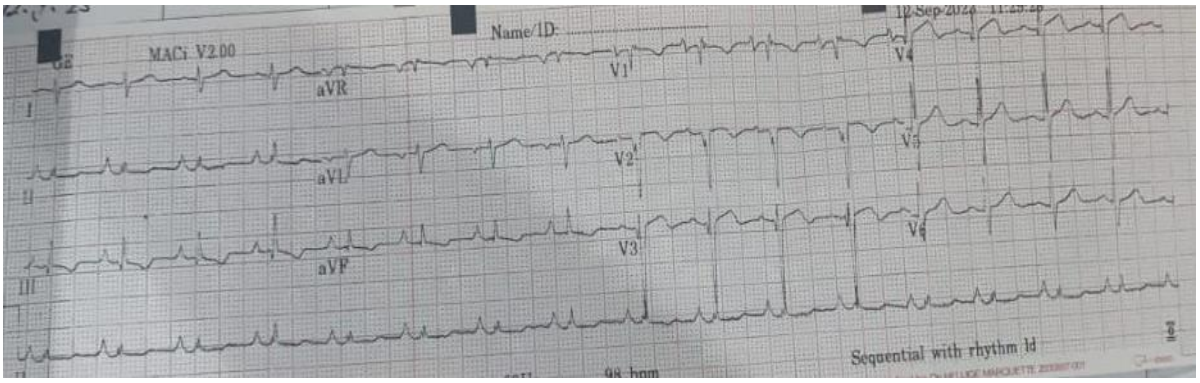

Figure 1.1 The ECG in this patient showed deep S wave in lead I, Q wave in lead III, P pulmonal in lead II, III, aVF, and inverted T in lead II, III, aVF, V1-V2

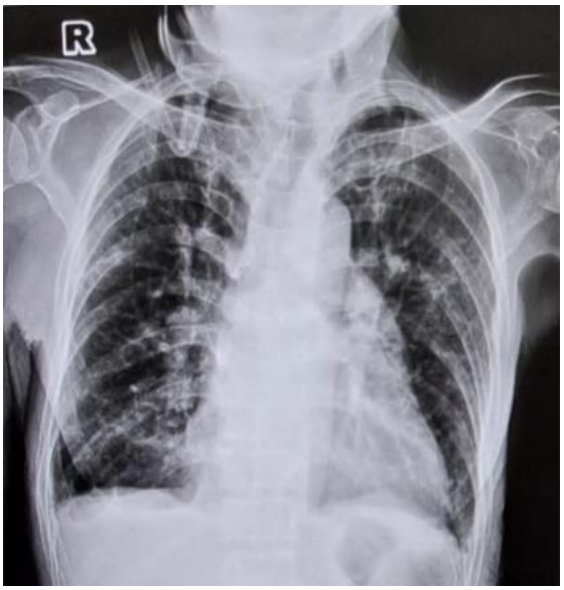

Figure 1.2 Chest X-Ray showed cardiomegaly, with infiltration in both parts of the lungs

In the emergency department, we stabilized the patient by increasing the oxygen saturation using 8 liters/min oxygen with simple mask, administration of intravenous furosemide 20 mg, intravenous ceftriaxone 1 gram, and intravenous ranitidine 50 mg. We diagnosed the patient as suspected pulmonary embolism and needed further examination to confirm the diagnosis. We planned to transfer the patient to another hospital, but the patient and family refused. The patient was admitted into our high care unit (HCU) ward and started the administration of fondaparinux sodium 5 mg subcutaneously.

On the second day of the hospitalization the patient developed shock. His blood pressure dropped to 77/45 mmHg. First, we did the fluid challenge by administrating 1000 cc of crystalloid fluid, but there was no improvement in his condition. Subsequently, we start vasopressin 0.05 iu and dobutamine 5 mcg/kgbb/mnt.

On the fifth day, the patient suddenly developed a loss of consciousness. His GCS score is 8. We adjusted the therapy for the patient by titrating the dose of dobutamine and vasopressin to maximal dose but the shock remained persistent. We did the blood examination and there was increasing in creatinine level to 2.51 and ureum level 124 (eGFR: 23 mL/min/1.73m2). We stop the administration of Fondaparinux sodium because of the acute kidney injury. At 15.30, the patient developed cardiac arrest and the family chose not to resuscitate this patient, the patient was declared dead after the fifth day of hospitalization.

DISCUSSION

Pulmonary embolism is one of the cardiovascular emergencies with high frequency of death worldwide. The mortality rate is 15% after 3 months of diagnosis and increase to 20% in one year (Turetz et al. 2018). Estimated 5-15% of PE patients are at risk of death due to Haemodynamic instability (Barnes et al. 2020). The early diagnosis and initial treatment of Pulmonary embolism is important for 10% of patient with PE die in 2 hours after admission (Bělohlávek et al. 2013).

The study was performed by Medson et al in 2019 shown that dyspnea (61%) is the most common symptoms for ED visit in PE patient accompanied by chest pain (20%), and syncope (3%) (Medson et al. 2022). The clinical symptoms may appear abruptly in the patient and worsening within time. Nevertheless, the diagnosis of pulmonary embolism remain challenging for the symptoms is unclear and require the expert diagnostic tools that is not widely available in all hospital of Indonesia especially in rural area.

The clinical probability score is one of the modalities that can be used to establish the probability of pulmonary embolism in various patient.(Robert-Ebadi *et al.*, 2017)The modified Geneva and Well's rule are the most widely use criteria for clinical probability for PE. (Robert-Ebadi *et al.*, 2017; Duffett, Castellucci and Forgie, 2020) The well's rule divided the patient into 3 categories i.e Low, intermediate and high probability of PE. Patient with low probability of PE will be rule out by using Pulmonary Embolism Rule-out Criteria (PERC) (Robert-Ebadi et al. 2017).

CTPA is the method of choice as imaging tools for establish the diagnosis of Pulmonary embolism (Konstantinides et al. 2020). Trial of PIOPED II showed that CTPA has high sensitivity value of 83% and high specificity value of 96% in diagnosis of Pulmonary embolism.(Moore *et al.*, 2018) CTPA allows the visualization of pulmonary arteries, allowing visualization of the filling defect

within the vessel with acute pulmonary embolism (Zantonelli et al. 2022).

The risk stratification in the acute pulmonary embolism patient is important for that will determine the appropriate therapeutic strategy. The initial risk stratification is made by assessing the clinical symptoms and sign of haemodynamic instability (Konstantinides et al. 2020). Patient with haemodynamic instability included as the high-risk Pulmonary embolism with high mortality rate. Patient without haemodynamic instability will be stratified further using other prognostic tools such as the Clinical Parameter of Pulmonary Embolism Severity index (PESI/sPESI), Imaging, and laboratory test that indicates the right ventricular dysfunction (Konstantinides et al. 2020; Leidi et al. 2022).

Table 1.1 Well's prediction rule for pulmonary embolism(Duffett, Castellucci and Forgie, 2020; Konstantinides *et al.*, 2020)

No	Parameters	Score
1	Previous PE or DVT	1.5
2	Heart rate > 100 bpm	1.5
3	Surgery or immobilization for the past 4 weeks	1.5
4	Haemoptosis	1
5	Active Cancer	1
6	Clinical Sign of DVT	3
7	Alternative diagnosis is likely than PE	3

In this case, the patient came to emergency department presented with unexplained dyspneu and haemoptoe occurred rapidly with history of COPD before and history of immobilization for 3 months. Calculating the patients' clinical probability score and Wells rules score is 7, therefore he is being included as high probability of PE.

Electrocardiogram exam was performed, as ECG is the predominant supporting examination that is widely available for diagnosis of cardiovascular disease even in rural hospitals. Patient's ECG shows the S1Q3T3 or the Mc-Ginn Whiter sign accompanied by the inversion of T wave in the inferior and anterior lead, and right axis deviation (RAD). The S1Q3T3 pattern is the classic sign of pulmonary embolism with specify of 95% but it has low sensitivity rate of 5 % (LeVarge et al. 2018). Study by Barco et al. (2018), shows that T wave inversion, especially in inferior and anterior lead, was the most common ECG changes found in pulmonary embolism. The T wave inversion was found in 34.4% of PE patient confirmed by CTPA (Barco et al., 2018). This study is in accordance with Laurentius et al. (2023), which shown that anterior T-wave inversion has diagnostic value in patient with suspected pulmonary embolism (Laurentius and Ariani 2023). Study by Thomson et al. (2019), explain that RV Strain ECG appearance such as T wave inversion in Inferior lead and right precordial lead (V1-V4) in patient complaining rapid dyspneu is highly suggestive with PE (sensitivity 11.1% and specificity 97.4%) (Thomson et al. 2019). There are many mechanisms of ECG changes in PE patient. ECG changes in PE is attributed to the right ventricular strain due to the pressure overload and these changes are usually found in severe case of PE (Laurentius and Ariani, 2023).

This patient developed haemodynamic instability in the second day of hospitalization that is indicates a high-risk case of pulmonary embolism. High-risk pulmonary embolism account for 4.5-5% of all PE cases, with in hospital mortality approximately 50 %. The haemodynamic instability in PE occurs due to the increase of pulmonary vascular resistance that leads to right ventricular failure.

In acute phase of Pulmonary Embolism, the treatment should be focus on maintaining the haemodynamic and respiratory support. The treatment includes oxygen therapy and ventilation, cautious volume administration, administration of vasopressor and inotropes drugs, and mechanical circulatory support. The ESC Guideline in 2019 stated that Anticoagulant therapy should be initiated immediately in patient with high risk of pulmonary embolism even while waiting for another diagnostic result (Konstantinides et al. 2020). This becomes the foundational basis to start the anticoagulant therapy in this patient. Administration of fondaparinux is done subcutaneously as the initial anticoagulant therapy. Fondaparinux usage ispreferred over unfractioned heparin (UFH) for its lower bleeding risk (Konstantinides et al. 2020).

Systemic thrombolysis is the treatment of choice for High Risk or Massive pulmonary embolism. The recent European Cardiology Society (ESC) in 2019 classifies systemic thrombolysis in high-risk PE patients as a 1B recommendation. Systemic thrombolysis should be administered in high-risk PE patients immediately unless contraindicated (Konstantinides et al. 2020; Sidhi et al. 2021). The absolute contraindications for systemic thrombolysis such as history of haemorrhagic stroke, history of ischaemic stroke in the past 6 months, central nervous system neoplasm, major trauma in the past 3 months, and active bleeding. The administration of systemic thrombolysis should be closely monitored for it is also associated with major bleeding risk in 10% of cases. Catheter-directed therapy (CDT) is the insertion of a catheter into pulmonary arteries. CDT is recommended in a patient who is contraindicated for systemic thrombolysis, patient who has high bleeding risk and in patient who has failed the systematic thrombolysis treatment (Konstantinides et al. 2020). Study by Pietrasik et al., showed CDT has lower bleeding risk compared to systemic thrombolysis (Pietrasik et al. 2022; Purwowiyoto et al. 2021).

In the rural area the management's limitation begin with the lack of diagnosis facilities and the availability of the pharmacology therapy. In this case. the diagnosis using patient's clinical probability score and the ECG pattern is highly suggestive of pulmonary embolism diagnosis. Based on the ESC guideline, CTPA examination should be performed in the patient with haemodynamic instability, but there is no CTPA or echocardiography available in the hospital making the diagnosis challenging. This patient included as high-risk pulmonary embolism with hemodynamic instability that should be given the systemic thrombolysis but it is not available in most limited healthcare facilities. Providing inadequate therapy results in increasing mortality rate in PE patients especially in rural setting.

CONCLUSION

Pulmonary embolism is a cardiovascular emergency that is hard to diagnose for its symptoms and signs often mimics other cardiovascular disease, therefore adequate examination is needed to establish the diagnosis of pulmonary embolism. In Rural setting, the clinical probability score and ECG can be used as the modality for diagnosing pulmonary embolism and to start the therapy based on the patient criteria.

Limited therapy is one of the biggest challenges in rural setting for that can increase the mortality rate of PE Patient. The procurement of the examination modalities and pharmacology therapies should be carried out in all hospital in Indonesia for providing the best management for the patient.

REFERENCES

Barco, S. *et al.* (2018) 'Differential impact of syncope on the prognosis of patients with acute pulmonary embolism: a systematic review and meta-analysis', *European Heart Journal*, 39(47), pp. 4186–4195. doi:10.1093/eurheartj/ehy631.

Barco, S. *et al.* (2021) 'Global reporting of pulmonary embolism–related deaths in the World Health Organization mortality database: Vital registration data from 123 countries', *Research and Practice in Thrombosis and Haemostasis*, 5(5), p. e12520. doi:10.1002/rth2.12520.

Barnes, G.D. *et al.* (2020) 'Comparison of 4 Acute Pulmonary Embolism Mortality Risk Scores in Patients Evaluated by Pulmonary Embolism Response Teams', *JAMA Network Open*, 3(8), p. e2010779. doi:10.1001/jamanetworkopen.2020.10779.

Bělohlávek, J., Dytrych, V. and Linhart, A. (2013) 'Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism.', *Experimental and clinical cardiology*, 18(2), pp. 129–38.

Dalen, J.E. (2002) 'Pulmonary embolism: what have we learned since Virchow? Natural history, pathophysiology, and diagnosis', *Chest*, 122, pp. 1440–1456.

Duffett, L., Castellucci, L.A. and Forgie, M.A. (2020) 'Pulmonary embolism: update on management and controversies', *BMJ*, p. m2177. doi:10.1136/bmj.m2177.

Konstantinides, S. V *et al.* (2020) '2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS)', *European Heart Journal*, 41(4), pp. 543–603. doi:10.1093/eurheartj/ehz405.

Laurentius, A. and Ariani, R. (2023) 'Diagnostic comparison of anterior leads T-wave inversion and McGinn-White sign in suspected acute pulmonary embolism: A systematic review and meta-analysis', *Hong Kong Journal of Emergency Medicine*, 30(1), pp. 54–60. doi:10.1177/1024907920966520.

Leidi, A. *et al.* (2022) 'Risk Stratification in Patients with Acute Pulmonary Embolism: Current Evidence and Perspectives', *Journal of Clinical Medicine*, 11(9), p. 2533. doi:10.3390/jcm11092533.

LeVarge, B.L., Wright, C.D. and Rodriguez-Lopez, J.M. (2018) 'Surgical Management of Acute and Chronic Pulmonary Embolism', *Clinics in Chest Medicine*, 39(3), pp. 659–667. doi:10.1016/j.ccm.2018.04.017.

Ma, X. *et al.* (2022) 'A multitask deep learning approach for pulmonary embolism detection and identification', *Scientific Reports*, 12(1), p. 13087. doi:10.1038/s41598-022-16976-9.

McLendon, K., Goyal, A. and Attia, M. (2023) 'Deep Venous Thrombosis Risk Factors.', in *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing.

Medson, K. *et al.* (2022) 'Comparing "clinical hunch" against clinical decision support systems (PERC rule, wells score, revised Geneva score and YEARS criteria) in the diagnosis of acute pulmonary embolism', *BMC Pulmonary Medicine*, 22(1), p. 432. doi:10.1186/s12890-022-02242-1.

Moore, A.J.E. *et al.* (2018) 'Imaging of acute pulmonary embolism: an update', *Cardiovascular Diagnosis and Therapy*, 8(3), pp. 225–243. doi:10.21037/cdt.2017.12.01.

Pietrasik, A. *et al.* (2022) 'Catheter-Based Therapies Decrease Mortality in Patients With Intermediate and High-Risk Pulmonary Embolism: Evidence From Meta-Analysis of 65,589 Patients', *Frontiers in Cardiovascular Medicine*, 9. doi:10.3389/fcvm.2022.861307.

Robert-Ebadi, H. *et al.* (2017) 'Assessing clinical probability of pulmonary embolism: prospective validation of the simplified Geneva score', *Journal of Thrombosis and Haemostasis*, 15(9), pp. 1764–1769. doi:10.1111/jth.13770.

Stals, M. *et al.* (2021) 'Challenges in the diagnostic approach of suspected pulmonary embolism in COVID-19 patients', *Postgraduate Medicine*, 133(sup1), pp. 36–41. doi:10.1080/00325481.2021.1920723.

Thomson, D. *et al.* (2019) 'ECG in suspected pulmonary embolism', *Postgraduate Medical Journal*, 95(1119), pp. 12–17. doi:10.1136/postgradmedj-2018-136178.

Turetz, M. *et al.* (2018) 'Epidemiology, Pathophysiology, and Natural History of Pulmonary Embolism', *Seminars in Interventional Radiology*, 35(02), pp. 92–98. doi:10.1055/s-0038-1642036.

Zantonelli, G. *et al.* (2022) 'Acute Pulmonary Embolism: Prognostic Role of Computed Tomography Pulmonary Angiography (CTPA)', *Tomography*, 8(1), pp. 529–539. doi:10.3390/tomography8010042.