



Acute Pulmonary Embolism (PE) with Acute Cor-Pulmonale treated successfully by Catheter Directed Fibrinolysis (CDF)

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General Note



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ABSTRACT

Acute pulmonary embolism (PE) is a variant of venous thromboembolism which in some cases may be fatal if not treated promptly. A high index of suspicion is required to diagnose PE in an appropriate clinical setting. Diagnostic approach usually starts with a quantitative D-Dimer assay. CT pulmonary angiography usually confirms the diagnosis. Treatment modalities for acute pulmonary

embolism are ranges from systemic thrombolysis to surgical embolectomy. Now a days, catheter based revascularization procedures are emerging as substitute of systemic thrombolysis/surgical embolectomy in intermediate and high risk cases. Ultrasound-assisted catheter-directed thrombolysis (UACDT) is an emerging and evidence based modality in the treatment of pulmonary embolism. We describe a case of a 40 year old hyperhomocysteinemic male with deep vein thrombosis and submassive PE who presented with acute Cor-Pulmonale and was successfully treated with catheter directed thrombolysis.

Keywords: PE, thrombolysis, embolectomy, surgical, cor-pulmonale

1. INTRODUCTION

PEs can be divided into massive, submassive, and low risk. Submassive or intermediate-risk PEs comprises of 31% of diagnosed PE cases and has a 5% to 12.6% in-hospital mortality rate (Marshall et al., 2011). The overall incidence of pulmonary embolism ranges from 0.5–1 case per 1000 population (Heit, 2008). A rise in homocysteine is a risk factor for arterial and venous pulmonary thromboembolism (Ayush et al., 2019). In severe hyper homocysteinemia, serum homocysteine concentrations are in the ranges from 50 to 500 $\mu\text{mol/L}$ (Welch et al., 1998). There is a strong correlation between plasma homocysteine levels and atherosclerotic vascular disease (Cattaneo, 1995). Diagnostic work up in pulmonary embolism include a clinical decision rule, biomarkers (e.g., d-dimer), and/or imaging modalities, such as computed tomography angiography and echocardiography (Wells et al., 1998; Le Gal et al., 2006). In treatment modalities of PE include anticoagulation, systemic thrombolysis, catheter directed thrombolysis and mechanical thrombectomy (Konstantinides et al., 2014). For intermediate–high-risk patients who have stabilized but exhibit features of marked right ventricular strain (RVS)/ failure, ultrasound assisted thrombolysis (USAT) and catheter derived fibrinolysis (CDF) offer theoretical advantages in reducing sequelae of RVS and pulmonary hypertension with lower thrombolytic doses compared with those of systemic thrombolysis (ST) (David et al., 2009).

2. CASE REPORT

A 40-year-old male presented to us with complaints of pain and swelling in his left leg since 10 days, gradually progressive dyspnea over 3 days. The dyspnea increased from NYHA grade 2 to grade 3 by the time of admission. There was no history of prolonged bed rest, cough, expectoration, chest pain, hemoptysis. General physical examination revealed Pulse of 118/ minute, regular, low volume, peripheral pulses were felt. Blood pressure was 130/90 mm of Hg in right arm supine position and respiratory rate was 26 cycles/min. Jugular venous pressure (JVP) was raised at 11 cms of water (Figure-1). Left lower limb edema was present (left mid thigh diameter 37 cm, right mid thigh diameter 32 cm), oxygen saturation in room air was 90%. Homan's sign was positive on left lower limb.



Figure 1 Showing raised JVP

Examination of respiratory system revealed decrease air entry in the right basal area. A clinical diagnosis of deep vein thrombosis with pulmonary embolism was made and investigations like D-dimer, CBC, LFT, KFT, RBS, was normal. ECG was showed sinus tachycardia. X-ray chest was normal.

Investigations

A quantitative D- dimer assay was 587 micrograms/L by ELISA. Serum homocysteine was 88 $\mu\text{mol/L}$, venous Doppler of left lower limb revealed deep vein thrombosis. 2 D Echo revealed dilated right atrium and right ventricles. CT pulmonary angiography revealed near total occlusion in bilateral distal pulmonary arteries extending into left segmental arteries of both lower lobe and left upper lobe anterior segmental arteries (figure-2).

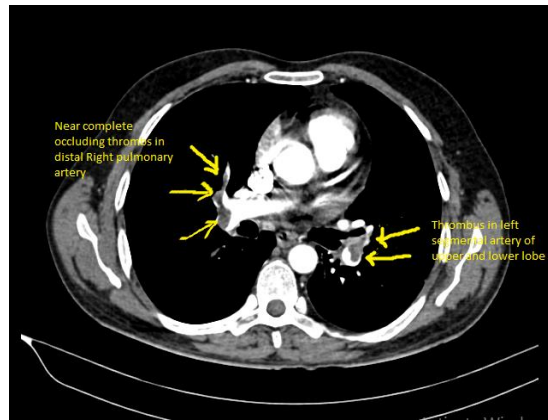


Figure 2 CT pulmonary angiography showing near total occlusion in bilateral distal pulmonary arteries extending into left segmental arteries of both lower lobe and left upper lobe anterior segmental arteries.

Treatment was initiated with injection unfractionated heparin at a dose of 80 units/kg bolus followed by 18 units/kg/hr infusion with monitoring of activated partial thromboplastin time. Then decision of catheter directed intrapulmonary artery thrombolysis was taken. A 5-French pigtail catheter was placed into the main pulmonary artery for pulmonary artery angiogram. Two 110 cm perfusion catheters were selectively placed into the right and left pulmonary arteries and selective thrombolysis was done with injection Urokinase (4 ml of Urokinase; total 20,000 units in 4 ml of normal saline) (Figure-3).



Figure 3 Showing catheter in right pulmonary artery

Post thrombolysis repeat CT pulmonary angiography revealed almost complete resolution of thrombus in bilateral distal main pulmonary artery (Figure 4). Residual partial lumen occluding thrombus seen in segmental branch of anterior segment of right lower lobe and anterior segment of left lower lobe. Patient reported improvement in symptoms on day 2 of thrombolysis. He was also treated with folic acid 40mg, 2mg vitamin B12, 100 mg of vitamin B 6 which was continued and tablet warfarin 2 mg (adjusted to INR 2).



Figure 4 Post Thrombolysis CT pulmonary angiogram showing resolution of thrombus in both pulmonary arteries.

3. DISCUSSION

Massive PE is usually defined as suspected or confirmed PE that presents with hypotension/shock (Marti et al., 2015; Konstantinides et al., 2014; Jaff et al., 2011). As far as the treatment modality is concerned, therapeutic thrombolysis is regarded as a class 1B recommendation, according to the European Society of Cardiology (ESC), and, class 2B with presence of bradycardia in the 2016 updated CHEST guidelines (Kearon et al., 2012; Collen, 1987; Kearon et al., 2016). Submassive PE is defined as suspected or confirmed PE with evidence of right ventricular dysfunction but in absence of shock (Marti et al., 2015; Konstantinides et al., 2014; Jaff et al., 2011). The various treatment modalities used in PE are anticoagulation, systemic thrombolysis, catheter directed thrombolysis, ultrasound assisted thrombolysis and mechanical thrombectomy. The benefits of systemic thrombolysis generally outweigh the risks in massive PE. The only contraindications are being presence of active, uncontrollable bleeding. The role of thrombolysis in hemodynamically stable patients with submassive embolism is predictably fair (Kearon et al., 2012). Chatterjee et al. conducted a systematic review to evaluate the survival benefit of thrombolysis compared with that of anticoagulation in patients with acute PE. The review concluded that, thrombolytic agents are found to be associated with lower all-cause mortality compared with anticoagulants (2.17% versus 3.89%, respectively), though, they increased the risk of major bleeding (Chatterjee et al., 2014).

Catheter-directed fibrinolysis (CDF) is an emerging modality in treatment of PE. The practical edge it gives is the creation of a channel while navigating the catheter physically through an obstructive pulmonary artery thrombus leading to increase surface area of thrombus that would be exposed to thrombolytic agent (Diamond & Anand, 1993; Blinc et al., 1994). It overcomes the limitation of peripherally infused ST, where blood is shunted toward the unobstructed pulmonary artery segments rather than those with thrombus. The promise of CDF lies in a potential increase in thrombolytic efficacy, coupled with improved safety profile because of decrease in the dose of the drug. Ultrasound assisted catheter directed thrombolysis (UACDT) is a procedure where a catheter is directed into the pulmonary artery through a systemic vein and it targets the blood clots by deploying ultrasound waves (Engelberger et al., 2015). It can be performed in limited resourceful hospitals where skilled and trained personnel in catheter based therapy are available (Francis et al., 1995; Braaten et al., 1997; Siddiqi et al., 1998).

If the conventional methods are contraindicated then, surgical embolectomy remains the final treatment modality, especially in high risk cases. Two recent studies suggest in-hospital mortality rates 6.6% to 11.7% based on high- and intermediate-risk PE cohorts, with a third reporting overall 4.6% 30-day mortality (Konstantinides et al., 2014; Fukuda et al., 2011; Leacche et al., 2005). Catheter Directed thrombolysis offer advantages in reducing sequelae of RVS and pulmonary hypertension with lower thrombolytic doses compared with those of systemic thrombolysis.

4. CONCLUSION

CDF is a relatively safe procedure and can be used as a primary therapeutic modality in PE, complicated with acute cor-pulmonale or shock. With adequate skill and expertise its potential role as first line management cannot be overruled. It is target oriented, specific, requires lower dosage of the fibrinolytic agent and is associated with decreased incidence of bleeding.

Informed Consent

Written and oral informed consent was taken from the patient before writing this case report.

Conflict of Interest

The authors declare that they have no conflict of interest.

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REFERENCE

1. Blinc A, Kennedy SD, Bryant RG, Marder VJ, Francis CW. Flow through clots determines the rate and pattern of fibrinolysis. *Thromb Haemost.* 1994;71:230–235
2. Braaten JV, Goss RA, Francis CW. Ultrasound reversibly disaggregates fibrin fibers. *Thromb Haemost.* 1997;78:1063–1068.
3. Cattaneo M. Hyperhomocysteinemia, atherosclerosis and thrombosis. 1999;81:165–176.
4. Chatterjee S, Chakraborty A, Weinberg I, et al. Thrombolysis for pulmonary embolism and risk of all-cause mortality, major bleeding, and intracranial hemorrhage: a meta-analysis. *JAMA.* 2014;311:2414–2421.

5. Collen D. Molecular mechanisms of fibrinolysis and their application to fibrin-specific thrombolytic therapy. *J Cell Biochem.* 1987;33:77–86.
6. David M, Dudzinski, Jay Giri ; Kenneth Rosenfield, Interventional Treatment of Pulmonary Embolism. 2017;10;116.
7. Diamond SL, Anand S. Inner clot diffusion and permeation during fibrinolysis. *Biophys J.* 1993;65:2622–2643.
8. Engelberger RP, Moschovitis A, Fahrni J, et al. Eur Heart J Fixed low-dose ultrasound-assisted catheter-directed thrombolysis for intermediate and high-risk pulmonary embolism. 2015;36:597–604.
9. Francis CW, Blinc A, Lee S, et al. Ultrasound accelerates transport of recombinant tissue plasminogen activator into clots. *Ultrasound Med Biol.* 1995;21:419–424.
10. Fukuda I, Taniguchi S, Fukui K, Minakawa M, Daitoku K, Suzuki Y. Improved outcome of surgical pulmonary embolectomy by aggressive intervention for critically ill patients. *Ann Thorac Surg.* 2011;91:728– 732.
11. Heit JA. The epidemiology of venous thromboembolism in the community. *Arteriosclerosis, Thrombosis, and Vascular Biology.* 2008; 28 370-2.
12. Jaff MR, McMurtry MS, Archer SL, et al. Management of massive and submassive pulmonary embolism, iliofemoral deep vein thrombosis, and chronic thromboembolic pulmonary hypertension: a scientific statement from the American Heart Association. *Circulation.* 2011;123:1788–1830.
13. Kearon C, Akl EA, Comerota AJ, et al. Antithrombotic therapy for VTE disease: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest.* 2012;141(suppl):e419S–e494S.
14. Kearon C, Akl EA, Comerota AJ, et al. Antithrombotic therapy for VTE disease: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest.* 2012;141:e419S–e494S.
15. Kearon C, Akl EA, Ornelas J, et al. Antithrombotic therapy for VTE disease: CHEST guideline and expert panel report. *Chest.* 2016;149:315–352.
16. Konstantinides SV, Torbicki A, Agnelli G, Danchin N, Fitzmaurice D, Galiè N, Gibbs JS, Huisman MV, Humbert M, Kucher N, Lang I, Lankeit M, Lekakis J, Maack C, Mayer E, Meneveau N, Perrier A, Pruszczyk P, Rasmussen LH, Schindler TH, Svitil P, Vonk Noordegraaf A, Zamorano JL, Zompatori M; Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). 2014 ESC guidelines on the diagnosis and management of acute pulmonary embolism. *Eur Heart J.* 2014;35:3033–3069, 3069a.
17. Konstantinides SV, Torbicki A, Agnelli G, et al. 2014 ESC guidelines on the diagnosis and management of acute pulmonary embolism. *Eur Heart J.* 2014;35:3033–3073.
18. Le Gal G, Righini M, Roy PM, et al. Prediction of pulmonary embolism in the emergency department: the revised Geneva score. *Ann Intern Med.* 2006;144:165–171.
19. Leacche M, Unic D, Goldhaber SZ, Rawn JD, Aranki SF, Couper GS, Mihaljevic T, Rizzo RJ, Cohn LH, Aklog L, Byrne JG. Modern surgical treatment of massive pulmonary embolism: results in 47 consecutive patients after rapid diagnosis and aggressive surgical approach. *J Thorac Cardiovasc Surg.* 2005;129:1018–1023.
20. Marshall PS, Mathews KS, Siegel. Diagnosis and management of life-threatening pulmonary embolism. *J Intensive Care Med.* 2011;26:275–294.
21. Marti C, John G, Konstantinides S, et al. Systemic thrombolytic therapy for acute pulmonary embolism: a systematic review and meta-analysis. *Eur Heart J.* 2015;36:605–614.
22. Siddiqi F, Odrliin TM, Fay PJ, et al. binding of tissue-plasminogen activator to fibrin: Effect of ultrasound. 1998;91:2019–2025.
23. Welch G, Loscalzo J. *N Engl J Med.* Homocysteine and atherothrombosis. 1998;338:1042–1050.
24. Wells PS, Ginsberg JS, Anderson DR, et al. Use of a clinical model for safe management of patients with suspected pulmonary embolism. *Ann Intern Med.* 1998;129:997–1005.