



The Value of Bedside Ultrasound in the Diagnosis and Treatment of Pulmonary Embolism in Severe Patients

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Abstract: Objective — To explore the diagnostic value of bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasonography in patients with venous thromboembolism. Methods — Select 97 patients with high-risk Caprini scores and high-risk Padua scores from December 2019 to April 2021 in the Second Affiliated Hospital of Shandong First Medical University as the research objects, all of whom completed bedside transthoracic echocardiography combined with bedside lower limbs or upper extremity venous ultrasound examination; compare the results of different ultrasound examinations with spiral CT pulmonary angiography (CTPA); analyze the diagnostic value of bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasound in patients with pulmonary embolism. Results — 97 patients with high-risk Caprini score and high-risk Padua score were confirmed by CTPA in 41 cases of pulmonary embolism; bedside transthoracic echocardiography, bedside lower extremity or upper extremity venous ultrasonography for venous thromboembolism were all positive in 35 cases; among them, 32 cases were confirmed by CTPA as pulmonary embolism, and the diagnostic compliance rate with the gold standard was 87.63%; bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasonography had a diagnostic sensitivity of 78.05% and a diagnostic specificity of 94.64%; Conclusion — Bedside transthoracic echocardiography and bedside lower extremity venous ultrasonography combined for venous thromboembolism can improve the specificity of diagnosis, and it is worthy of popularization and application.

Keywords: bedside transthoracic echocardiography, bedside lower extremity venous ultrasonography, venous thromboembolism, diagnostic power

Venous thromboembolism refers to the abnormal coagulation of blood in the veins, resulting in complete or incomplete obstruction of blood vessels. It is a disease of venous return disorder, mainly including: deep vein thrombosis and pulmonary thromboembolism. The clinical symptoms of patients in the early stage of onset lack typicality. As the course of the disease is prolonged, the clinical manifestations are mostly unexplained collapse, pale complexion, and cold sweats. In severe cases, the patient's life can be endangered ^[1]. Pulmonary angiography is the "gold standard" for the diagnosis of patients with pulmonary embolism. Although it can help patients diagnose the diagnosis, the examination is risky and traumatic, resulting in poor diagnostic tolerance ^[2]. Use spiral CT pulmonary angiography (CTPA) Instead as a diagnostic criterion. Bedside lower extremity venous ultrasound examination is a commonly used auxiliary examination method in the prevention and treatment of pulmonary embolism in critically ill patients. It can determine the specific location of the thrombus, but the diagnostic method is less specific. Bedside transthoracic echocardiography can monitor the changes in the structure and function of the patient's right heart. Some patients with better acoustic windows can find emboli in the main trunk or left and right branches, which is helpful to the assessment of pulmonary artery systolic pressure^[3]. Therefore, this study focused on patients with pulmonary embolism to explore the diagnostic value of bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasonography in patients with pulmonary embolism. The report is as follows.

1. Materials and methods

1.1 Clinical data

A total of 97 patients with high-risk Caprini scores and high-risk Padua scores from December 2019 to April 2021 in the Second Affiliated Hospital of Shandong First Medical University were selected as subjects. There were 51 males and 46 females, with an average age of (35-78) years. (45.60±6.71) years old; body mass index (BMI) (18-29) kg/m², average (23.51±3.29) kg/m²; course of disease (5-15) days, average (10.21±3.53) days; complications: There were 25 cases of hypertension, 21 cases of hyperlipidemia, and 15 cases of diabetes.

1.2 Inclusion and exclusion criteria

Inclusion criteria: (1) Refer to the diagnostic criteria of venous thromboembolism ^[4], and all patients have complete CTPA examination results; (2) They can cooperate to complete bedside transthoracic echocardiography, bedside lower extremity or upper extremity venous ultrasonography, Patients can be tolerated; exclusion criteria: (1) poor ultrasound window, mental abnormalities and abnormal blood coagulation; (2) severe mental disorders or autoimmune system diseases; (3) severe liver and kidney dysfunction, Those with organic diseases.

1.3 Methods

All completed bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasonography (for patients with upper extremity venous catheterization, the specific method is as follows.

1.3.1 Bedside ultrasound examination of the veins of the lower extremities

Routine ultrasound examination of the lower extremity veins is performed on the patient with a linear array high-frequency probe of 5-10MHz. The patient is placed in a supine position, allowing it to naturally abduct or externally rotate, fully exposing the lower extremity veins. The ultrasound probe completes the patient in a "top-down" manner. Scan the veins of the lower extremities. When the patient is examined, the common femoral vein, the great saphenous vein, the deep femoral vein, and the superficial femoral vein are scanned first. During the examination of the lower leg, the subject is a critically ill patient who has difficulty in prone position, so guide and assist the patient in the lateral or supine position. Knee flexion and abduction to explore popliteal vein, posterior tibial vein, peroneal vein, calf intermuscular vein and small saphenous vein, etc.; after the above operation, perform scan of dorsal vein and anterior tibial vein with knee flexion, and observe the thickness of venous lumen and vein in detail The size of the inner diameter and blood flow ^[5]. If necessary, press the probe to observe whether there are thrombus and blood circulation in the lumen. In the upper extremity vein scan, the patient lies in the supine position and the upper extremities are abducted. Starting from the supraclavicular fossa and axilla, scan the subclavian vein, left and right innominate veins, axillary veins, brachial veins, ulnar veins and radial veins, cephalic veins and important veins.

1.3.2 Bedside transthoracic echocardiography

After the bedside venous ultrasonography of the lower or upper limbs is completed, bedside transthoracic echocardiography is performed on the patient. The specific methods are as follows. Before the examination, actively explain the relevant knowledge and basic precautions of the echocardiography examination to the patients and their families, so as to improve the patient's examination compliance and cognitive level. Choose a color Doppler ultrasound diagnostic instrument to check the patient, the probe frequency is 2.5-6.0MHz. After the above operations are completed, instruct the patient to take the supine or left-side supine position to obtain the left ventricular long axis, fundus short axis, apical four-chamber, right ventricular outflow tract, and subword four-chamber slices, and complete the scan of the relevant slices , To explore the patient's left and right branches, as well as the shape and size of the main pulmonary artery, and the length of the inner diameter, and provide multi-sectional examination conditions to explore the patient's internal echo of the pulmonary artery to determine whether there is an embolus. After the examination, observe the local blood flow, and carefully observe the speed and change trend of the blood flow, combined with the obtained measurement values, the condition of tricuspid regurgitation, and the estimation of the pulmonary artery systolic pressure. The results of different ultrasound examinations were compared with the results of spiral CT pulmonary angiography (CTPA), and the diagnostic value of bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasonography in patients with pulmonary embolism was analyzed.

1.4 Statistical analysis

The SPSS24.0 software was used to process the count data and the χ^2 test was performed using n (%), and the measurement data was performed using t test, which was represented by (). The difference was statistically significant at $P < 0.05$.

2. Results

2.1 The application of CTPA in patients with venous thromboembolism

Among 97 patients with high-risk Caprini score and high-risk Padua score, 41 cases of pulmonary embolism were confirmed by CTPA examination, and the diagnosis rate was 42.27%. Among the patients with suspected pulmonary embolism, 0 had direct signs of transthoracic echocardiography, and 58 had indirect signs. Indirect signs included large right heart, decreased right ventricular wall motion, tricuspid regurgitation, and pulmonary hypertension.

2.2 The diagnostic effect of bedside ultrasound in patients with venous thromboembolism

In 61 cases, the bedside venous ultrasonography was positive, and the diagnostic coincidence rate with the gold standard was 71.13% ($P < 0.05$). The diagnostic sensitivity of bedside lower extremity venous ultrasonography in patients with venous thromboembolism was 90.24%, and the specificity was 57.14%, as shown in Table 1.

Table 1. The diagnostic value of bedside venous ultrasonography in patients with venous thromboembolism

Inspection method		Gold standard		Total	χ^2	P
		Positive	Negative			
Bedside lower extremity vein ultrasound	Positive	37	24	61	8.492	0.031
	Negative	4	32	36		
Total		41	56	97		

Bedside transthoracic echocardiography was positive in 58 cases. The diagnostic coincidence rate with the gold standard was 78.35%, the diagnostic sensitivity was 95.12%, and the specificity was 66.07%, as shown in Table 2.

Table 2. The diagnostic value of bedside transthoracic echocardiography in patients with venous thromboembolism

Inspection method		Gold standard		Total	χ^2	P
		Positive	Negative			
Bedside transthoracic echocardiogram	Positive	39	19	58	12.194	0.014
	Negative	2	37	39		
Total		41	56	97		

2.3 The diagnostic value of bedside ultrasound in patients with venous thromboembolism

Bedside transthoracic echocardiography, bedside lower extremity or upper extremity venous ultrasonography were all positive in 35 patients with venous thromboembolism. Among them, 32 cases were confirmed by CTPA as pulmonary embolism, and the diagnostic compliance rate with the gold standard was 87.63%; bedside The diagnostic sensitivity of transthoracic echocardiography combined with bedside lower extremity venous ultrasonography was 78.05%, and the diagnostic specificity was 94.64%, as shown in Table 3.

Table 3. The diagnostic value of bedside ultrasound in patients with venous thromboembolism

Inspection method		Gold standard		Total	χ^2	P
		Positive	Negative			
Joint examination	Positive	32	3	35	8.325	0.032
	Negative	9	53	62		
Total		41	56	97		

3. Discussion

In recent years, bedside ultrasound has been used in patients with venous thromboembolism, and the effect is ideal [6]. In this study, 35 cases were positive for bedside transthoracic echocardiography, bedside lower extremity or upper extremity venous ultrasonography for venous thromboembolism. Among them, 32 cases were confirmed to be pulmonary embolism by CTPA, and the diagnostic coincidence rate with the gold standard was 87.63%; bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasonography has a diagnostic sensitivity of 78.05% and a diagnostic specificity of 94.64%. It can be seen from the results of this study that bedside ultrasound can be used in patients with venous thromboembolism. The higher diagnostic coincidence rate can guide clinical diagnosis and treatment. Bedside lower extremity venous ultrasound is a commonly used auxiliary examination method for patients with venous thromboembolism. This method can understand the blood flow status of patients with suspected venous thromboembolism, and judge the location and activity of the thrombus. However, the single use of bedside ultrasound diagnosis of lower extremity veins has high sensitivity, but low specificity and low diagnostic coincidence rate (I revised the sentence when the data changed). The

bedside transthoracic echocardiography can monitor the changes of the patient's right heart structure and function, and has certain value for the assessment of pulmonary artery systolic pressure. Direct signs and indirect signs are the important basis for clinical diagnosis of echocardiography. Embolus echoes in the left and right pulmonary arteries and main pulmonary arteries are all direct signs in patients with venous thromboembolism. Ventricular septal movement compliance, pulmonary hypertension, and tricuspid valve regurgitation Flow etc. are all indirect signs. In this study, 32 cases were diagnosed by bedside transthoracic echocardiography combined with bedside lower extremity venous ultrasonography. From the results of this study, bedside transthoracic echocardiography and bedside lower extremity venous ultrasonography were used for patients with venous thromboembolism. It can obtain high diagnostic efficiency and provide reference basis for clinical diagnosis and treatment.

In summary, bedside transthoracic echocardiography and bedside lower extremity venous ultrasonography have clinical value in patients with venous thromboembolism and are worthy of promotion and application.

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