□ Case Report □

A case of pulmonary thromboembolism in a healthy infant

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A pulmonary thromboembolism (PTE), which is a sudden blockage in a pulmonary artery, usually due to a blood clot, is rare in children. The clinical presentation is often subtle or masked by the underlying clinical condition and the condition must be suspected during clinical testing. Although the choice of treatment depends on the clinical presentation, anticoagulation is the mainstay of therapy for children with PTE. We report the case of a healthy 1-month-old boy who presented with hemoptysis without hemodynamic instability. He was diagnosed based on chest computed tomography with angiography and 99mTc macroaggregated albumin lung perfusion scintigraphy and treated with low-molecular-weight heparin. (Korean J Pediatr 2007;50:1030-1033)

Key Words : Pulmonary thromboembolism, Infant, Low molecular weight heparin

Introduction

A pulmonary thromboembolism (PTE) is a sudden blockage in a pulmonary artery, usually due to a blood clot. While it is rare in children, Stevenson and Stevenson made the first report of childhood PTE in 1861[1].

Most children with PTE have an underlying clinical condition; the presence of a central venous catheter is the most frequent. The clinical presentation is often subtle or masked by the underlying clinical condition. The choice of treatment depends on the clinical presentation, but anticoagulation is the mainstay of therapy for children with PTE.

Here, we report PTE in a healthy infant who presented with hemoptysis and was treated with low-molecular-weight heparin (LMWH). We also briefly review the related literature.

Case Report

A 1-month-old boy presented to the emergency department with a small amount of fresh bloody hemoptysis with acute onset. The hemoptysis had developed 1 hour earlier and recurred once more while in the hospital. A history of cough, sputum and mild fever was noted, but these had improved. His birth and family history were unremarkable.

On physical examination, no specific findings were detected. His blood pressure, pulse, respiratory rate and body temperature were 96/60 mmHg, 148 bpm, 34 bpm, and 36.0℃, respectively. The room air oxygen saturation was 100%.

The result of laboratory studies were as follows : Hemoglobin concentration 12.3 g/dL, white blood cell count of 13,700/mm^3 with 34.6% neutrophils, 55.0% lymphocytes and 197,000/mm^3 platelets, prothrombin time (PT) 12.9 sec, activated partial thrombin time (aPTT) 52.9 sec, bleeding time 2 minutes, fibrinogen 242.2 mg/dL, FDP 1.9 μg/mL, D-dimer 0.12 mg/dL, and the AST, ALT, BUN, and creatinine were all within the normal range.

Initially we performed simple chest radiography, which showed unusual infiltration pattern on both lung parenchyme (Fig. 1). To determine the cause of the hemoptysis, we performed chest computed tomography (CT) with CT angiography, which revealed a filling defect in the right main pulmonary artery (Fig. 2) and bilaterally multifocal wedge shaped consolidations in peripheral lung zones, predominantly in lower lungs. We thus added 99mTc macroaggregated albumin (MAA) lung perfusion scintigraphy, which was strongly suggestive of PTE with multiple perfusion defects in the posterior segment of the right upper lobe, superior segment of the right lower lobe, and apicoposterior segment of the left upper lobe (Fig. 3). To evaluate the concealed causes and risk factors of PTE, we checked protein-C, pro-

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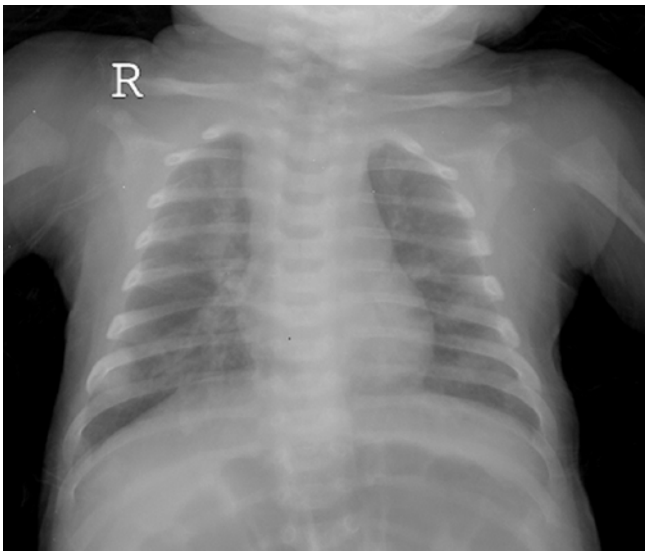

Fig. 1. Chest radiography showed increased parenchymal infiltration on both lung field, especially on the right.

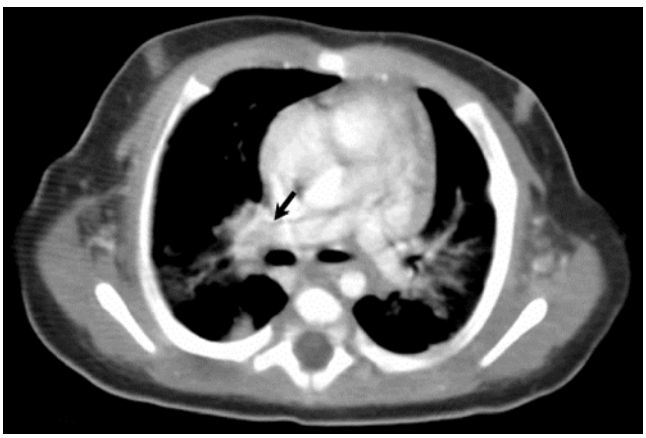

Fig. 2. Chest CT with CT angiography showed a suspicious filling defect in the right pulmonary artery (arrow) and bilaterally multifocal wedge shaped consolidations in peripheral lung zones, predominantly in lower lungs.

tein-S, lupus anticoagulant, and the factor V Leiden mutation. All were normal. In addition, echocardiography revealed no structural abnormalities or thrombus. Thus we started anticoagulation treatment with enoxaparin sodium (LMWH, Clexan prefilled®, 1.5 mg/kg/dose q12h subcutaneous infusion) with antibiotics therapy and these treatment continued for 2 weeks while monitoring platelet count and aPTT. But we didnt monitor plasma heparin concentration. During the enoxaparin treatment, he developed mild bruising without a hematoma at the injection sites, but no other side effects were observed. After the enoxaparin treatment, we observed nearly complete resolution of the obstruction; chest CT angiography showed

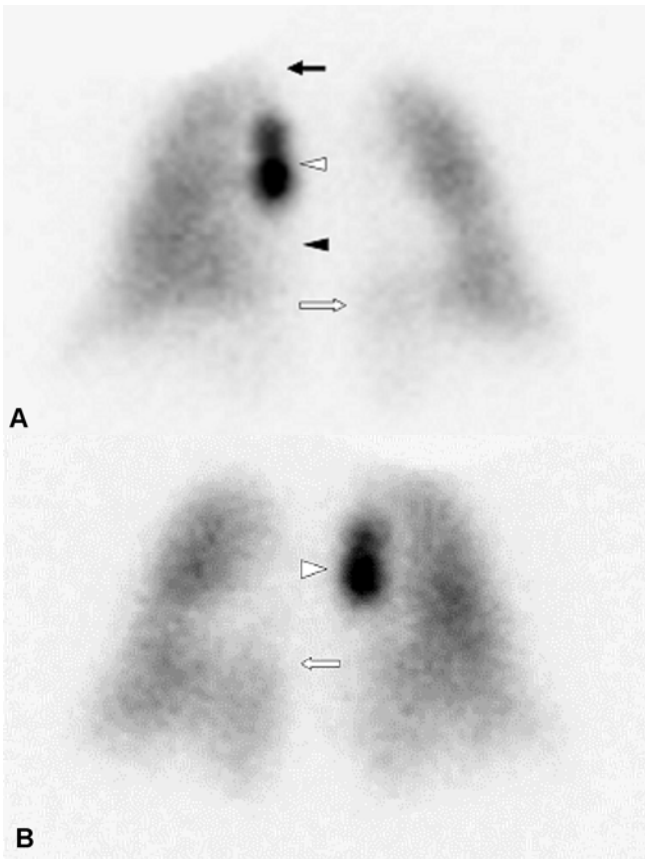

Fig. 3. 99mTc MAA lung perfusion scintigraphy revealed multiple perfusion defects in the posterior segment of the RUL (arrow), superior segment of the RLL (arrowhead), and apicoposterior segment of the LUL (blank arrow). The hot uptake lesion in the medial portion of the RUL was thought to be artifact due to the central venous catheter (blank arrowhead). (A) Anterior view. (B) Posterior view.

no detectable thromboembolism in the pulmonary arteries and nearly complete improvement of the previously seen peripheral consolidations (Fig. 4) and near complete improvement of previously seen peripheral consolidations. But ground glass opacities and uneven aerations still remained in dependent lung zones.

Without further management, the patient was discharged, and he remained clinically well without recurrence of PTE at 4 months following the initial diagnosis.

Discussion

PTE is pulmonary arterial obstruction by a thrombus, and pulmonary infarction is present when the condition is associated with hemorrhage and lung necrosis. While PTE is rare in children, Stevenson and Stevenson first reported its occur-

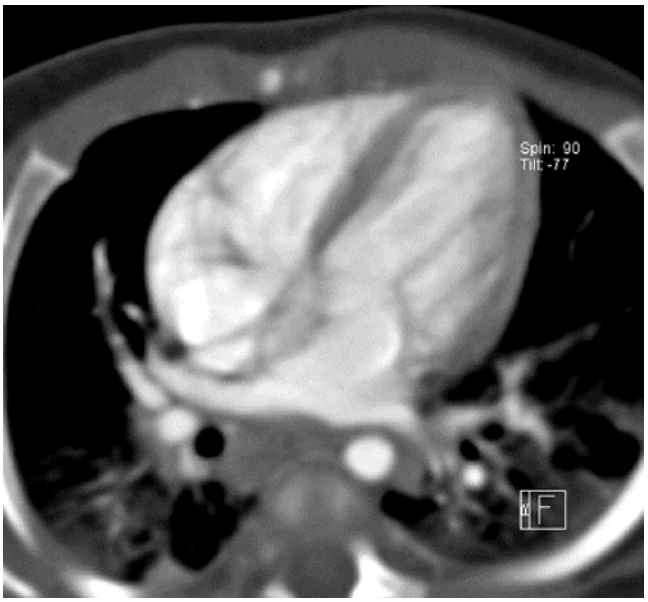

Fig. 4. Chest CT with angiography obtained after 2 weeks of LMWH treatment showed no detectable thromboembolism in the pulmonary arteries and near complete improvement of previously seen peripheral consolidations. But ground glass opacities and uneven aeration still remained in dependent lung zones.

rence during childhood in 1861[1]. The annual incidence for females and males younger than 15 years is 0 and 0.3 per 100,000, respectively. In prospective Canadian and Dutch pediatric registries, the respective annual incidence of PTE was determined as 0.86 per 10,000 pediatric hospital admissions and 0.14 per 100,000 children (ages 0-18 years)[2, 3]. These incidences are probably underestimated because the condition is frequently silent clinically or presents with symptoms that can be explained by underlying diseases. The incidence of PTE will probably rise as result of the increased survival of children with chronic diseases and the increased use of central venous catheters[4]. Most children have several associated risk factors present before vascular occlusion occurs. The etiologic and associated risk factors for pediatric PTE include burns, central venous lines and catheters, deep vein thrombosis, dehydration, heart disease, hematologic disorders, immobility, neoplasm, obesity, renal disease, sepsis, shock, stem cell/bone transplantation, surgery, thrombophilia, hypercoagulation, trauma and vascular malformation. Generally, these risks are interrelated, and multiple factors are often present. But our patient didnt have these related risk factors. So we couldnt suspect pulmonary thromboembolism at first. During evaluation of hemoptysis, pulmonary thromboembolism was detected.

PTE can have a variable clinical presentation depending on the degree of obstruction, the amount of liberated vasoactive amines, and underlying cardiopulmonary status of the child. The clinical symptoms and signs of PTE can include pleuritic pain, dyspnea, hemoptysis, tachypnea, cyanosis, dullness to percussion, pleural friction rub, severe hypoxia, and hypercapnia[5, 6]. Other signs reported in children with acute PTE include acute right heart failure, hypotension, arrhythmia, pallor, syncope, and sudden death. Unexplained persistent tachypnea can be an important indication of PTE in pediatric patients in all age-categories[7]. Our patient had a small amount hemoptysis with no other respiratory symptoms.

To diagnose this disease, it is important to suspect it when the clinical symptoms, signs, and associated risk factors present. Imaging studies add support to the diagnosis. After the diagnosis and subsequent treatment of PTE, a follow-up imaging study can be used to establish a new baseline for subsequent episodes of suspected recurrence and to assess the efficacy of anticoagulation treatment. Imaging studies include pulmonary angiography, ventilation-perfusion lung scanning, CT, magnetic resonance imaging (MRI), and echocardiography. Babyn[8] summarized several tests that may help to confirm the presence or absence of pediatric PTE based on the report of Kearon9). The test results confirming PTE are pulmonary angiography (an intraluminal filling defect), spiral CT (an intraluminal filling defect in a lobar or main pulmonary artery), a ventilation-perfusion scan [a high-probability scan when combined with moderate/high clinical probability and evidence of acute deep vein thrombosis (DVT) with clinical suspicion of PTE]. The test results excluding PTE are normal pulmonary angiography and a normal ventilation-perfusion scan. A non-diagnostic ventilation-perfusion scan or normal helical CT with normal proximal upper/lower venous sonography and low clinical suspicion for PTE may not exclude a non-obstructive central clot. In our case, chest CT with CT angiography showed a filling defect in the right lung, and 99mTc MAA lung perfusion scintigraphy revealed multiple perfusion defects. These imaging findings helped to confirm the presence PTE and thus we started the anticoagulation therapy.

In general, the treatment of pediatric patients with PTE must be guided by the risks associated with the clinical condition of the individual patient. Patients with stable hemodynamics can be anticoagulated to prevent extension of the thrombus and the development of late complications, such as recurrences. In patients with unstable hemodynamics, such as shock, a quick reduction of the thrombus mass using more aggressive therapy, such as thrombolysis, might improve

right ventricular function. The management of children with PTE includes supportive care, anticoagulant therapy with heparin or LMWH, warfarin, thrombolysis, inferior vena cava filters, and surgical or interventional thrombectomy[10-12]. Since large clinical trials of anti-thrombotic therapy are lacking, children are treated according to recommendations based on small pediatric studies and clinical trials in adult populations [13, 14]. The most frequently used anticoagulant for the initial treatment of pediatric venous thromboembolic disease is unfractionated heparin[2, 3]. The disadvantages of unfractionated heparin include its unpredictability due to the variability in the plasma levels of heparin-binding proteins[15]. Therefore, careful laboratory monitoring of the aPTT is critical. An alternative anticoagulant is LMWH. Compared to unfractionated heparin, LMWH has a reduced capacity to bind to plasma proteins, endothelial cells and macrophages. Therefore, it has greater bioavailability, a more predictable anticoagulant response, and a longer half-life. In this case, we used LMWH for 2 weeks to prevent further thrombus formation, and no complications occurred, except bruising at the injection site. And patient didnt show recurrence of pulmonary thromboembolism.

The outcome of pediatric pulmonary embolism, including the mortality, risk of recurrence, and effects on pulmonary function, is unknown. To improve the care of children with pulmonary embolism, multicenter and international prospective trials are essential.

한 글 요 약

건강한 영아에서 발생한 폐혈전색전증 1례

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폐혈전색전증은 혈전에 의해서 폐동맥이 갑자기 막혀 폐동맥 혈류의 장애를 초래하는 질환으로 1861 Steveson에 의해 처음 보고되었다. 소아에서는 매우 드문 질환이나 최근에는 소아 치료 기술의 향상으로 장기 입원 환자가 늘고 중심정맥도관 삽입 기회가 늘어남에 따라 그 발병률이 증가되었을 것으로 추정된다. 임상증상은 비특이적이며, 폐혈류 장애정도와 질환의 급성도에 의해 중증도가 결정되어 임상증상만으로 이 질환을 진단하기는 어렵다. 먼저 위험인자가 있는 환아에서 질환을 의심하고 이에 따른 영상검사를 시행하여 확진되거나 의심되면 치료를 시작하는 것이 중요하다. 아직 소아에서의 치료에 대해서 연구가 부족한 상태로 성인을 대상으로 시행한 연구에서 효과적이라고 알려진 치료법을 소아에 적용하고 있는 실정이다. 국내에서는 건강한 영아에서 발생한 폐혈전 색전증의 진단이나 치료에 대하여 보고된 바가 없어 저자들은 객혈을 주소로 내원한 위험요인이 없었던 건강한 환아에서 폐혈전색전증을 진단하고 저분자량 헤파린 치료를 통해 회복된 1례를 경험하였기에 문헌 고찰과 함께 보고하는 바이다.

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