POSTOPERATIVE PULMONARY THROMBOEMBOLISM AFTER REMOVAL OF A PARASAGITTAL MENINGIOMA: CASE REPORT AND LITERATURE REVIEW

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Abstract

Pulmonary thromboembolism as a postoperative complication of neurosurgical procedure is seldom reported in Taiwan. Hence we present a patient of parasagittal meningioma who suffered symptomatic pulmonary thromboembolism 10 days after tumor excision operation. Early diagnosis and immediate treatment offered favorable outcome. By this case report, we hope that critical care physicians more alert of this complication and through comprehensive review of the literature, judicious use of perioperative thromboprophylaxis should be emphasized in neurosurgical patients.

Key Words: Parasagittal meningioma, Pulmonary thromboembolism, Thromboprophylaxis, Westermark Sign

Introduction

Parasagittal tumors lie near or close to the falx. The falx is a groove that runs between the two sides of the brain extending from front to back, and contains a large blood vessel such as sagittal sinus. Because of the danger of invasion of the blood vessels, removing a tumor in the falx or parasagittal region can be at high risk of vascular complication associated with the venous system. Here we present a case of symptomatic postoperative pulmonary embolism following removal of a parasagittal meningioma.

Case Presentation

A 59-year-old man had suffered insidious onset of focal convulsion on his left lower extremities one year before he came to a neurologist for help. On August 2011, the frequency increased to one to two episodes per month and the duration, more than 5 seconds. Magnetic resonance image (MRI) study revealed a 3.8x3.3x4.3 cm parasagittal mass with a wide dural base, a dural tail and strong enhancement at right frontal region (Fig. 1). Perifocal edema at right frontal lobe and mild left midline deviation were also noticed with no evidence of intracranial hemorrhage. Thus, he was referred to neurosurgical clinics for surgical intervention. On September 20th 2011, transarterial embolization of tumor-feeding arteries was performed. Patients endured the whole procedure well. On September 22nd Craniotomy with right frontal approach proceeded with the attempt of...
radical tumor excision. After opening the dura, a white color parasagittal tumor was exposed, about 4x4x4 cm in size, consisting of soft content outside and harder inside with calcification. Tumor excision was then operated with Cavitron Ultrasonic Surgical Aspirator after careful coagulation of bleeding points and preservation of normal brain parenchyma. After checking any bleeding or residual tumor by the microscope carefully, the dura was closed by silk and dura form, replacing the prior bone flap, and bone cement was applied along the edge of craniotomy. The duration of operation was 8 hours and 10 minutes. Pathology of the tumor sections show a picture of mixed type meningioma, composed of both fibrous and meningothelial components.

After craniotomy and tumor excision, he was transferred to the critical care unit for postoperative care. No convulsion was noticed. However, mild chest pain with intermittent shortness of breath developed since October 3rd 2011. Chest X-ray showed an abrupt tapering of right inferior pulmonary artery (Fig. 2). Chest computed tomography performed on October 5th confirmed the presence of pulmonary embolism at right main pulmonary artery (Fig. 3A); the right superior and inferior pulmonary arteries were also involved (Fig. 3B). Under the impression of pulmonary embolism, he was treated with intravenous unfractioned heparin followed by oral Coumadin. In the duration of anticoagulant therapy, his hemodynamic was generally stable. Cardiac echo on October 5th showed only mild Tricuspid Regurgitation. The estimated right ventricular systolic pressure was 33 mmHg. Bilateral lower extremity duplex...
disclosed diffuse spontaneous contrast echo and partial damping flow in both side deep veins. He was discharged on October 25th with sustained oral Coumadin administration. After a series of hematological study, no inherited prothrombotic disorders were identified; nor did we discover any acquired prothrombotic condition such as antiphospholipid antibody syndrome. Left femoral vein central catheter was introduced on September 22nd and it was removed on September 28th, six days before the onset of symptomatic pulmonary thromboembolism.

**Discussion**

In 1856, Rudolf Virchow proposed a triad of causes for venous thrombosis: stasis, changes in the vessel wall or changes in the blood, but thrombosis begins even with no endothelial injury at the venous valves. They are also areas where stasis and hypoxia may occur. Several important antithrombotic proteins, including thrombomodulin and endothelial protein C receptor (EPCR), were found to be expressed on the valves in a recent study with inter-individual variation, which might be the reason why thrombosis occurs in a certain high risk patient. On the other hand, valvular sinus stasis are associated with a potentially hypercoagulable micro-environment, where oxygen tension drops very rapidly once blood flow is halted. Hypoxia can lead to up-regulation of procoagulant activity including tissue factor on endothelium, and the expression of P-selectin on endothelium leading to the recruitment of leukocytes and tissue factor which can serve as the source for initiation of thrombotic response. Another reason of thrombosis comes from intervention: operation and perioperative procedure with coagulation activation such as femoral central venous catheters. It will certainly be high-risk if the tumor for removal is near the venous sinus draining system of the brain.

Association between pulmonary embolism and perioperative meningioma has been documented since 1991 with two retrospective researches. One reviewed the incidence rate of clinical postoperative deep vein thrombosis (DVT) or pulmonary embolism (PE) in 1703 patients un-
undergoing initial craniotomy for meningioma, glioma, or cerebral metastasis. Patients undergoing surgery for meningiomas had a statistically significant increased risk of DVT or PE despite fewer overall perioperative risk factors, when compared with the other tumor groups. The tumor-specific incidence rates of DVT or PE for meningioma, glioma, and metastasis were 3.09%, 0.97%, and 1.03%, respectively. Another study reporting on the frequency of PE during the hospital stay in a series of 7,250 neurosurgical patients concluded that meningioma was the most frequent intracranial tumor to be affected by this complication. The relationship between meningioma and PE was thus under passionate discussion. Whether the association is caused by prolonged surgery duration or tumor itself is still under debate.

In 1999, two cases that suffered a PE in the first week following surgery for removal of a meningioma were reported. Both patients were treated with anticoagulants, and as a result, both suffered intracerebral hemorrhage requiring further surgery. An inferior vena caval (IVC) filter was then used in both patients to prevent further embolic events. In 2004, a paper describes a clinical case of severe and potentially fatal complication of massive pulmonary thromboembolism in a patient after uncomplicated removal of meningioma of the sphenoid wing. Moreover, an intraoperative fatal pulmonary embolism was proven in 2008 during resection of a parasagittal meningioma. In a recent case series study of postoperative complication of elderly meningioma patients in China, DVT and PE comprised 4.69% (15/320).

Neurosurgical intervention is highly associated with venous thromboembolism (VTE) and PE. In a recent investigation in Japan, prevalence of DVT of the lower legs was 13.5% (5/37). Incidence of pulmonary embolism was 60% (3/5) in patients having DVT. VTE prevalence after neurosurgery was high even under mechanical prophylaxis. Whatever the cause maybe, additional pharmacological prophylaxis is thus considered necessary for patients who undergo neurological procedures. In 2010, a study in China retrospectively analyzed the clinical data of 7 patients who experienced pulmonary thromboembolism after neurosurgical operations. Of these 7 patients, 6 were confirmed with computed tomographic pulmonary angiography (CTPA). This study emphasized that although many risk factors may cause PE perioperatively, postoperative CTPA may be indicated for early diagnosis and treatment if any symptom developed. Pharmacological anticoagulation or other management strategies such as inferior vena cava filter may be considered to improve the outcome.

When it comes to the issue of thromboprophylaxis of neurosurgical populations, recent study in the United States showed that the majority of DVT occurred within the first week after a neurosurgical procedure. There was a linear correlation between the duration of surgery and DVT occurrence. Use of early subcutaneous heparin was associated with a 43% reduction of developing a lower-extremity DVT, without an increase in surgical site hemorrhage, but there was no association of pharmacological prophylaxis with overall PE occurrence. In a systemic review and meta-analysis, after data pooling from six randomized-controlled trials, for every 1000 patients who receive heparin prophylaxis, 91 VTE events will be prevented (approximately 35 of which are proximal deep vein thrombosis or pulmonary embolism), whereas 7 Intracranial hemorrhages and 28 more minor bleedings will occur. In conclusion, heparin prophylaxis for patients undergoing elective cranial neurosurgery reduces the risk of VTE but may also increase bleeding risks. Thromboprophylaxis is only slightly favorable and should be carried out with caution.

References
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矢狀竇旁腦膜瘤摘除術後合併肺血栓栓塞：病例報告與文獻回顧

林志鴻，張坤權

摘要

肺血栓栓塞在神經外科術後的併發症中並不常見。本病例為矢狀竇旁腦膜瘤摘除術後合併有症狀的肺血栓栓塞症。立即的診斷及治療使此病患有良好的臨床結果。希望以此病例報告提醒臨床重症醫師在照護術後患時及早診斷給予適當治療，並從文獻回顧討論靜脈血栓症預防的臨床可行性。

關鍵詞：矢狀竇旁腦膜瘤，肺血栓栓塞症，靜脈血栓症之預防，Westermark Sign

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