



## Pulmonary embolism following an ankle fracture in a 9-year-old boy : A case report

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**Venous thromboembolism following trauma is an uncommon event in childhood and associated pulmonary embolus after routine lower extremity fracture is exceedingly rare. We present a case report of postoperative pulmonary embolus following an open reduction and internal fixation of a Salter-Harris IV medial malleolus fracture in a 9-year-old boy.**

Four days after open reduction and percutaneous pin fixation of the ankle fracture, the child began to experience chest pain and shortness of breath. Computed tomographic angiography demonstrated a pulmonary embolus, and he was started on anticoagulation therapy. The child had no medical history, family history, nor known risk factors for venous thromboembolism other than the fracture, and a thrombophilic work-up revealed no coagulopathies or other blood disorders. He was treated with Coumadin for three months. His orthopedic course was uneventful ; the fracture healed and he returned to normal function.

This appears to be the first case reported in the literature of a significant pulmonary embolus after a routine ankle fracture in a child. While insufficient to warrant deep venous thrombosis prophylaxis in all children, this case report suggests that a venous thromboembolic event can occur even in uncomplicated fractures in children.

**Keywords :** thromboembolism ; pulmonary embolus ; child ; paediatric fracture.

### INTRODUCTION

Venous thromboembolism (VTE) in the adult population is an important and well-documented

source of morbidity and mortality (7,8). The incidence of deep venous thrombosis (DVT) has been reported to exceed 50% without prophylaxis in adult trauma patients (6,11). Pulmonary embolism (PE) is the most serious complication of DVT, with a mortality rate of approximately 25% in the adult trauma population (10,13).

VTE following trauma is an uncommon event in childhood, and while the true incidence is yet undetermined, it is thought to occur in less than 0.1% of the paediatric trauma population (1-3,5,9,12,14,17-19). Lower extremity injury is certainly a risk factor for VTE ; however, VTE and especially PE after a routine lower extremity fracture are exceedingly rare (4,15,16,19).

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*Fig. 1.* — Preoperative radiograph showing Salter-Harris IV fracture of the distal tibia.



*Fig. 2.* — Postoperative radiograph after open reduction and percutaneous pinning of the fracture.

We present a case of postoperative PE following an open reduction and internal fixation of a Salter-Harris IV medial malleolus fracture in a 9-year-old boy. To our knowledge, this is the first report of VTE subsequent to an uncomplicated lower-extremity fracture in a child. The purpose of this study is to emphasize that although rare, awareness of VTE in the pediatric trauma population can help limit potential significant morbidity and mortality.

### CASE REPORT

A 9-year, 8-month-old Asian boy with no known medical history presented to our institution complaining of an injury sustained to his left ankle while playing football. His maternal family history was unremarkable, although his paternal family history was unknown. Radiographs revealed a displaced Salter-Harris IV medial malleolus fracture, and a displaced Salter-Harris I lateral malleolus fracture (Fig. 1). Approximately 24 hours after his injury, an open reduction and internal fixation of this fracture was performed, using a 3 cm medial approach, with smooth pin fixation (Fig. 2). The lat-

eral malleolus fracture was reduced closed, without fixation. A tourniquet was utilized, the patient's blood pressure was 122/82 mm Hg, an Esmarch dressing was used to exsanguinate the limb, and the tourniquet pressure was inflated at 225 mm Hg. The total tourniquet time for the case was 16 minutes. The patient tolerated the procedure well without initial complications, and the limb was placed in a well-padded posterior short-leg splint. He was kept overnight for pain control and observation and was discharged the next day.

Four days later, he began experiencing a stabbing anterior chest pain at rest, worse with inspiration, and shortness of breath. He presented to our Emergency Department where he was diagnosed with a pulmonary embolism in his left main pulmonary artery, detected on computed tomographic angiography. He was initially started on unfractionated heparin, and then transitioned to Lovenox. Two days after initial anti-coagulation therapy, a duplex ultrasound of his bilateral lower extremities demonstrated no deep venous thrombosis. A paediatric haematology consult was obtained, and coagulation studies were performed. The coagulation work-up

Table I. — Coagulation workup and results

Risk Factor	Results
Factor V Leiden	Negative
Prothrombin Gene Mutation	Negative
Protein C	125%
Protein S	81%
ATIII	110%
Cardiolipin Antibodies	Negative
Homocysteine	4.6

(Table I) revealed no coagulopathies or other blood disorders. The patient was subsequently transitioned to Coumadin, which he continued for three months with routine monitoring, with a goal INR of 2-3.

His orthopaedic course was uneventful. He was kept non-weight-bearing in a cast for six weeks until fracture healing. The smooth pins were removed at three weeks. His fracture healed uneventfully (Fig. 3), and at last follow-up, he had returned to normal activities, including sports, without any complaints.

## DISCUSSION

VTE can be a devastating complication, whether it occurs in the setting of chronic medical conditions or with significant trauma. Although VTE in children is a much rarer phenomenon than in adults, the consequences can be equally significant, with a high mortality rate for PE in children (1,3,12). The recognition of the risk of VTE and PE for paediatric trauma patients has increased our ability for earlier diagnosis and better treatment, which ultimately reduces morbidity and mortality.

However, this increased risk for VTE from trauma is usually associated with the most significantly injured trauma victims. Patients who have spinal cord injuries, multiple long-bone fractures, those with significant head injuries, and those patients requiring extended periods of time in the PICU with prolonged periods of non-weight-bearing are routinely considered for prophylaxis against VTE because of their increased risk (2,17,19).



Fig. 3. — Radiographs at 6 months postoperative

Routine lower extremity fractures in children have not generally been considered significant risk factors for VTE. Our literature review found one additional case of a PE after an ankle fracture in a skeletally mature 17-year-old woman, a much different clinical situation than our 9-year-old male football player (4). The haematological workup in the patient in this case report revealed no intrinsic reason for hypercoagulability. Other than the fracture and his non-weightbearing status, no other risk factor for VTE could be determined. Certainly the use of a tourniquet could be questioned to be a risk factor, although the tourniquet time was kept at a minimal and not considered excessive. A tourniquet is routinely used in the ORIF of such fractures.

This is the first case reported in the literature of a significant PE after a routine ankle fracture in a child. This case report suggests that even in those uncomplicated fractures in children, we should all be vigilant for the potential morbidity and mortality that VTE can cause.

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