

The Primary Cause of Embolism in Acute Trauma Patients; Fat Versus Thrombus

Karen Nussbaumer

Massachusetts General Hospital

Harvard Medical School

INTRODUCTION/BACKGROUND

Acute trauma patients are likely to develop symptoms of Acute Respiratory Distress Syndrome (ARDS). It has been considered that the cause of this pulmonary stress is from either embolus of deep venous thrombosis (DVT) or from fat embolus.

Fat embolus is characterized by ARDS, cerebral dysfunction, petechial skin rash and high fever, occurring 12-72 hours after trauma. Fat droplets appear in the circulating blood and embolize the capillaries in the lungs and other organs.

The biochemical theory of fat embolism explains that fat emboli arise from plasma fat when through some type of systemic stimulus associated with trauma and other medical conditions (diabetes mellitus, chronic pancreatitis, alcoholism, sickle cell disease and acute decompression syndrome) chylomicrons coalesce and fuse to form larger fat globules.¹

The incidence of fat embolization is at least 90% in patients who sustain a long bone or pelvic fracture,² however, the diagnosis of fat embolism in trauma patients is often overlooked.³

The failure to recognize fat as the primary cause of embolism can lead to unnecessary prophylactic treatment of DVT. In trauma patients with clear clinical symptoms of fat embolism, any systemic treatment for DVT with heparin, coumadin or otherwise, may be contraindicated due to interference in clotting mechanism which may cause hemorrhage complications.

Clinical scoring of DVT and FES symptoms may assist in the identification of pulmonary distress in trauma patients. (See Charts 1 and 2)

OBJECTIVE/PURPOSE

- 1) To identify the primary cause of ARDS in trauma patients.
- 2) To evaluate the necessity of performing upper and lower extremity venous duplex ultrasound exams on acute trauma patients with ARDS symptoms.
- 3) To recommend clinical scoring for DVT and FES symptoms.

MATERIALS/METHOD

Duplex ultrasound of the upper and lower extremity veins from November 1, 2004 to April 30, 2005.

A total of 134 patients were scanned.

The total number of exams including follow up exams is 358. 164 upper venous duplex ultrasound exams. 194 lower venous duplex ultrasound exams.

Upper venous studies examined the internal jugular, subclavian, axillary and brachial veins. The cephalic and basilic veins were examined when indicated.

Lower venous studies examined the common femoral, femoral, and popliteal veins. The calf veins were examined when indicated.

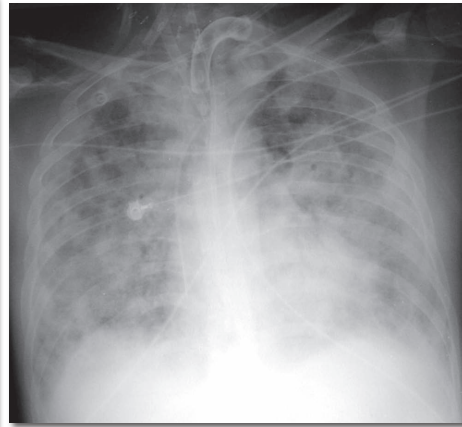


CHART 1 WELLS CLINICAL SCORE FOR DVT*
CLINICAL PARAMETER SCORE

+1	Active Cancer
+1	Paralysis or recent plaster immobilization
+1	Recently bedridden >3d or major surgery <4wk
+1	Collateral superficial veins (non varicose)
+1	Entire leg swelling
+1	Localized tenderness
+1	Calf swelling >3cm compared to asymptomatic leg
+1	Pitting Edema
+1	Previous DVT documented
-2	Alternative diagnosis as likely or >DVT

*Adapted from Anand SS, Wells PS, Hunt D, et al. Does this patient have deep vein thrombosis? JAMA, 1998 April 8;279(14):1094-9.
Total of Above Score > Or = 3 - high probability
1 or 2 - moderate probability
< or = 0 - low probability

CHART 2 NUSSBAUMER CLINICAL SCORE FOR FES
CLINICAL PARAMETER SCORE

0.5	Fever
0.5	Tachycardia
0.5	Fat in sputum
0.5	Fat in urine
+1	Retinal hemorrhage
+1	CNS dysfunction
+1	Hypoxemia
+1	Multiple fractures
+1	Thrombocytopenia
+1	Acute Respiratory Distress Syndrome
+1	Petechial Rash
-1	History of DVT
-1	History of cancer

Total of Above Score > Or = 3 - high probability
1 or 2 - moderate probability
< or = 0 - low probability

RESULTS/ANALYSIS

ULTRASOUND FINDINGS

23 upper venous exams were positive for superficial thrombus in the cephalic and/or basilic vein(s) at an area of IV line placement.

1 upper venous exams revealed nonocclusive internal jugular vein (IJV) thrombus at an area of line placement. Initial scan was negative.

1 upper venous exam revealed nonocclusive brachial vein thrombus at an area of line placement. Initial scan was negative.

1 lower venous exam revealed chronic residual at the level of the common femoral and superficial femoral veins. This patient had a known IVC filter and a history of DVT.

4 lower venous exams revealed acute DVT from the tibial veins to the level of the popliteal vein. No femoral thrombus identified. Two of these patients had a history of cancer and/or DVT.

2 lower venous exams revealed acute DVT to the level of the common femoral vein after prolonged hospital stay, no less than two weeks from admission.

RESULTS/ANALYSIS II

The incidence of acute DVT associated with traumatic event in upper extremity veins is 0.

The incidence of acute DVT associated with traumatic event in lower extremity veins (excluding calf veins) is 2 percent.*

Based on the initial studies, trauma victims have a paucity of DVT and thromboembolism. Other sources of embolus are therefore considered.

* Including factors possibly not associated with a traumatic injury such as history of DVT or cancer, prolonged bed rest, line placement in groin, etc., therefore, the actual incidence of large vessel acute DVT in trauma patients is less than 2%.

CHEST X-RAY ANALYSIS

Chest x-ray of fat embolism reveals a pneumonia-like picture, or "snowstorm" appearance, diffuse bilateral pulmonary infiltrates which classically describes fat embolism, possibly more appropriately termed 'fat pneumonia.'

LAB VALUES

When albumen levels, platelet count and hematocrit are within normal limits, the embolus from thrombus should be considered more likely than from fat. When there is an alteration in coagulation and thrombocytopenia, a diagnosis of fat embolism should be entertained.

CONCLUSION/RECOMMENDATIONS

1) Thrombotic events are very rare (less than 2%) in acute trauma patients. The primary source of embolic insults in patients with acute trauma is fat, not thrombus.

2) It is probably not necessary to perform upper and lower venous ultrasound exams on trauma patients that have evidence of fat embolism when lab values and a clear clinical picture is identified.

3) The use of clinical scoring for DVT and FES symptoms can assist in identifying the primary cause of respiratory distress in acute trauma patients.

References

1. Gurd AR. Fat Embolism: an aid to diagnosis. J Bone Joint Surg BR.1970;52:732-737.
2. Kirland, L: Fat Embolism. Emedicine. Mar 2004.
3. Odegard, K: Fat Embolism: Diagnosis and Treatment. Orthoteers.com.