

Venous Thrombosis

Thrombus formation in deep veins of legs or thighs



Approximately **600,000** new cases are diagnosed in
the U.S. each year

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Thrombus formation in deep veins of legs or thighs



Approximately **one-third** develop pulmonary embolism (PE)

Deep Venous Thrombosis

DVT in the U.S.:

- **Symptomatic PE** is the most important acute complication of DVT
 - **600,000** new DVT cases a year
 - Responsible for **200,000** deaths (more than combined deaths from AIDS and breast cancer)
 - **Leading cause** of preventable in-hospital mortality
- Diagnosis is confirmed in only **20-30%** of ER patients with clinically suspected DVT

Sources:

Society of Vascular Surgeons website, www.vascularweb.org, 1-6-06
Schreiber, D. Deep venous thrombosis and thrombophlebitis.
www.emedicine.com/emerg/topic122.htm, last updated October 2005.

Venous thrombosis: Causes

Precipitating causes are usually:

- **Injury / trauma**
- **Surgery**
- **Cancer**
- **Prolonged inactivity**
- **Bed rest post-op or post-partum**
- **Extended plane or car travel (longer than 4 hrs)**
- **Contraceptives/estrogen therapy**
- **Severe infection**
- **Undiagnosed anticoagulation disorder**

Source: Schreiber, D. Deep venous thrombosis and thrombophlebitis.
www.emedicine.com/emerg/topic122.htm, last updated October 2005.

Venous thrombosis : Risk Factors

- **Over 40 years old**
- **Cancer**
- **Obesity**
- **Previous or family history of DVT/PE**
- **Recent surgery, particularly orthopedic, within past 4 weeks**
- **Paralysis or immobility for longer than 3 days**
- **Contraceptives/estrogen therapy**
- **Pregnancy**
- **Smoking in females**
- **Serious illness: CHF, MI, sepsis, ulcerative colitis**
- **Anticoagulation disorders**
- **Trauma: spinal cord injury, burns, lower extremity fractures**

Venous thrombosis : Symptoms

DVT in Upper & Lower Extremities:

- Sudden swelling in affected limb
- Limb pain/tenderness
- Pain on dorsiflexion of the foot
- Dilated superficial collateral veins
- Cyanosis or pallor
- Warm skin over area of thrombosis
- Lack of distal pulses

Often difficult to differentiate from non-thrombotic disorders



Venous thrombosis: Complications



- **Pulmonary embolism (approximately one-third develop PE)**
- **200,000 deaths from PE every year**
- **Post-thrombotic syndrome leading to Chronic Venous insufficiency, valvular incompetence and venous ulcers**
- **Critical limb ischemia**

Pulmonary Embolism

Venous thrombosis: Diagnostic Tools

- Patient risk factors/medical history
- Physical exam
 - Specific limb symptoms (edema, pallor)
- Duplex ultrasound
- MRI
- Venography
- D-dimer

Venous thrombosis : Treatment Options

Anticoagulation is Standard of Care (heparin, warfarin, LMWH)

Advantages:

- Reduces occurrence of a PE
- Can decrease symptoms
- Easy to administer LMWH
- Only approved treatment at this time

Disadvantages:

- Bleeding complications from long-term use of anticoagulants
- Does not decrease thrombus burden
- Has not been shown to reduce incidence of valve damage

Source: AbuRahma AF. Iliofemoral deep vein thrombosis: Conventional therapy versus lysis and percutaneous transluminal angioplasty and stenting. *Annals of Surgery* 2001; 233(6):752-760.

Venous thrombosis : Treatment Options

Thrombus Removal:

- **Surgical removal**
- **Catheter-directed thrombolytic therapy (off-label)**
- **Mechanical Thrombectomy Device (MTD)**

Thrombus Containment:

- **IVC filters are placed to help prevent PE**

Venous thrombosis: New Treatment Option

A New Option

- **Mechanical Thrombectomy for the removal of venous thrombus**

Mechanical Thrombectomy Advantages

- **On-label**
- **Quick reperfusion**
- **Removal of thrombus vs. dissolving**
- **Can be used with other treatment strategies**

Venous thrombosis: New Treatment Option

Potential benefits:

- Minimally invasive
- May resolve symptoms rapidly
- Further study needed to determine if early thrombus removal preserves normal valve function
- May quickly remove occlusion from body
- May decrease amount and duration of thrombolytics

Potential risks:

- Kidney impairment due to hemolysis
- Embolization including PE

Venous thrombectomy: Clinical Data

Table 3
Clinical Studies of PMT for Treatment of Venous Thromboembolism

Study	Patients (Limbs)	Treatment	Mean Treatment Duration (h)	Thrombosis Outcome	Complications
Kasirajan et al (14)	17 (17)	AngioJet with UK, rt-PA or reteplase	20.2 ± 19.4	Clinical improvement 14 (82%)	Pericardial tamponade in 1 patient (5.9%)
Vedantham et al (15)	20 (28)	Amplatz, AngioJet Trerotola, or Oasis device with UK, rt-PA or reteplase	23.1 ± 13.4	Procedural Success 23 limbs (82%)	Major bleeding in 3 patients (15%)
Vedantham et al (16)	18 (23)	Helix device with or reteplase	24.61 ± 9.8	Clinical success in 22 limbs (96%) grade II/III lysis in 19 limbs (83%)	Major bleeding in 1 patient (5.6%)
Bush et al (12)	20 (23)	AngioJet with UK, rt-PA or reteplase	N/R	Clinical improvement in 17 limbs (74%); complete thrombus removal in 15 limbs (65%)	Retroperitoneal hematoma in 1 patient (5%)
Current study	14 (19)	AngioJet with UK	30.3 ± 17.8	Grade III lysis in 16 limbs (84%)	Major bleeding in 1 patient (7.1%), pulmonary embolism in 1 patient (7.1%)

Note: — rt-PA = recombinant tissue plasminogen activator, UK = urokinase, N/R = not reported

Venous thrombosis: AngioJet® Therapy

Adjunctive Percutaneous Mechanical Thrombectomy for Lower-extremity Deep Vein Thrombosis: Clinical and Economic Outcomes

Hyun S. Kim, MD, Ajanta Patra, MD, Ben E. Paxton, BA, Jawad Khan, MD, and Michael B. Streiff, MD

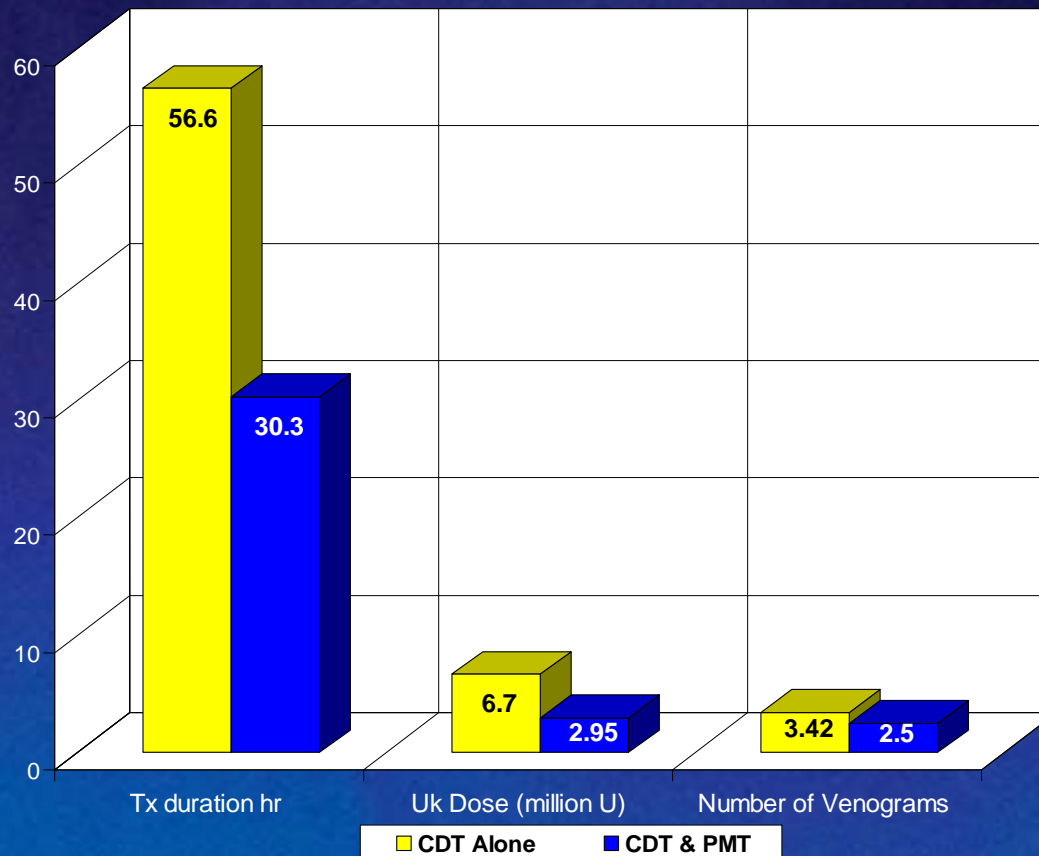
Journal of Vascular and Interventional Radiology, vol.17, number 7, July 2006

CONCLUSIONS:

“Percutaneous CDT with rheolytic PMT is as effective as CDT alone for acute iliofemoral DVT but requires significantly shorter treatment and lower lytic agent dose, resulting in lower costs. Randomized studies to confirm the benefits of pharmacomechanical thrombolysis in the treatment of DVT are warranted.”

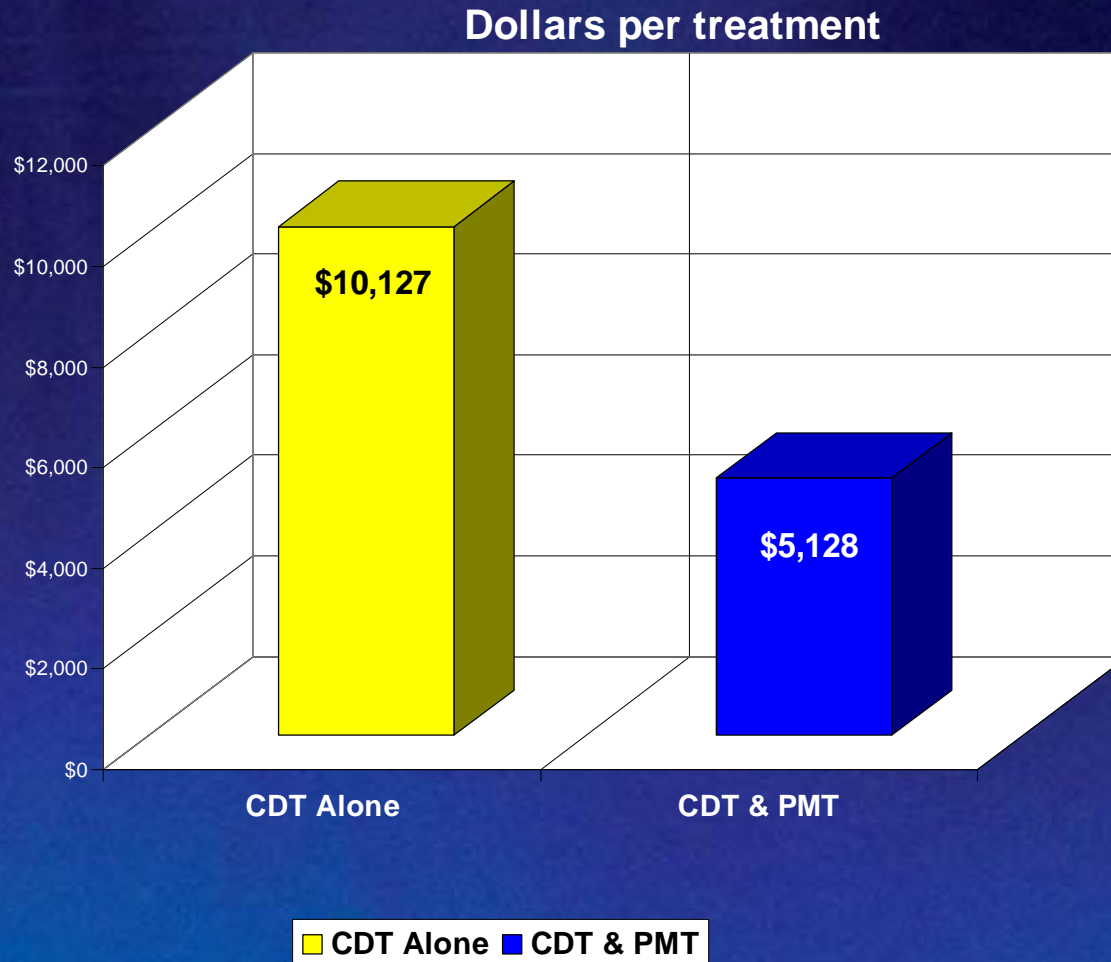
Venous thrombosis: AngioJet® Therapy

A study of pre-treatment using thrombolytic infusions followed by Mechanical Thrombectomy for the removal of Venous Thrombus



Source
Kim et al,
Journal of Vascular and Interventional Radiology
Vol.17,7,July 2006

Venous thrombosis: AngioJet[®] Therapy



Venous thrombosis: AngioJet[®] Therapy

Complications	CDT Alone (26 Limbs)	CDT & PMT (19 Limbs)
Major Bleeding	2 (7.7)	1 (5.3)
Minor Bleeding	1 (3.8)	0
Pulmonary embolism	1 (3.8)	1(5.3)

Venous thrombosis: AngioJet® Therapy

Catheter-direct thrombolysis versus pharmacomechanical thrombectomy for treatment of symptomatic lower extremity deep venous thrombosis

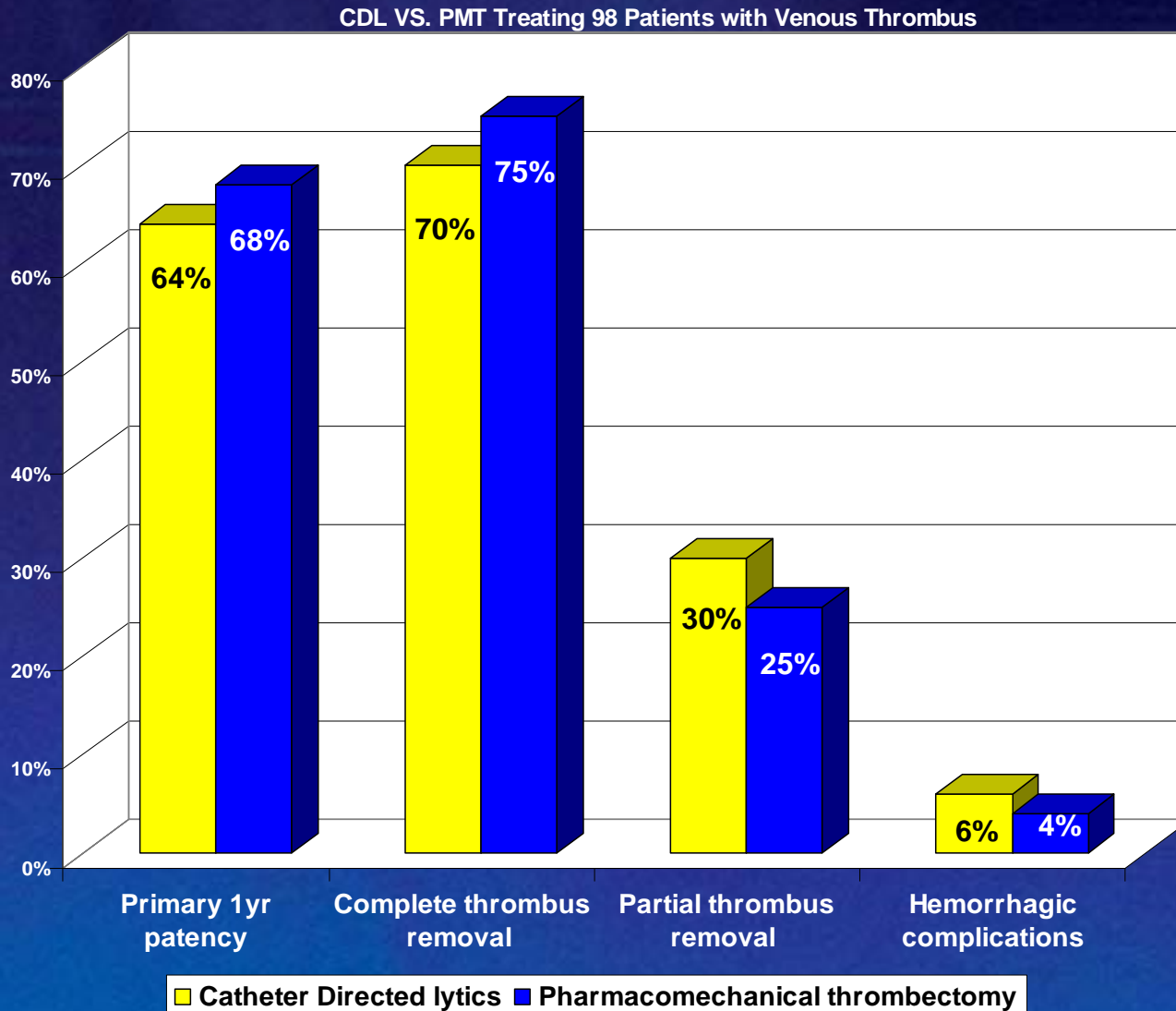
Peter H. Lin, MD, Wei Zhou, MD, Alan Dardik, MD, Firas Mussa, MD, Panos Kougiyas, MD, Nasim Hedayati, MD, Joseph J. Naoum, MD, Hosam El Sayed, MD, Eric K. Peden, MD, Tam T. Huynh, MD

The American Journal of Surgery vol.192, number 6, Dec. 2006

Conclusions:

“PMT with adjunctive thrombolytic therapy is an effective treatment modality in patients with significant DVT. When compared to CDT, this treatment provides similar treatment success with reduced ICU, total hospital length of stay and hospital costs.”

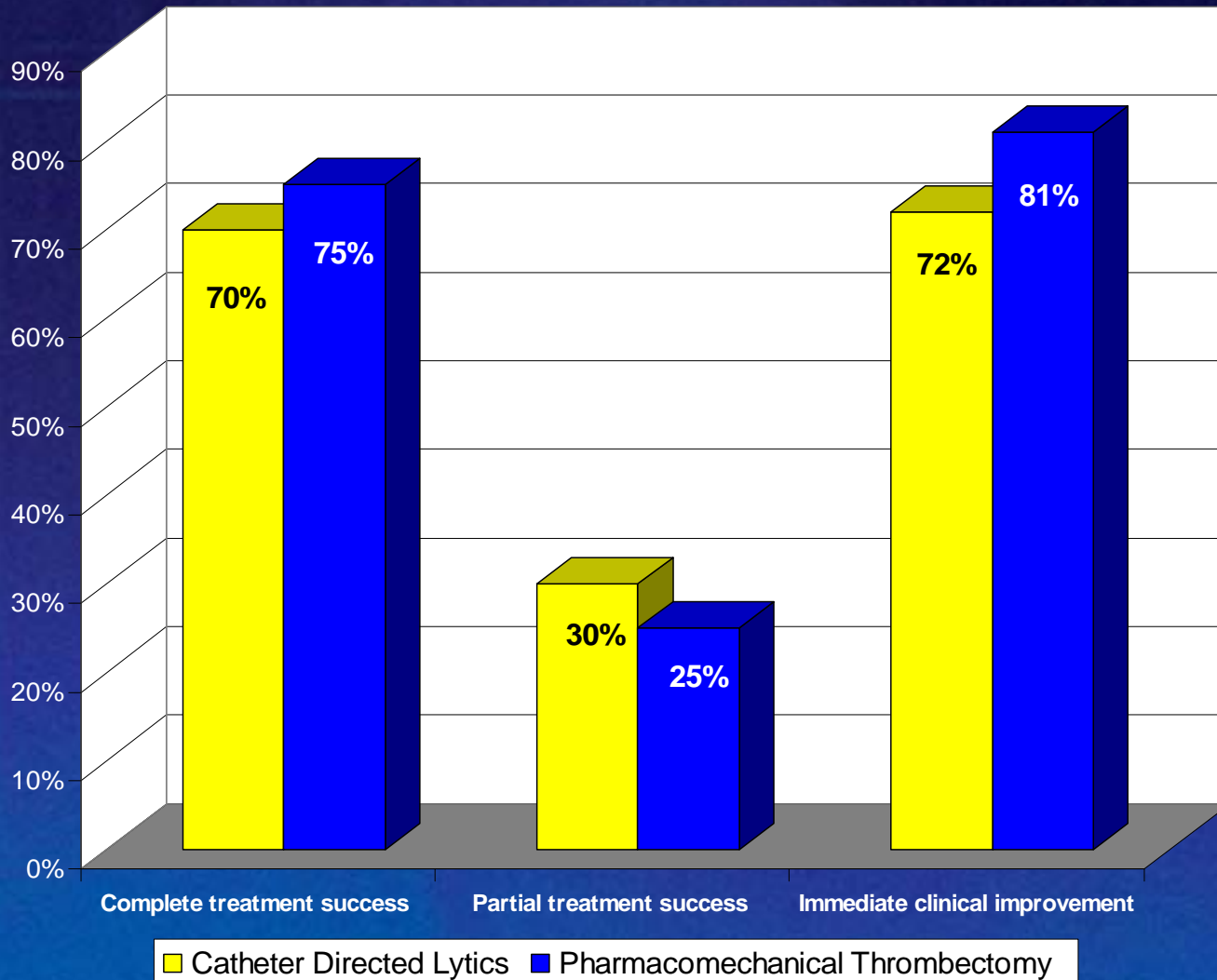
Venous thrombosis: AngioJet[®] Therapy



Source
Lin et al,
American Journal of Surgery
Vol.192 ,6, Dec. 2006

Venous thrombosis: AngioJet[®] Therapy

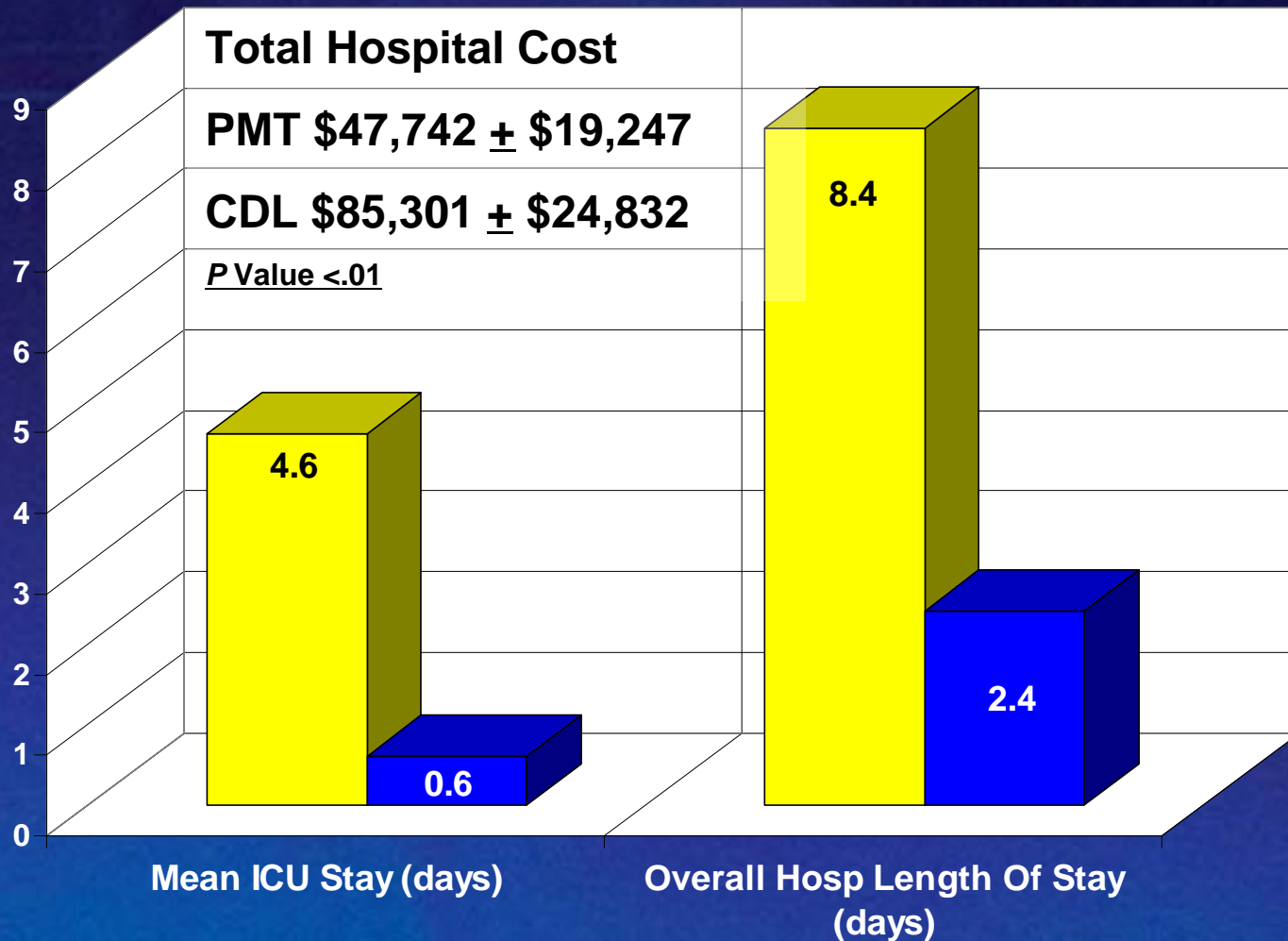
Treatment Outcomes CDL vs. PMT 98 Patients



Source
Lin et al,
American Journal of Surgery
Vol.192 ,6, Dec. 2006

Venous thrombosis: AngioJet[®] Therapy

Hospital Stay & Associated Costs



Venous thrombectomy: MTD results

Preliminary MTD Results in DVT Removal

Retrospective review:

- 7 participating centers
- 44 patients
- Mean age 50.9
- Upper and lower extremity DVTs

Thrombolytics:

- Pre-MDT: 24 (55%)
- Post-MDT: 25 (57%)
- No thrombolytics: 10 (23%)
- PTA: 16 (41%)
- Stent: 16 (41%)
- IVC filter: 5 (11%)

Major complications hemaglobinuria/hematuria following MTD,

- **Following MTD, reported in 6 patients (14%).**
- **All were successfully resolved in 48-72 hours.**

Sources:

Kasirajan K, et al. Rheolytic thrombectomy for management of venous thrombosis: Results of a multi-center venous registry. *Journal of Vascular Interventional Radiology* 2003;14:S16.

Venous thrombectomy: MTD Results

In 44-patient retrospective study:

50% had
> 90% of
thrombus
removed

25% had
50-90% of
thrombus
removed

16% had
≤ 50% of
thrombus
removed



Sources:

Kasirajan K, et al. Rheolytic thrombectomy for management of venous thrombosis: Results of a multi-center venous registry. *Journal of Vascular Interventional Radiology* 2003;14:S16.

Emergency THROMBUS Management