Retrospective analysis of the efficacy and safety of interventional techniques in the treatment of severe, acute pulmonary embolism
Disclosure

Speaker name: Thomas Heller

I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other(s)

X I do not have any potential conflict of interest
Epidemiology of PE

US: 600.000/y, 150.000 – 300.000 lethal
80/100.000 (NCHS 2007)
1/3 postmortem (NEJM 358, 2008, 1037-1052)

Europe: 210/100.00 (Nordstrom M, Lindblad B. Autopsy-verified venous thromboembolism within a defined urban population—the city of Malmo, Sweden. APMIS 1998;106: 378–384)

Course: 10% - 30% lethal (wo treatment) (Nowak, Radiologe 2007; 47: 663-672)


VTE Impact Assessment Group in Europe (VITAE) Estimation in 2004

<table>
<thead>
<tr>
<th></th>
<th>Outpatient</th>
<th>During hospital stay</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>200.482</td>
<td>265.233</td>
<td>465.715</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>86.511</td>
<td>209.471</td>
<td>295.982</td>
</tr>
<tr>
<td>VTE associated death</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient on anticoagulation</td>
<td>8.124</td>
<td>18.349</td>
<td>26.473</td>
</tr>
<tr>
<td>Patient not on anticoag.</td>
<td>63.541</td>
<td>153.853</td>
<td>217.394</td>
</tr>
<tr>
<td>Sudden death</td>
<td>36.870</td>
<td>89.275</td>
<td>126.145</td>
</tr>
<tr>
<td>Chronic complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postthrombotic Syndrome</td>
<td>177.236</td>
<td>218.437</td>
<td>395.673</td>
</tr>
<tr>
<td>Pulm. Hypertension</td>
<td>1.173</td>
<td>2.961</td>
<td>4.135</td>
</tr>
</tbody>
</table>
Risk stratification of PE

High risk: Hemodynamic instable with shock
(RR syst. <100 mmHg, Puls >100/min)
30% 30d Mortality in case of shock
60 – 90% 30d Mortality ic of resuscitation

Intermediate risk: Hemodynamic stable with rightventricular dysfunction
1 – 8%

Low risk: Hemodynamic stable without rightventricular dysfunction


PE – treatment options

Systemic thrombolysis

Local thrombolysis

Endovascular approaches

- Thrombus fragmentation and removal by Ballon-PTA, Basket, Aspiration

- Pharmacomechanical thrombolysis
  AngioJet (Boston Sc. (Medrad))
  EkoSonic (BTG)

- Mechanical thrombectomy devices
  Aspirex (Straub)
Management of Massive and Submassive Pulmonary Embolism, Iliofemoral Deep Vein Thrombosis, and Chronic Thromboembolic Pulmonary Hypertension: A Scientific Statement From the American Heart Association


2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism

The Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC)

Endorsed by the European Respiratory Society (ERS)
systemic thrombolysis
local thrombolysis

Placement of the catheter in / on the thrombus, rtpa:

15 mg/pulmonal artery Bolus
1 mg/h, 12 - 24h, control

The more effective, the fresher the fibrin aggregat is
10 x more effective than systemic lysis
AE up to 35% (generally loc. bleeding)

Pieri S, Agresti P; Radiol med (2007) 112; 837-849
Kuo WT et al.; Chest (2008) 134; 250-254
f, 40y, acute right heart failure, emergency op
mechanical thrombus fragmentation

Dormia-Basket

(Pigtail-rotational catheter)
f, 81 y, stroke, dyspnea, DVT, CI for systemic lysis
Ultrasound accelerated thrombolysis - EKOS

Features
- 5.4 Fr catheter
- 106 and 135 cm working length
- 6, 12, 18, 24, 30, 40 and 50 cm treatment zones
m, 74y, after road accident
m, 74y, after road accident
m, 74y, after road accident
Ultrasound accelerated thrombolysis

59 patients, mean age was 63±14 years, and 53%
n = 30 USAT regimen of 10 to 20 mg rtpa over 15 hours
n = 29 heparin
Primary outcome was the difference in the RV/LV ratio from baseline to 24 hours
USAT RV/LV ratio reduced from 1.28±0.19 to 0.99±0.17
heparin group RV/LV ratio 1.20±0.14 to 1.17±0.20
D 90: 1 death (in the heparin group), no major bleeding, 4 minor bleeding episodes (3 in the USAT group (2 hemoptysis, 1 accesssite groin hematoma and 1 in the heparin group (muscular hematoma))

pharmacomechanical thrombolysis - AngioJet
# mechanical thrombectomy - AspirexS

<table>
<thead>
<tr>
<th>Size</th>
<th>Length cm</th>
<th>GW</th>
<th>OD mm</th>
<th>rVD mm</th>
<th>Rotation rpm</th>
<th>MAC ml/min</th>
<th>Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 F</td>
<td>110</td>
<td>0,018</td>
<td>2,0</td>
<td>3 – 5</td>
<td>60.000</td>
<td>45</td>
<td>L-shape</td>
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<tr>
<td>8 F</td>
<td>85</td>
<td>0,018</td>
<td>2,6</td>
<td>5 - 8</td>
<td>40.000</td>
<td>75</td>
<td>L-shape</td>
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<tr>
<td></td>
<td>110</td>
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<tr>
<td>10 F</td>
<td>110</td>
<td>0,025</td>
<td>3,3</td>
<td>7 - 12</td>
<td>40.000</td>
<td>130</td>
<td>8-shape</td>
</tr>
</tbody>
</table>

GW-Guidewire, OD-outer diameter, rVD-recommended Vessel Diameter, MAC-maximum aspiration capacity
Mechanical thrombectomy - Aspirex®S


68 year old male patient, PE
68 year old male patient, PE
68 year old male patient, PAE
68 year old male patient, PE
Own Data

1998 - 2015:
96 patients, 15 – 87 y, mean age: 62y, gender: 35 f, 61 m

pre-intervention CT acute PE, Stage I (high risk)
right ventricular dysfunction (clinic, TTE, CT)

local thrombolysis, aspiration-thrombectomy combined with
local lysis, mechanical thrombus fragmentation (Pigtail,
Dormia-Basket) combined with local thrombolysis,
pharmocomechanical thrombolysis, mechanical thrombectomy

control: clinic, heart ultrasound, angiography, CT-scan
Own Data

mechanical TE: 20 pat.
local thrombolysis: 37
thrombus fragmentation + loc. lysis: 29
EKOS: 10

36 patients (37%) morphologically incomplete recanalisation (23 loc. lysis, 8 Clotbuster, 4 Aspirex, 1 EKOS) but hemodynamic imp.
2 pat (2%) MAE parenchymal bleeding (2 local lysis)
4 pat (4%) MIE bleeding at the puncture site wo rel. (2 ll, 2 EKOS)
3 pat (3%) died on table due to fulminant right heart failure
2 pat died within 30d (2%) (MOF)

PEITHO-Study:  sLyse: 2,6% d, 6,3% b,  2,4% stroke
              Hep:   5,6% d, 1,2% b,  0,2% stroke

Conclusion

Endovascular approaches can be very effective and livesaving.

Different methods with comparable results.

Safe.

RCT not available, need more data.

Optimal devices does not exist.

Operation is on your own responsibility.
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