Cardiopulmonary Collapse Following Ethanol Sclerotherapy

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Disclosure

• Cook Medical Inc.
  - Patent licenses/Royalties

Case 1

70 yo male

• Known AVM in the right shoulder causing left heart overload.
• Treated with 30cc ETOH delivered into the main feeder.
• ETOH given in 10 cc increments followed by compression of the single outflow vein during 20 minutes.
Case 1

- PA pressure was only slightly elevated following the second 10cc ETOH injection.
- After the third 10cc injection the PA pressure increased dramatically followed by right heart failure and systemic hypotension.
- Resuscitation, including Nitroglycerine delivered into the PA, stabilized the situation.
- Following a week in ICU with support the pt recovered.

Case 2

14 yo girl – 50 kg BW
- VM in right leg, previously treated with ETOH with good effect.
- The second ETOH treatment included 46ml ETOH, given in increments during 20 minutes.
- Upon awakening she developed cardiopulmonary arrest and did not respond to resuscitation with NO inhalation and intrapulmonary Nitroglycerine followed by Adenosine.

Case 2

- Urgent placement of ECMO gave temporary improvement.
- Despite all efforts she succumbed to subsequent complications including pneumothorax and G- infections.
- The bloodwork revealed no evidence of hemolysis.

Major complications associated with ethanol sclerotherapy

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Age</th>
<th>Ethanol dose</th>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venous malformation sclerotherapy</td>
<td>21</td>
<td>35 ml ethanol (0.52 ml/kg)</td>
<td>Hypotension, bradycardia, alteration in cardiac contraction, death</td>
</tr>
<tr>
<td>Vascular malformation</td>
<td>--</td>
<td>--</td>
<td>Thrombosis, hypoxia, pulmonary edema, death</td>
</tr>
<tr>
<td>Vertebral hemangioma</td>
<td>32</td>
<td>100 ml 100% ethanol</td>
<td>Bradycardia, apnea, asystole</td>
</tr>
<tr>
<td>Vascular malformation</td>
<td>16</td>
<td>1 ml/kg</td>
<td>Bronchospasm, unilateral pulmonary edema, right heart failure, hemolysis</td>
</tr>
<tr>
<td>Vascular malformation</td>
<td>11</td>
<td>40 ml mixture (0.85 g ethanol per kg)</td>
<td>Tachypnea, hypoxia, bradycardia, pulmonary hypertension, right ventricular dysfunction, pulmonary hypertension.</td>
</tr>
<tr>
<td>Lymphatic malformation</td>
<td>Neonate</td>
<td>--</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Vertebral hemangioma (11 cases)</td>
<td>10-36</td>
<td>5-10 ml</td>
<td>Hypotension, bradycardia</td>
</tr>
</tbody>
</table>


21 yo woman
67 kg
35 ml ETOH
REATH


45 yo woman
60 kg
65 ml ETOH
Systemic hypotension
Survived


VM left leg
31 yo woman
60 kg
50 ml ETOH
Systemic hypotension
Survived


Systemic complications in 7 pts
1 pt died in CPC
Acute Cor Pulmonale and Right Heart Failure Complicating Ethanol Ablative Therapy: Anesthetic and Radiologic Considerations and Management

Shin et al., 2010: Ethanol (single dose) strongly correlates with hemodynamic changes.
Ethanol causes severe pulmonary vasospasm
- Increased RV afterload
- Decreased RV output
- Hemodynamic changes affected more by the single bolus injection volume than by total dose.

Adversely impact RVEDVI and RVESVI with ethanol doses > 0.14 ml/kg
- 11 cc in 80 kg patient
- Progressive increases in PAP, CVP, PCWP and PVRI with increasing bolus dose

Even after RV pressures normalize, RV contractile dysfunction persists for at least 2 hours after one hour of PA constriction in an animal study

Increased peak airway pressure—coughing
- RV dysfunction
- Decreased cardiac contractility
- Treatment:
  - Ventilatory support
  - Pulmonary vasodilators
  - Time—ethanol induced PA pressure resolves over 15 minutes

Responses to acute PA hypertension

Ethanol bolus limited to 8 cc or less
- 20 minute intervals between injections
- Limitation of total dose to less than 1 ml/kg
- Personal preferences mandate 0.5 ml/kg

Recommendations: