Artículo:

Vasoactive drugs. A rational approach
Vasoactive drugs. A rational approach

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DOES THE CHOICE OF DRUG MAKE A DIFFERENCE??

- Though the truth is difficult to accept, often the answer is no
- But often it does
- Therapeutic armamentarium (P,A,C,R,R,OB)
  - BP drugs
    - BB, CEB, direct vasodilators, anesthetics
    - vasoconstrictors
  - catechols
    - variable α and β
    - effects on HR, BP, contractility
  - PDE inhibitors
  - Heart rate/rhythm controllers

HOW DO YOU PICK ONE

- Institutional preference
- One drug fits all
- Drug of the month
  - pizzaphrine pizzarinone
- Hemodynamic analysis and rational selection
  - Algorithm
  - Pressure - volume loops

USE OF VASOACTIVE DRUGS

- What is wrong?
  - Nothing may be the correct (or at least acceptable) answer
- Why is it wrong?
  - Not the topic of this discussion
- What will you do about it?
  - In what order??

PRESSURE-VOLUME LOOPS

- YES - Preload, afterload, contractility
- NO - Rate, rhythm, oxygen balance

CARDIAC CYCLE

Pressures (mmHg)

0 0.2 0.4 0.6 0.8 Time(s)

Electrocardiogram
Heart sounds (phonocardiogram)
Aortic pressure
(at O, the aortic valve opens: at C, it closes)
Left ventricular pressure (— —)
Left ventricular pressure (— —)
(right is similar)
Left ventricular volume
(at C, the mitral valve closes: at D' it opens)
Jugular venous pressure,
showing a, c, and v waves
Carotid pressure
(n= dicrotic notch)
Radial pressure
Pulmonary arterial pressure
Right ventricular pressure

Phases of cardiac cycle
1. Atrial systole
2. Isometric contraction
3. Ejection
4. Isometric relaxation
5. Filling
PRESSURE AND VOLUME VS TIME

YOUR BASIC PRESSURE-VOLUME LOOP

YOUR BASIC PRESSURE-VOLUME LOOP

ESPVR

COMPLIANCE
What is better for your heart

68 year man for CABG x 4 with EF at cath of 15%.

Do you want his BP to be:
- 105/70?
- 156/90?
Remember this is for your heart, probably his as well.

Altering preload

- Increase when too low
  - Hypovolemia
  - Sympathetic blockade
  - Vasodilation
  - Fixed SV
- With
  - Volume
  - ? Vasoconstriction

Altering afterload

- Decrease when too high
  - Ischemia
  - RV overload
  - RV/LV failure
- With
  - Venodilator
  - Diuretic

Altering afterload

- Increase when too low
  - Vasodilation - low BP/hi flow
  - Ischemia?
  - Buy time w/hypotension/volemia
- With
  - Vasoconstrictor

Altering afterload

- Decrease when too high
  - RV/LV failure
  - Hypertension
  - MR/AI
- With
  - Arteriolar dilator
ALTERING CONTRACTILITY

- Increase when too low
  - RV/LV failure
  - Cardiomyopathy
  - Ischemia
  - Stunning

- With
  - Inotropes

ALTERING CONTRACTILITY

- Decrease when too high
  - Ischemia
  - IHSS
  - Hypertension
- With
  - Anesthetics
  - Beta or Calcium Blockade

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>90</td>
</tr>
<tr>
<td>BP</td>
<td>151/82</td>
</tr>
<tr>
<td>PA</td>
<td>20/10</td>
</tr>
<tr>
<td>PAOP</td>
<td>9</td>
</tr>
<tr>
<td>CVP</td>
<td>7</td>
</tr>
<tr>
<td>CO</td>
<td>2.9</td>
</tr>
<tr>
<td>SV</td>
<td>32</td>
</tr>
</tbody>
</table>

SNP (I SWEAR - I ONLY GAVE 3 DROPS)

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<td>HR</td>
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</tr>
<tr>
<td>CO</td>
<td>2.9</td>
</tr>
<tr>
<td>SV</td>
<td>32</td>
</tr>
</tbody>
</table>

A REAL CASE!!

“Just a few drops!!”
Suppose this was a 52 you man, in the PACU after removal of sternal wires??
No pain, bladder small, etc, etc???
Do anything??
Drug choices???
Thomas SJ. Vasoactive drugs

HR  76  
BP  85/50  
PA  29/17  
PAOP  16  
CVP  10  
CO  7.6  
SV  100  

HR  110  
BP  80/50  
PA  40/22  
PAOP  20  
CVP  13  
CO  3  
SV  27  

HR  76  
BP  85/50  
PA  29/17  
PAOP  16  
CVP  10  
CO  7.6  
SV  100  

HR  110  
BP  80/50  
PA  40/22  
PAOP  20  
CVP  13  
CO  3  
SV  27  

HR  110  
BP  80/50  
PA  40/22  
PAOP  10  
CVP  21  
CO  3  
SV  27  

HR  110  
BP  80/50  
PA  40/22  
PAOP  10  
CVP  21  
CO  3  
SV  27
<table>
<thead>
<tr>
<th>Agent</th>
<th>Dosage range</th>
<th>Onset</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitroprusside</td>
<td>0.5-10 µg/kg/min</td>
<td>30-60 sec</td>
<td>1-5 min</td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>5-100 µg/min</td>
<td>1 min</td>
<td>3-5 min</td>
</tr>
<tr>
<td>Esmolol</td>
<td>0.5 mg/kg over 1 min; 50-300 mg/kg/min</td>
<td>1 min</td>
<td>12-20 min</td>
</tr>
<tr>
<td>Labetalol</td>
<td>5-20 µg</td>
<td>1-2 min</td>
<td>4-6 hours</td>
</tr>
<tr>
<td>Propranolol</td>
<td>1-3 mg</td>
<td>1-2 min</td>
<td>4-6 hours</td>
</tr>
<tr>
<td>Trimethaphan</td>
<td>1-6 mg/min</td>
<td>1-3 min</td>
<td>10-30 min</td>
</tr>
<tr>
<td>Phentolamine</td>
<td>1.5 mg/1-10 min</td>
<td>20-40 min</td>
<td></td>
</tr>
<tr>
<td>Diazoxide</td>
<td>1-3 mg/kg slowly</td>
<td>2-10 min</td>
<td>4-6 hours</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>5-20 mg</td>
<td>5-20 min</td>
<td>4-8 hours</td>
</tr>
<tr>
<td>Nifedipine (sublingual)</td>
<td>10 mg</td>
<td>5-10 min</td>
<td>4 hours</td>
</tr>
<tr>
<td>Methyldopa</td>
<td>250-1,000 mg</td>
<td>2-3 hours</td>
<td>6-12 hours</td>
</tr>
<tr>
<td>Nicardipine</td>
<td>0.25-0.5 mg</td>
<td>1-5 min</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>Enalaprilat</td>
<td>0.625-1 mg</td>
<td>6-15 min</td>
<td>4-6 hours</td>
</tr>
</tbody>
</table>

Activity of different inotropic agents (receptor activation or enzyme inhibition)

<table>
<thead>
<tr>
<th>Drug</th>
<th>β₁-AR</th>
<th>β₂-AR</th>
<th>α₁-AR</th>
<th>DA₁</th>
<th>PDE-III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dopamine</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>++++</td>
<td>++++</td>
<td>++++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norepinephrine</td>
<td>++++</td>
<td>++++</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isoproterenol</td>
<td>++++</td>
<td>++++</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dopexamine</td>
<td>±</td>
<td>++++</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amrinone</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Milrinone</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Dosage and actions of inotropic and vasopressor agents

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Predominant action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenergic agents: catecholamines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dopamine</td>
<td>1-2 µg/kg/min</td>
<td>Dopaminergic</td>
</tr>
<tr>
<td></td>
<td>3-10 µg/kg/min</td>
<td>β₁-adrenergic</td>
</tr>
<tr>
<td></td>
<td>&gt; 10 µg/kg/min</td>
<td>α₁-adrenergic</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>0.02-0.2 µg/kg/min</td>
<td>β₁,2-adrenergic</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>5-25 µg/kg/min</td>
<td>β1,2-adrenergic</td>
</tr>
<tr>
<td>Norepinephrine</td>
<td>0.01-0.1 µg/kg/min</td>
<td>α₁-adrenergic</td>
</tr>
</tbody>
</table>

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<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Predominant action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenergic agents: noncatecholamines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phentolamine</td>
<td>20-80 µg/kg/min</td>
<td>α₁-adrenergic</td>
</tr>
</tbody>
</table>

Nonadrenergic agents: phosphodiesterase inhibitors

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Predominant action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amrinone</td>
<td>1.5-3 mg/kg (l)</td>
<td>PDE-III inhibition</td>
</tr>
<tr>
<td></td>
<td>5-20 µg/kg/min (m)</td>
<td></td>
</tr>
<tr>
<td>Milrinone</td>
<td>50 µg/kg (l)</td>
<td>PDE-III inhibition</td>
</tr>
<tr>
<td></td>
<td>0.375-0.75 mg/kg/min (m)</td>
<td></td>
</tr>
</tbody>
</table>

(l), loading dose; (m), maintenance dose; PDE-III, phosphodiesterase III.