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Vasoactive drugs. A rational approach

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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

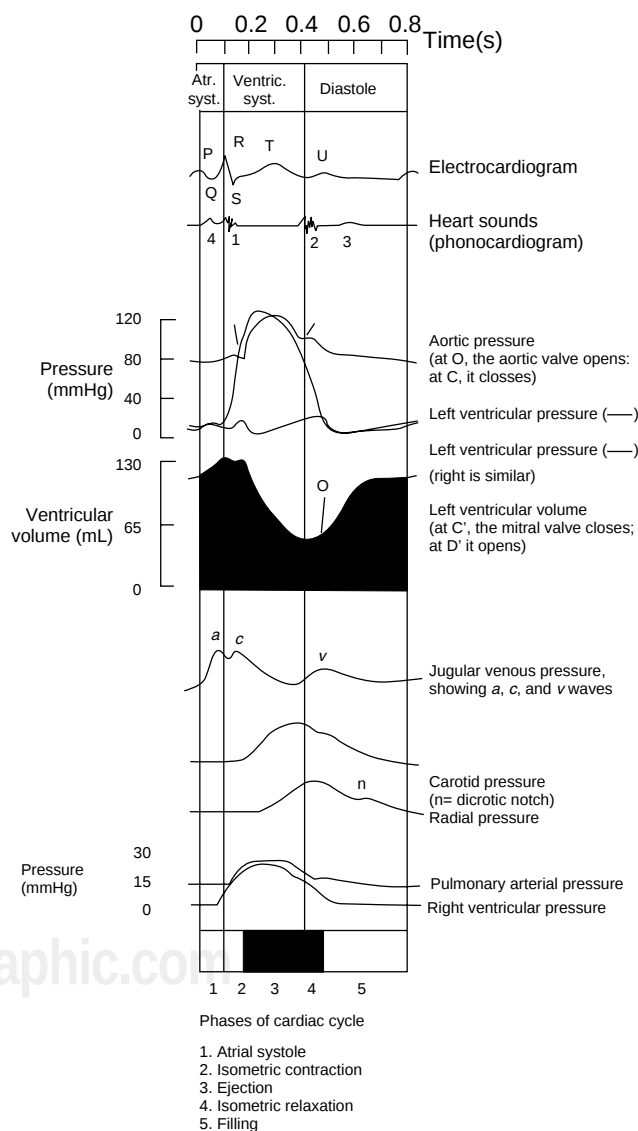
USE OF VASOACTIVE DRUGS

- 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??

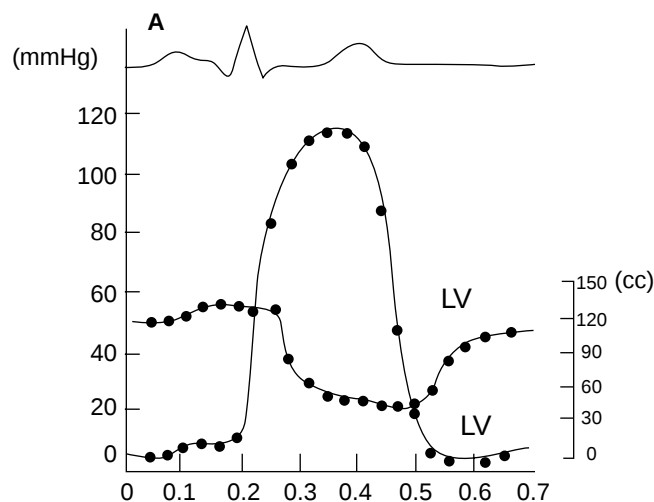
PRESSURE-VOLUME LOOPS

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

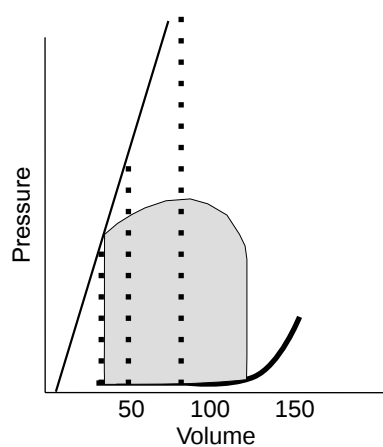
CARDIAC CYCLE



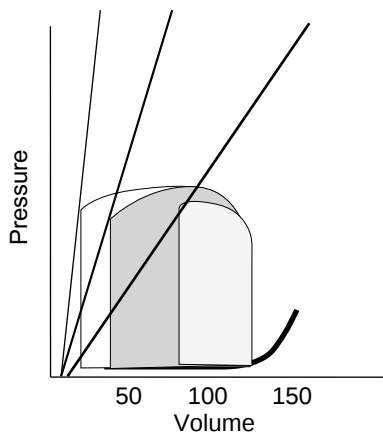
PRESSURE AND VOLUME VS TIME



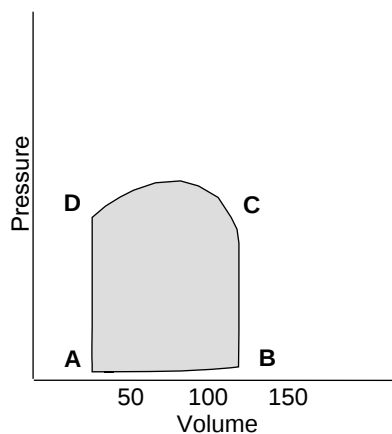
ESPVR



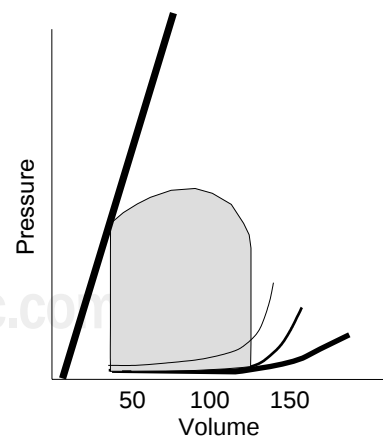
ESPVR



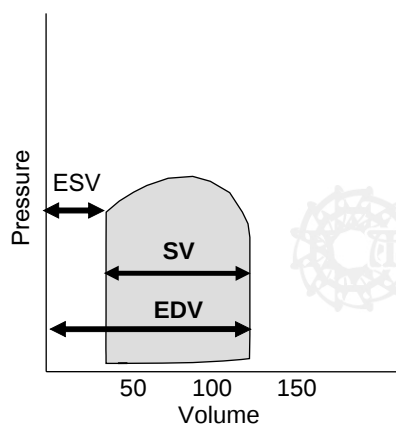
YOUR BASIC PRESSURE-VOLUME LOOP



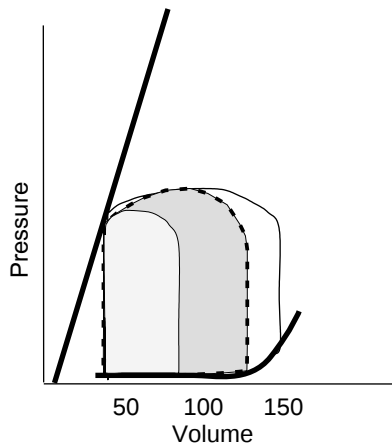
COMPLIANCE



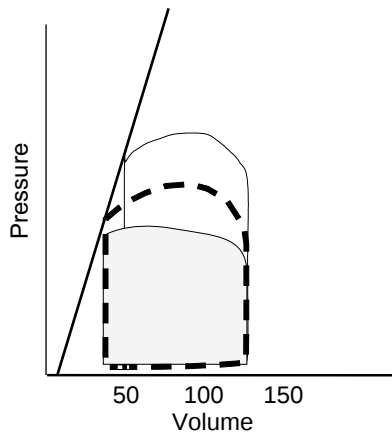
YOUR BASIC PRESSURE-VOLUME LOOP



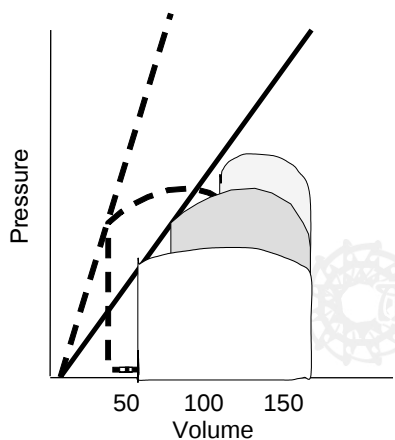
PRELOAD: FRANK - STARLING



AFTERLOAD



AFTERLOAD - NSG HEART THE NSG HEART IS AFTERLOAD DEPENDENT



NSG - not-so-good

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 PRELOAD

- 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

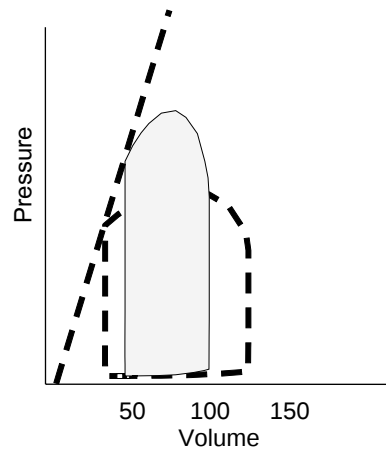
ALTERING CONTRACTILITY

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

ALTERING CONTRACTILITY

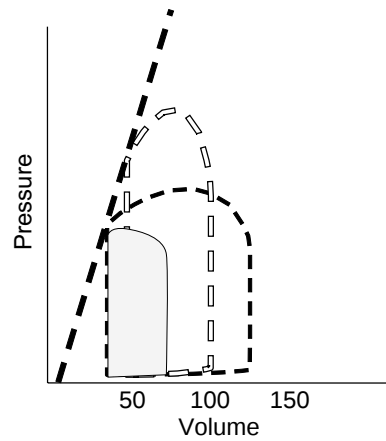
- Decrease when too high
 - Ischemia
 - IHSS
 - Hypertension
- With
 - Anesthetics
 - Beta or Calcium Blockade

HR	90
BP	151/82
PA	20/10
PAOP	9
CVP	7
CO	2.9
SV	32



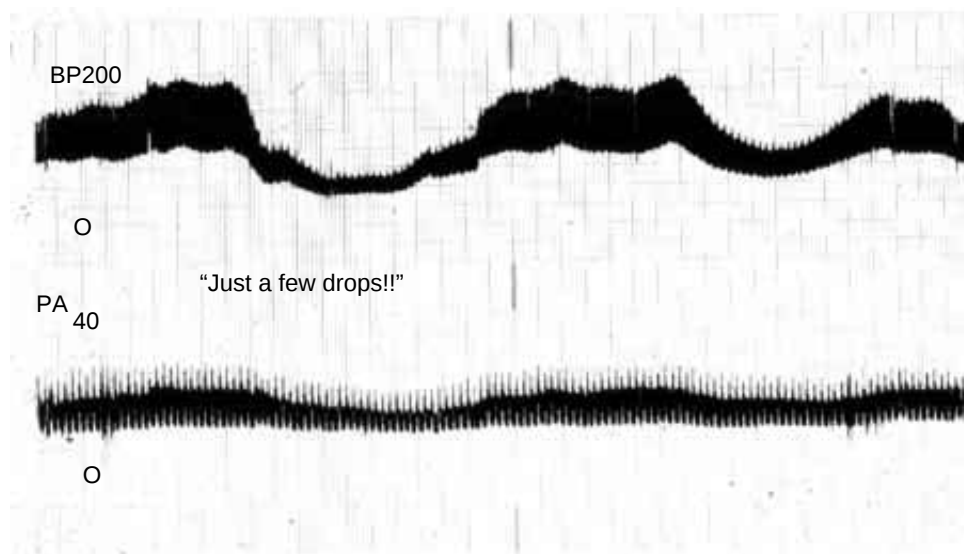
HR	90
BP	151/82
PA	20/10
PAOP	9
CVP	7
CO	2.9
SV	32

SNP (I SWEAR - I ONLY GAVE 3 DROPS)

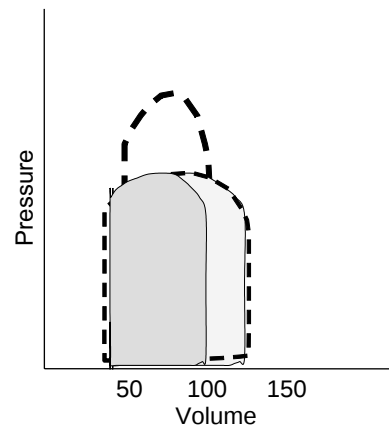


HR	90
BP	151/82
PA	20/10
PAOP	9
CVP	7
CO	2.9
SV	32

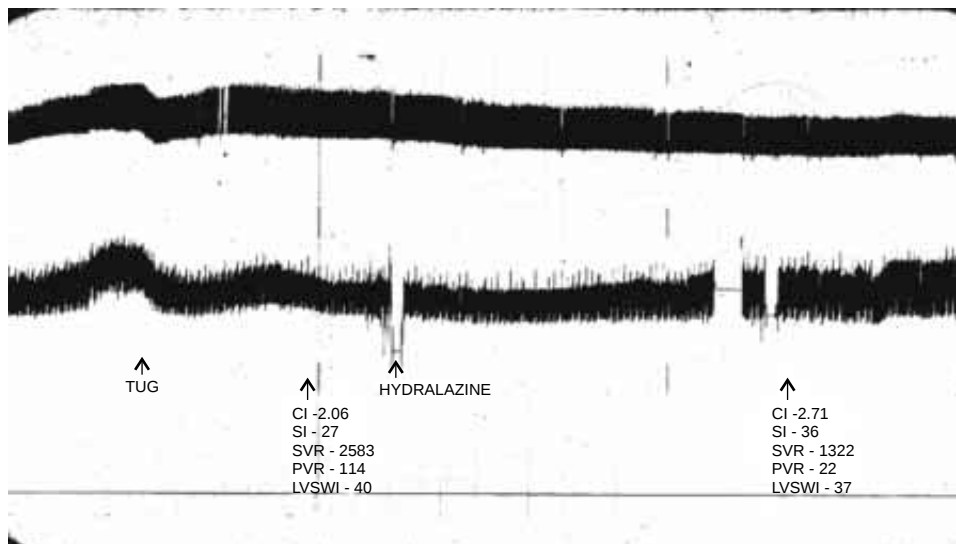
A REAL CASE!!



HYDRALAZINE AND VOLUME



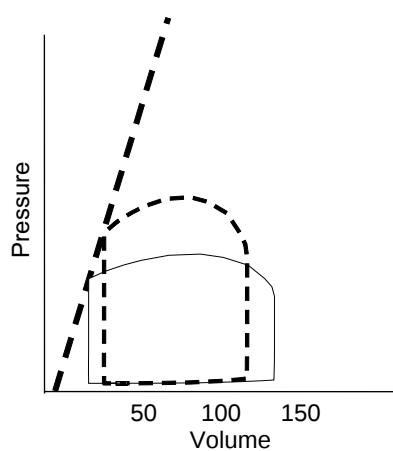
HR	90
BP	151/82
PA	20/10
PAOP	9
CVP	7
CO	2.9
SV	32



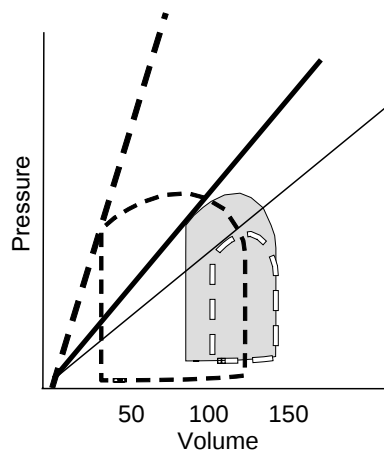
HR	90
BP	151/82

Suppose this was a 52 yo man, in the PACU after removal of sternal wires??
 No pain, bladder small, etc, etc??
 Do anything??
 Drug choices???

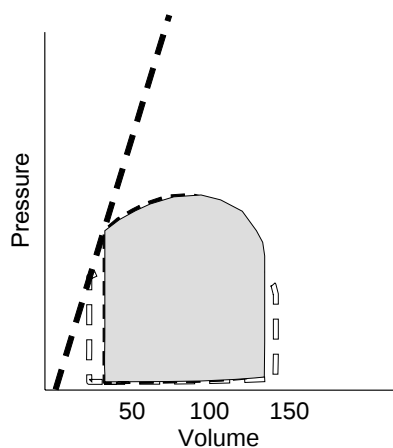
HR	76
BP	85/50
PA	29/17
PAOP	16
CVP	10
CO	7.6
SV	100



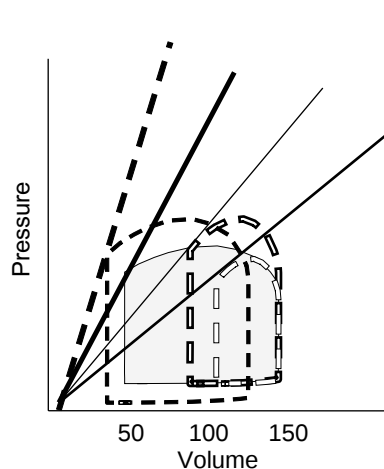
HR 76
BP 85/50
PA 29/17
PAOP 16
CVP 10
CO 7.6
SV 100



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



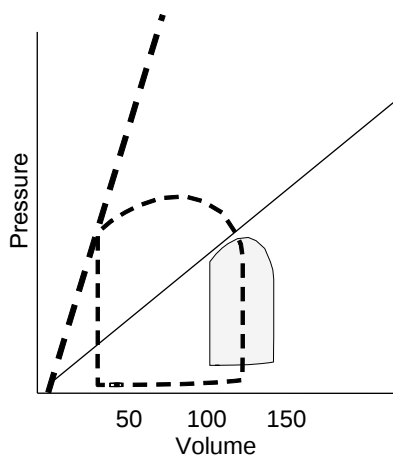
HR 76
BP 85/50
PA 29/17
PAOP 16
CVP 10
CO 7.6
SV 100



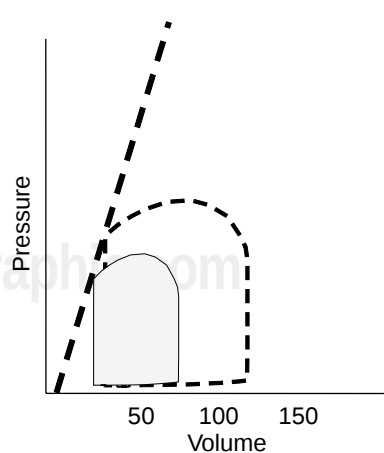
HR 110
BP 80/50
PA 40/22
PAOP 20
CVP 13
CO 3
SV 27

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



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

Agent	Dosage range	Onset	Duration
Nitroprusside	0.5-10 $\mu\text{g/kg/min}$	30-60 sec	1-5 min
Nitroglycerin	5-100 $\mu\text{g/min}$	1 min	3-5 min
Esmolol	0.5 mg/kg over 1 min; 50-300 mg/kg/min	1 min	12-20 min
Labetalol	5-20 μg	1-2 min	4-8 hours
Propranolol	1-3 mg	1-2 min	4-6 hours
Trimethaphan	1-6 mg/min	1-3 min	10-30 min
Phentolamine	1-5 mg/1-10 min	20-40 min	
Diazoxide	1-3 mg/kg slowly	2-10 min	4-6 hours
Hydralazine	5-20 mg	5-20 min	4-8 hours
Nifedipine (sublingual)	10 mg	5-10 min	4 hours
Methyldopa	250-1,000 mg	2-3 hours	6-12 hours
Nicardipine	0.25-0.5 mg	1-5 min	3-4 hours
Enalaprilat	0.625-1 mg	6-15 min	4-6 hours

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

Drug	β_1 -AR	β_2 -AR	α_1 -AR	DA ₁	PDE-III
Dopamine	++	++	++	+++	
Epinephrine	++++	++++	++++		
Dobutamine	+++	++	+		
Norepinephrine	++++		++++		
Isoproterenol	++++	++++			
Dopexamine	±	++++		++	
Amrinone					---
Milrinone					---

Dosage and actions of inotropic and vasopressor agents

Drug	Dosage	Predominant action
Adrenergic agents: catecholamines		
Dopamine	1-2 $\mu\text{g/kg/min}$ 3-10 $\mu\text{g/kg/min}$ > 10 $\mu\text{g/kg/min}$	Dopaminergic β_1 -adrenergic α_1 -adrenergic
Epinephrine	0.02-0.2 $\mu\text{g/kg/min}$	$\beta_{1,2}$ -adrenergic α_1 -adrenergic
Dobutamine	5-25 $\mu\text{g/kg/min}$	$\beta_{1,2}$ -adrenergic
Norepinephrine	0.01-0.1 $\mu\text{g/kg/min}$	α_1 -adrenergic β_1 -adrenergic
Adrenergic agents: noncatecholamines		
Phenylephrine	20-80 $\mu\text{g/kg/min}$	α_1 -adrenergic
Nonadrenergic agents: phosphodiesterase inhibitors		
Amrinone	1.5-3 mg/kg (l) 5-20 $\mu\text{g/kg/min}$ (m)	PDE-III inhibition
Milrinone	50 $\mu\text{g/kg}$ (l) 0.375-0.75 mg/kg/min (m)	PDE-III inhibition

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