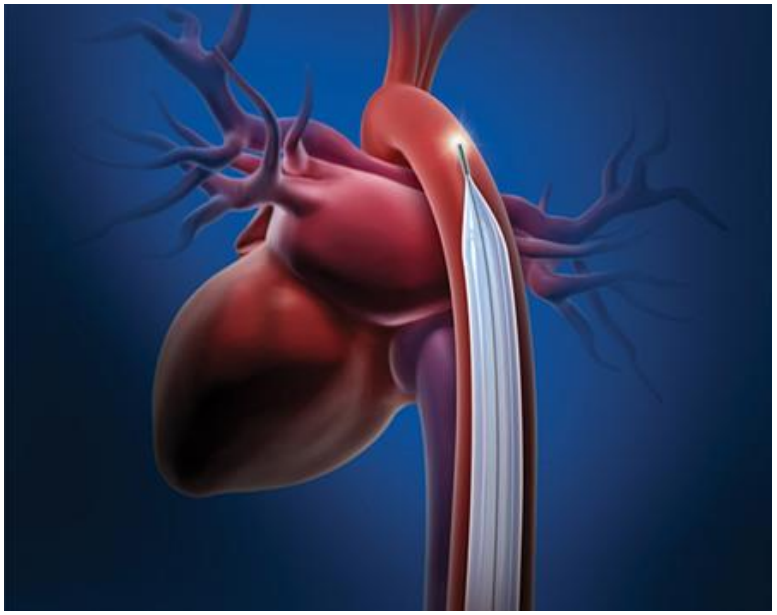
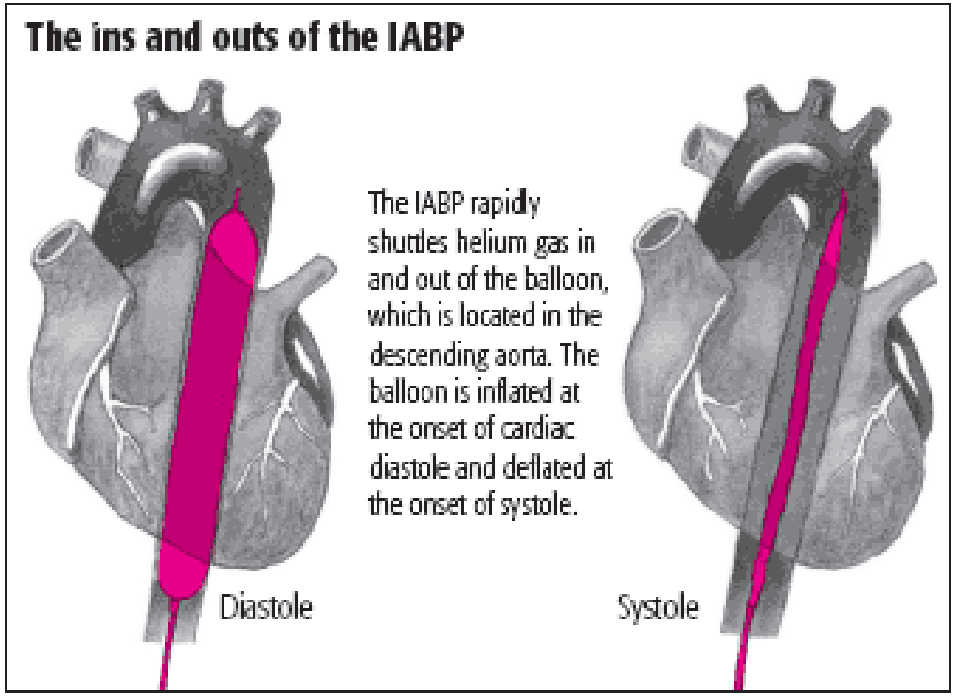
Intra-aortic Balloon Pump: Indications and Interpretation of Tracings



Claudia H. Viens, MD, FRCPC, FASE

IABP

- Goal is to augment myocardial perfusion
  - Increases coronary blood flow during diastole
  - Unloads left ventricle during systole
- Accomplished by mass displacement of blood (30 to 50 mL)



Royal College

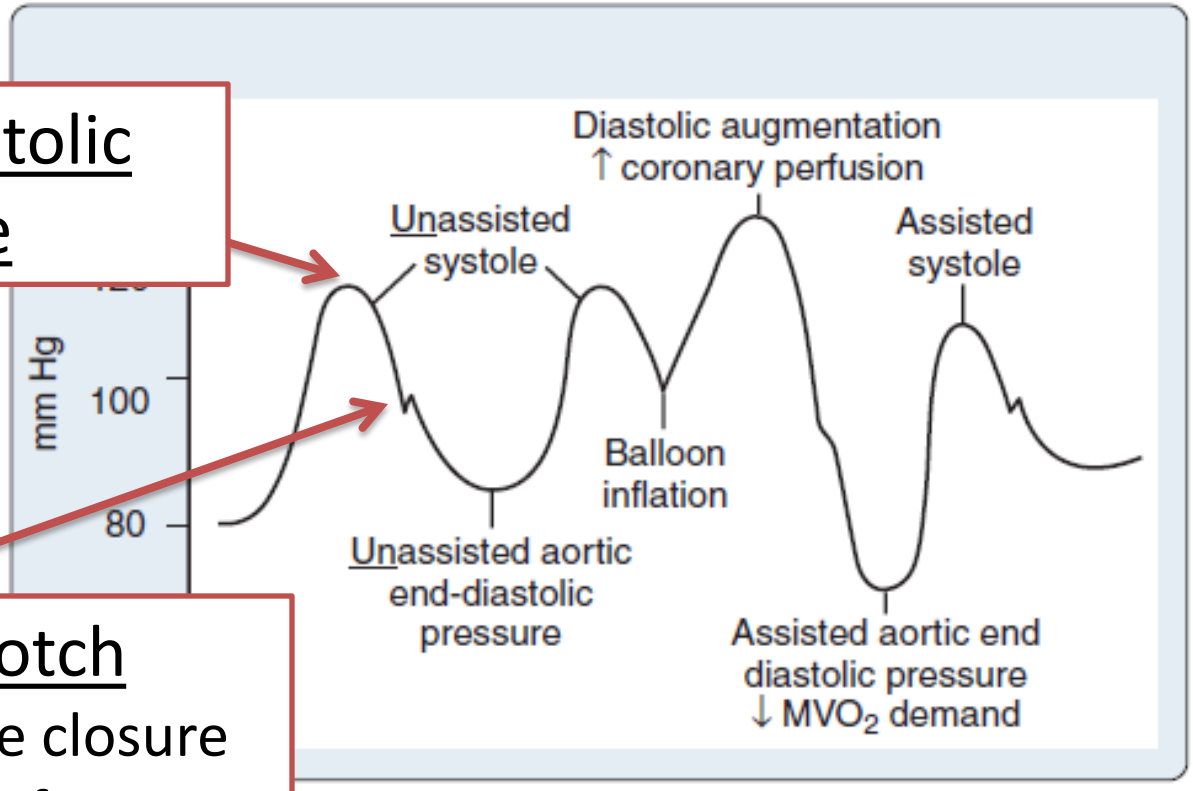
- You are called to the ER for a patient with angina, ST elevations, hypotension and shock….

- Emergency, full stomach
- ACLS algorithm
- Optimize myocardial oxygen supply and demand
  - MONA
    - Morphine
    - Oxygen
    - Nitroglycerin
    - Aspirin
  - Vasopressors
  - Inotropes
  - IABP
- Consult cardiology, cardiac surgery

TABLE 32-10 Intra-aortic Balloon Pump Counterpulsation Indications and Contraindications

Indications	*Contraindications*
1. Cardiogenic shock a. Myocardial infarction b. Myocarditis c. Cardiomyopathy	1. Aortic valvular insufficiency
2. ~~Failure to separate from CPB~~	2. Aortic disease a. Aortic dissection b. Aortic aneurysm
3. Stabilization of preoperative patient a. Ventricular septal defect b. Mitral regurgitation	3. Severe peripheral vascular disease
4. Stabilization of noncardiac surgical patient	4. Severe noncardiac systemic disease
5. Procedural support during coronary angiography	5. Massive trauma
6. Bridge to transplantation	6. Patients with "do not resuscitate" instructions
	7. Mitral SAM with dynamic outflow tract obstruction

Kaplan's Cardiac Anesthesia, 6th edition p. 1002



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e first two waveforms are unassisted, and the last is
he decreased end-systolic and end-diastolic pressures
diastolic pressures caused by IABP augmentation and
t at which balloon inflation occurs. These are wave-
forms generated by a correctly positioned and timed balloon. *(Courtesy of Datascope Corporation.)*

Peak systolic pressure

Dicrotic notch

-Aortic valve closure

-Beginning of isovolemic relaxation and diastole

Kaplan's Cardiac Anesthesia, 6th edition p.1003

Balloon Inflation

-Beginning of diastole for maximum blood volume displacement

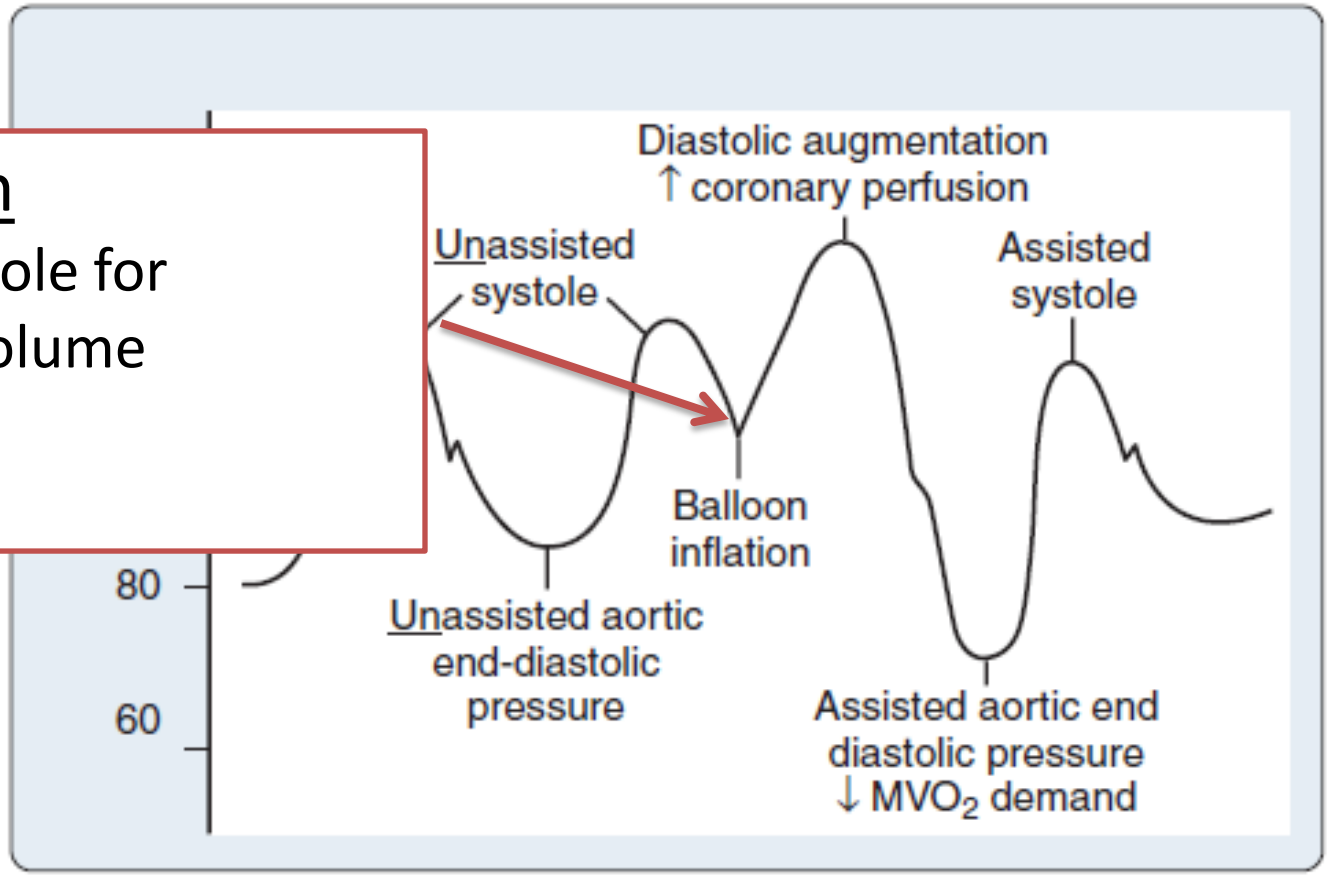


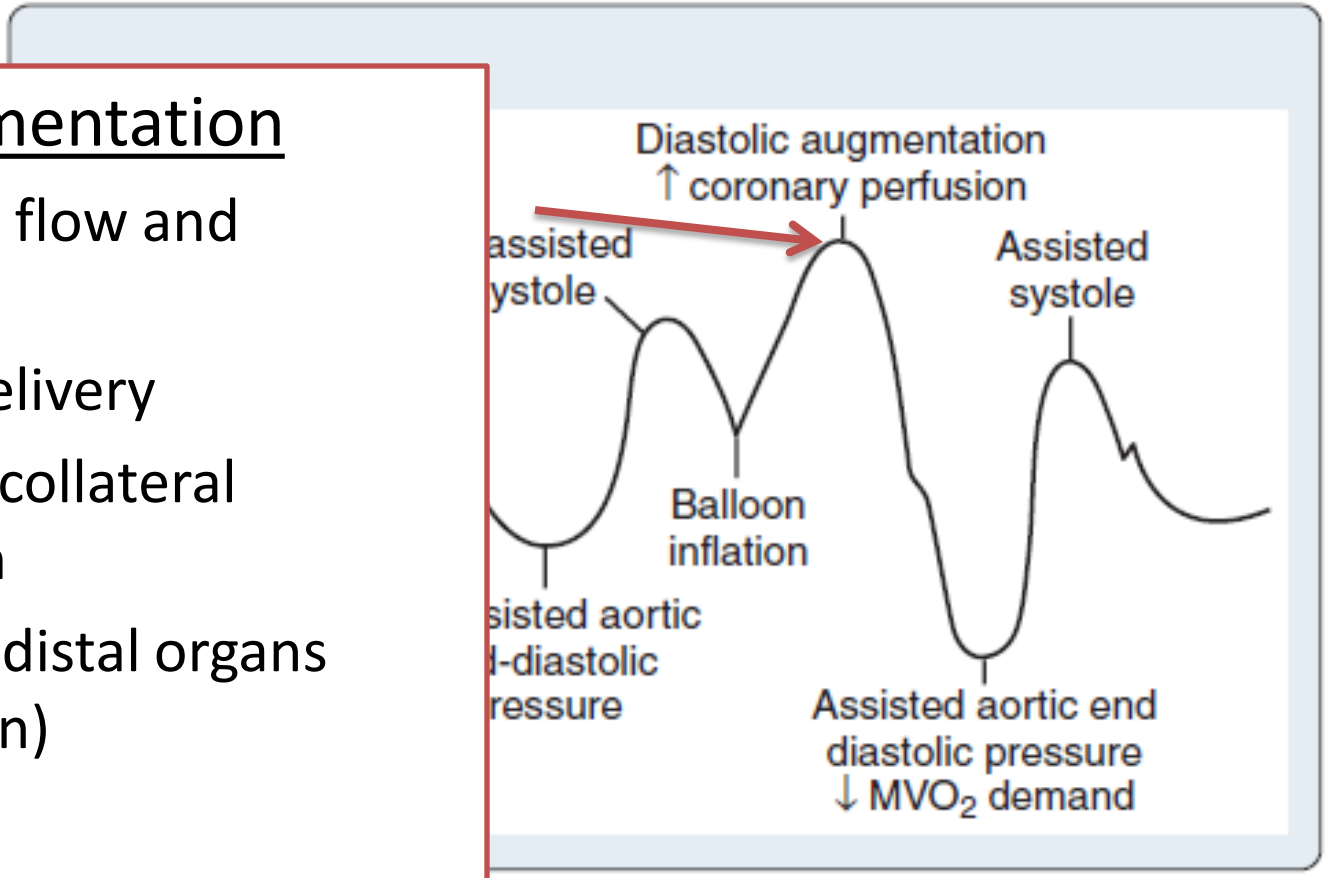
Figure 32-4 Arterial waveforms seen during intra-aortic balloon pump (IABP) assist. The first two waveforms are unassisted, and the last is assisted. Notice the decreased end-systolic and end-diastolic pressures and augmented diastolic pressures caused by IABP augmentation and the (correct) point at which balloon inflation occurs. These are waveforms generated by a correctly positioned and timed balloon. *(Courtesy of Datascope Corporation.)*

Diastolic Augmentation

-Coronary blood flow and pressure ↑

- -↑oxygen delivery
- -↑coronary collateral circulation

-↑ perfusion to distal organs (kidneys, brain)



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Balloon Deflation

-At onset of systole during isovolemic contraction

-Isovolemic contraction is shortened

-Sudden evacuation of 40mL of blood from aorta

-Left ventricle does not have to generate as much pressure to achieve ejection

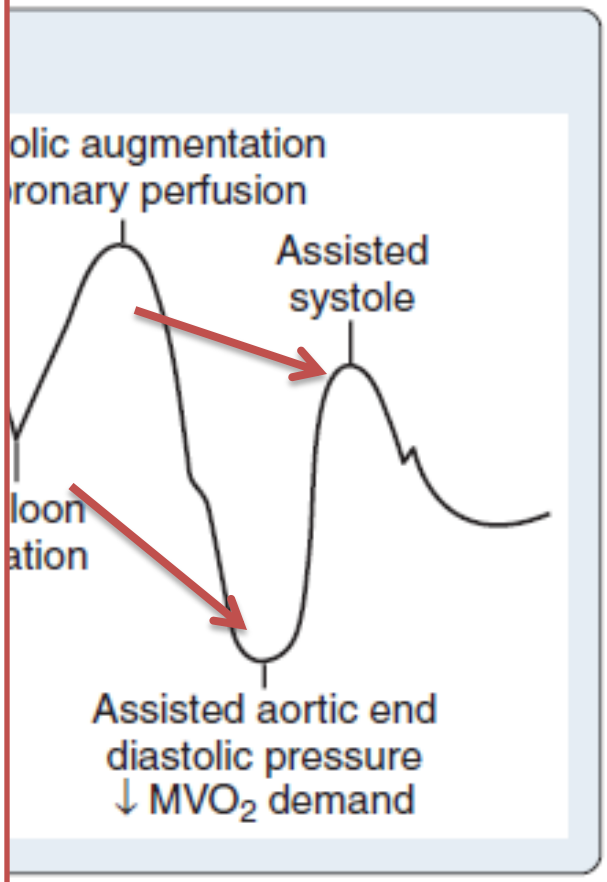
-↓peak systolic pressure

-↓oxygen demand

-Reduced afterload allows ventricle to empty

-↑stroke volume, cardiac output

-↓preload if elevated



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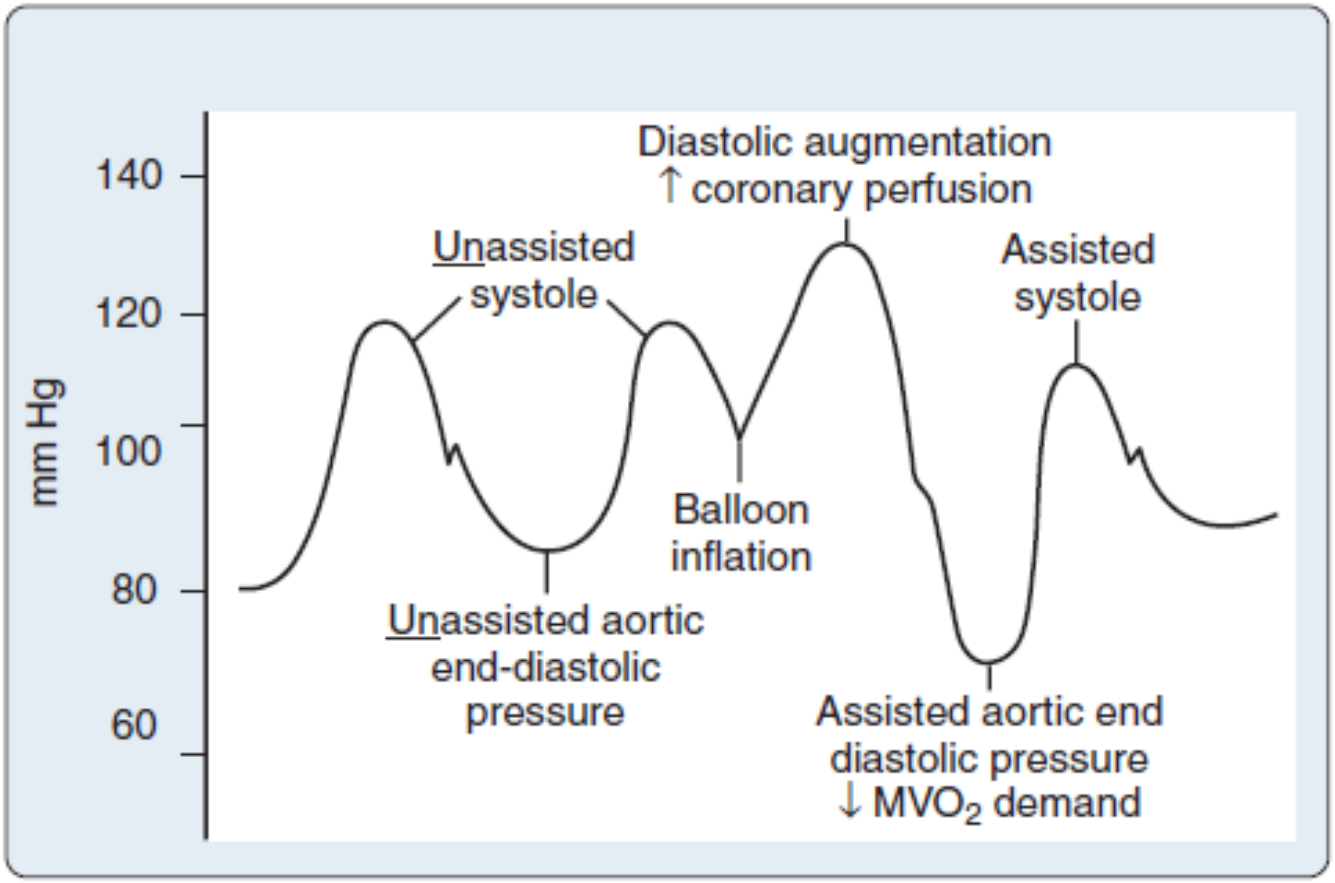

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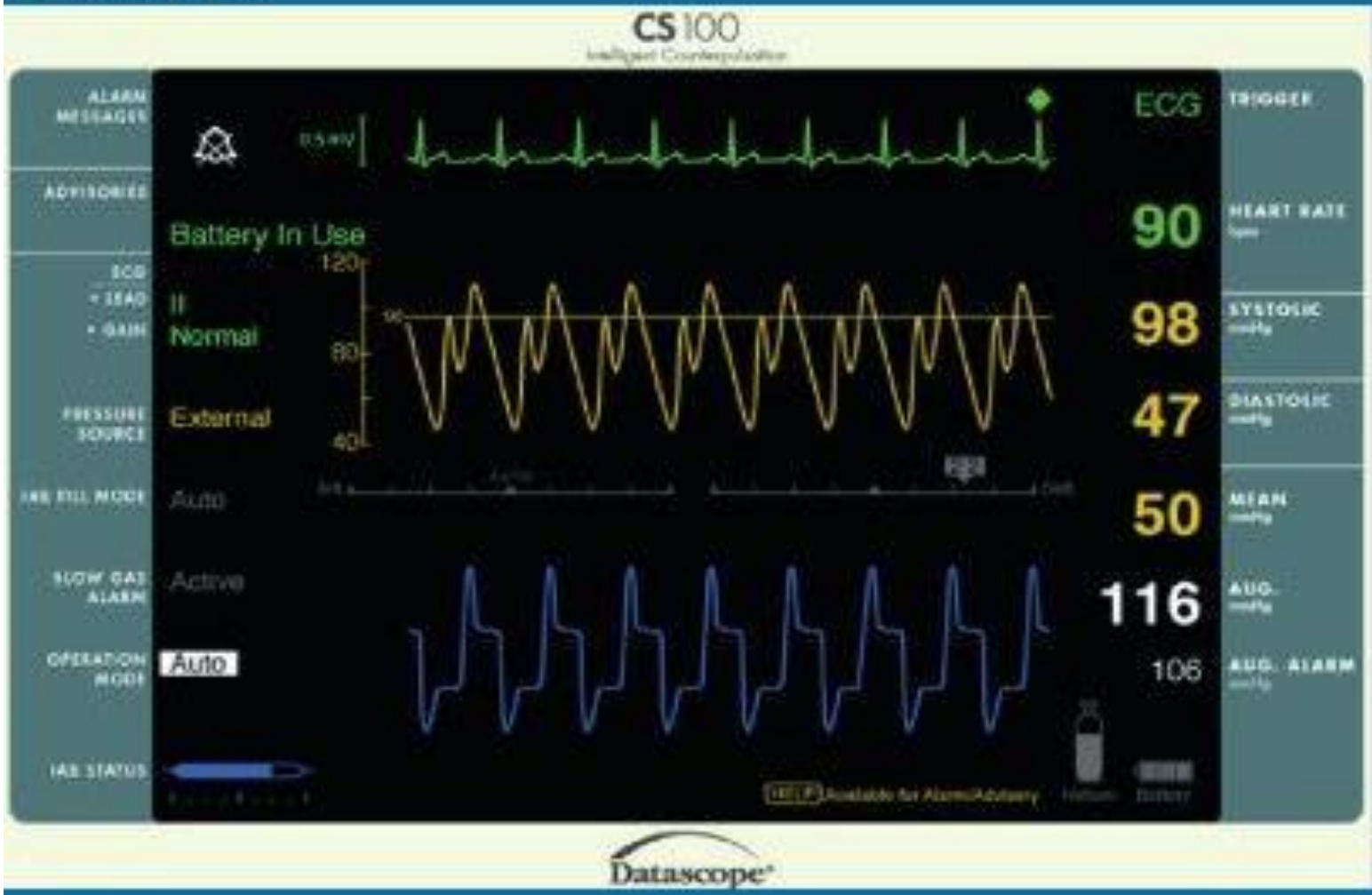

CS 100
ALARM MESSAGES
ADVISORIES
ECG + LEAD + GAIN
PRESSURE SOURCE
IAB FILL MODE
SLOW GAS ALARM
OPERATION MODE
IAB STATUS
Battery In Use
II
Normal
External
Auto
Active
Auto
120
80
40
ECG
90
98
47
50
116
106
TRIGGER
HEART RATE
SYSTOLIC
DIASTOLIC
MEAN
AUG.
AUG. ALARM
Datascope

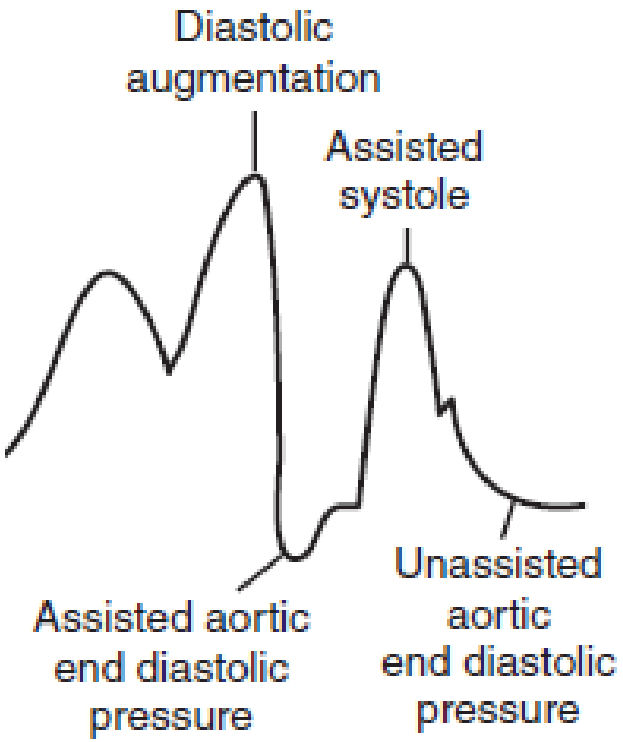
- Increased coronary perfusion
- Decrease myocardial oxygen demand
- Increased cardiac output

Clinical Parameters

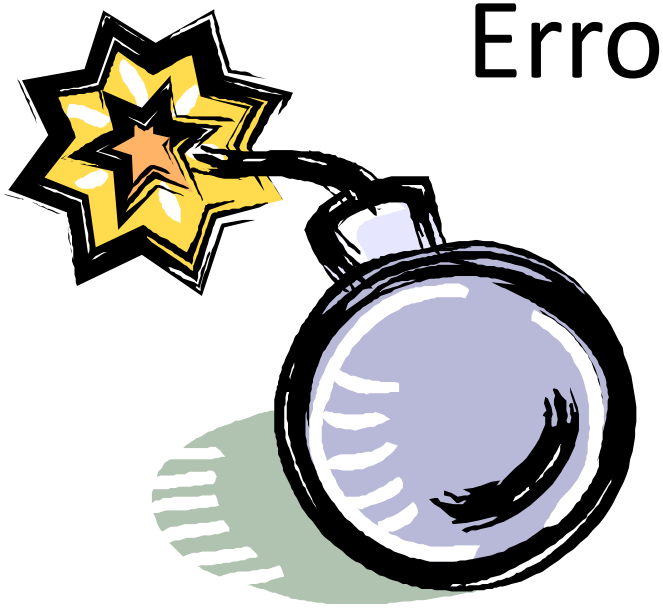
- Decreased signs of ischemia: angina, ST changes, arrhythmias
- Increased coronary blood flow
- Decreased afterload
- Decreased oxygen demand
- Increased cardiac output
- Increased urine output
- Decreased preload (PCWP, CVP)
- Decreased pulmonary congestion, improved arterial oxygenation
- Improved mentation
- Decreased heart rate
- Decreased lactic acidosis
- Increased pulse pressure

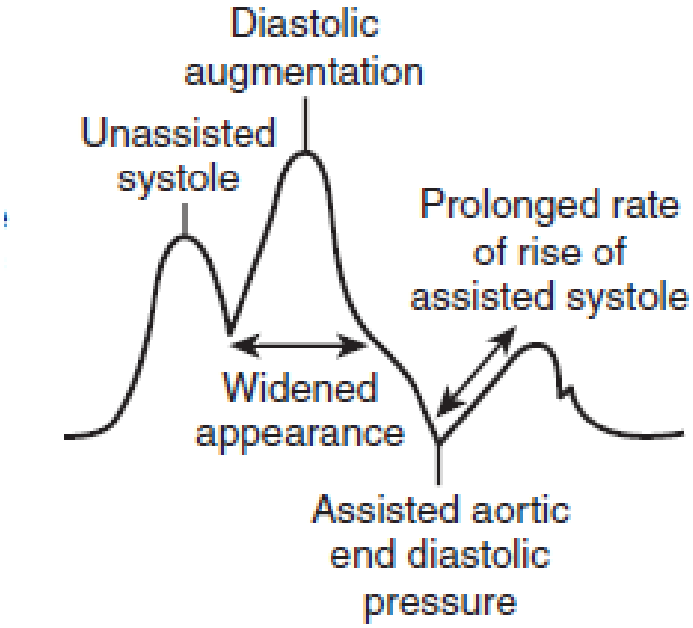
Counterpulsation Applied An Introduction to Intra-Aortic Balloon Pumping. Arrow international. Table 2 p23.

Errors in Timing



Errors in Timing





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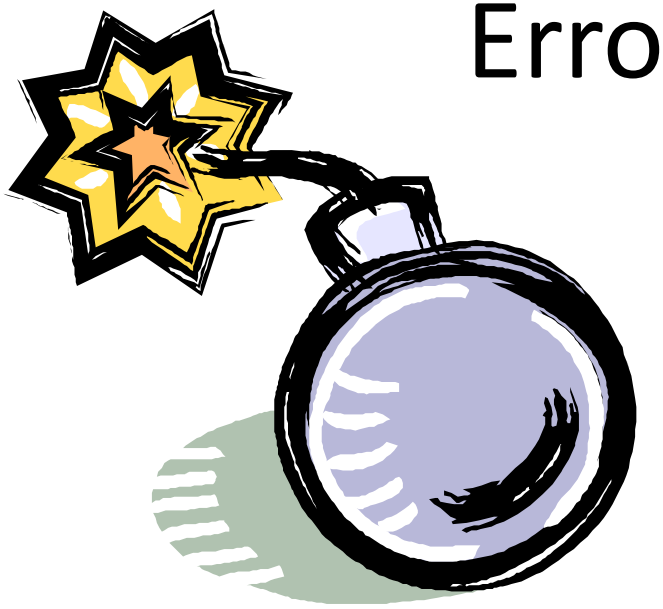
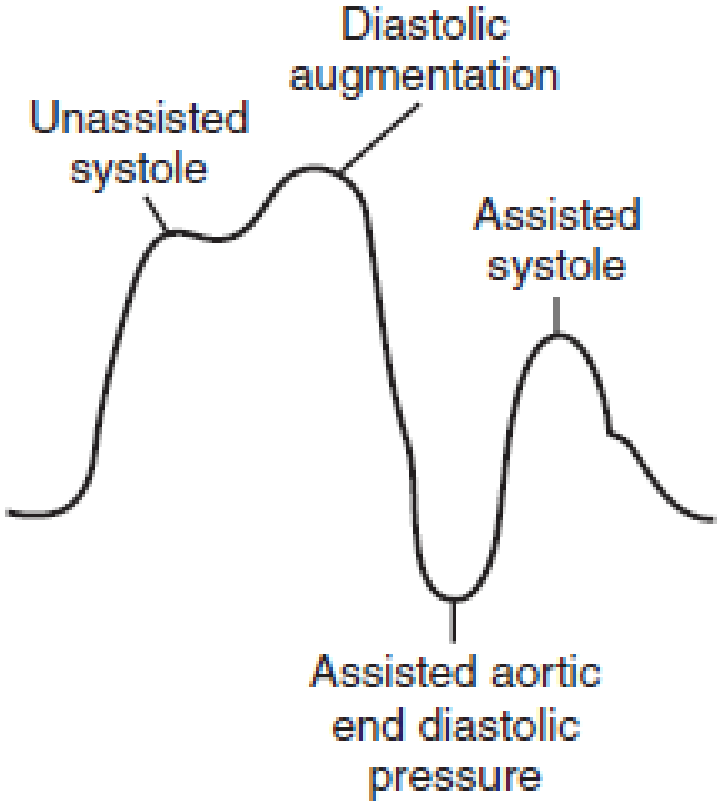
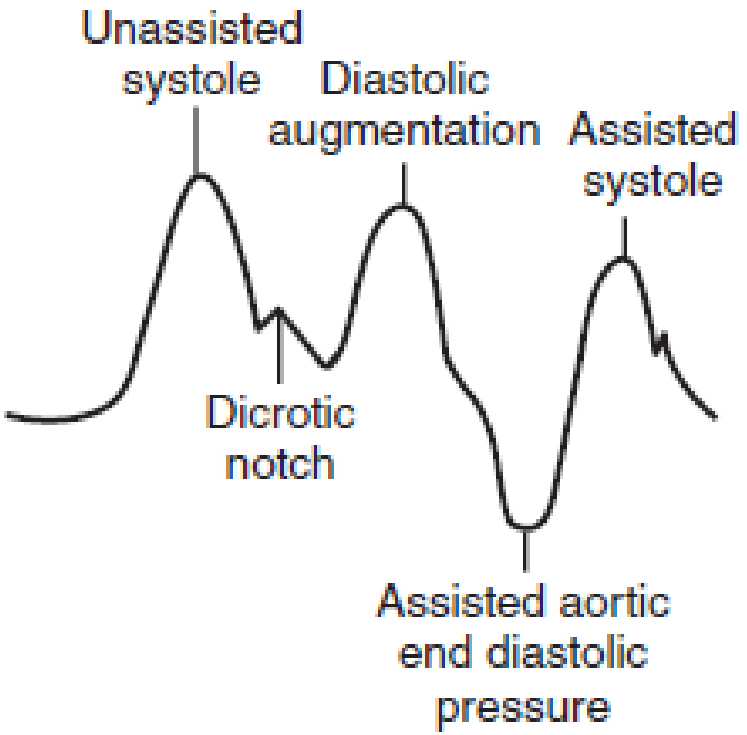
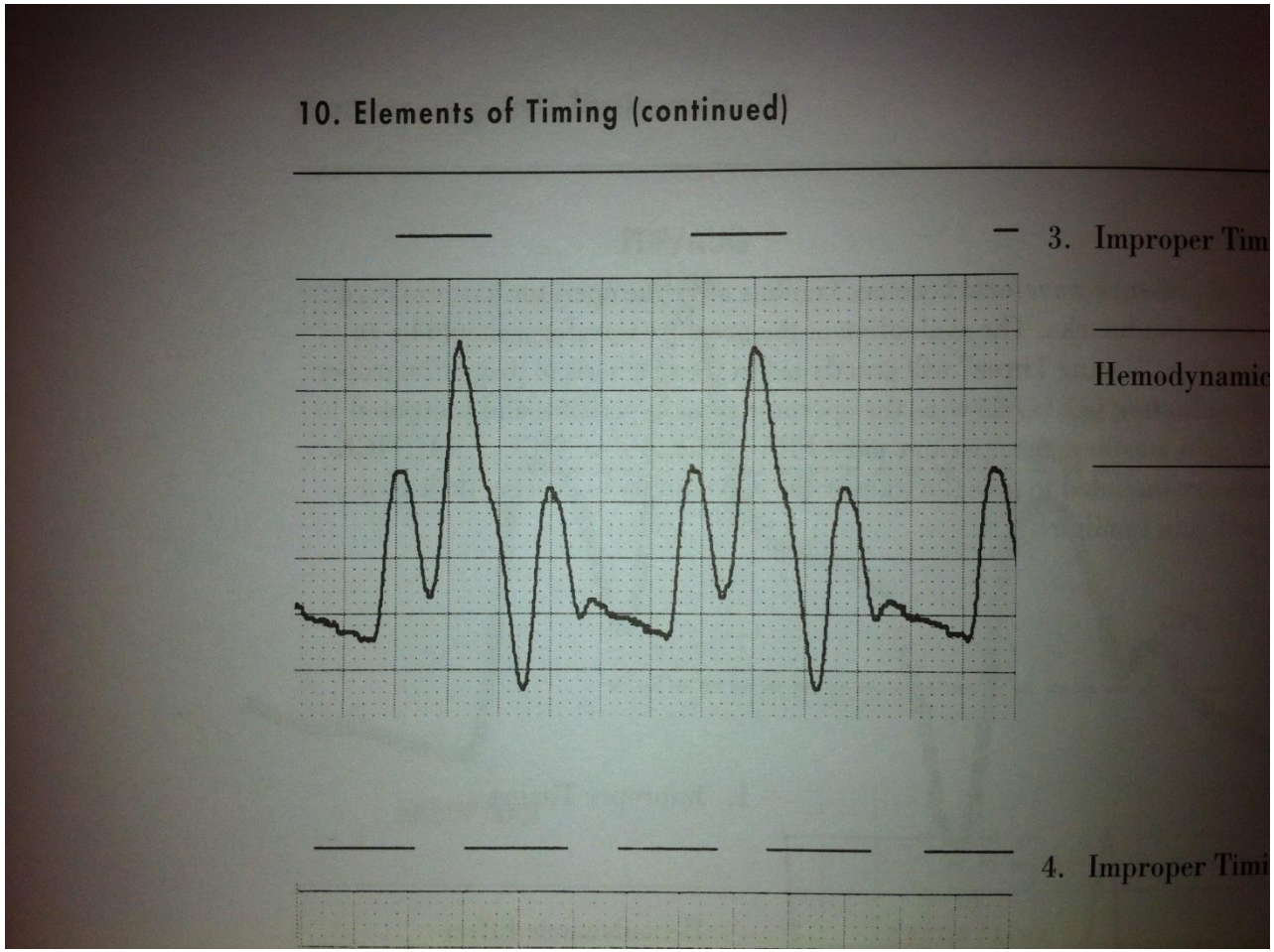




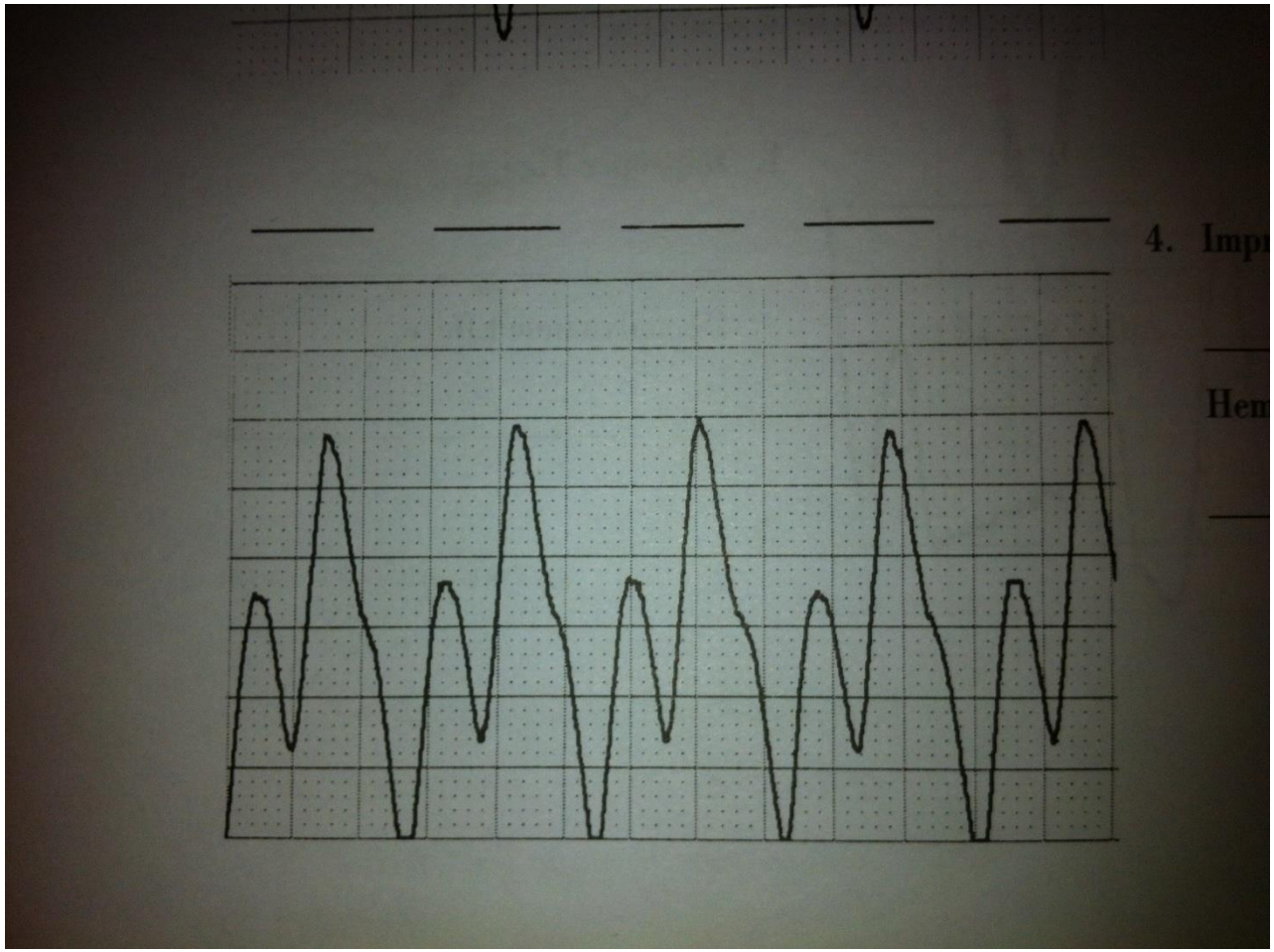
Errors in Timing



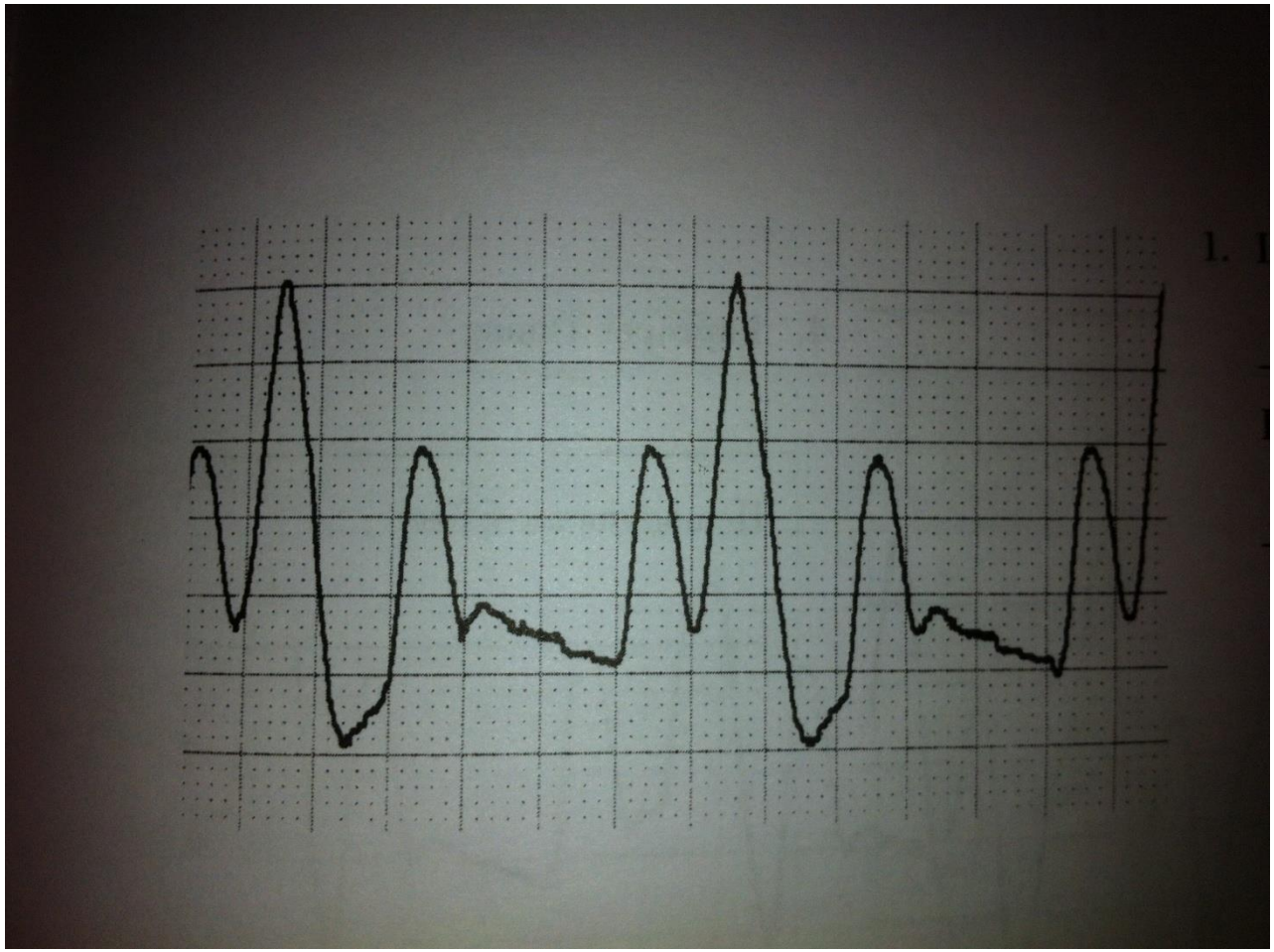
Timing set for optimal benefit!



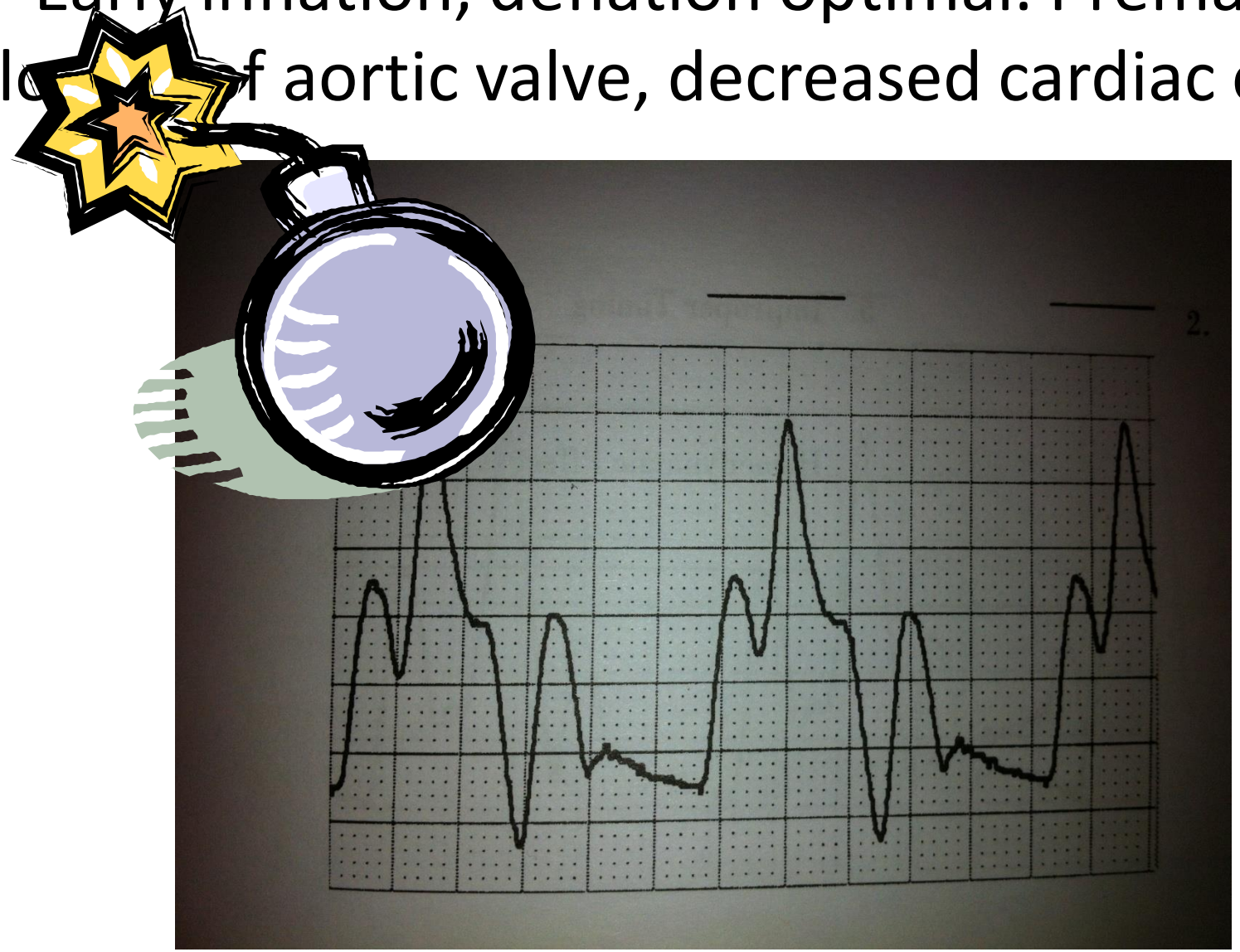
1:1 – cannot accurately assess timing



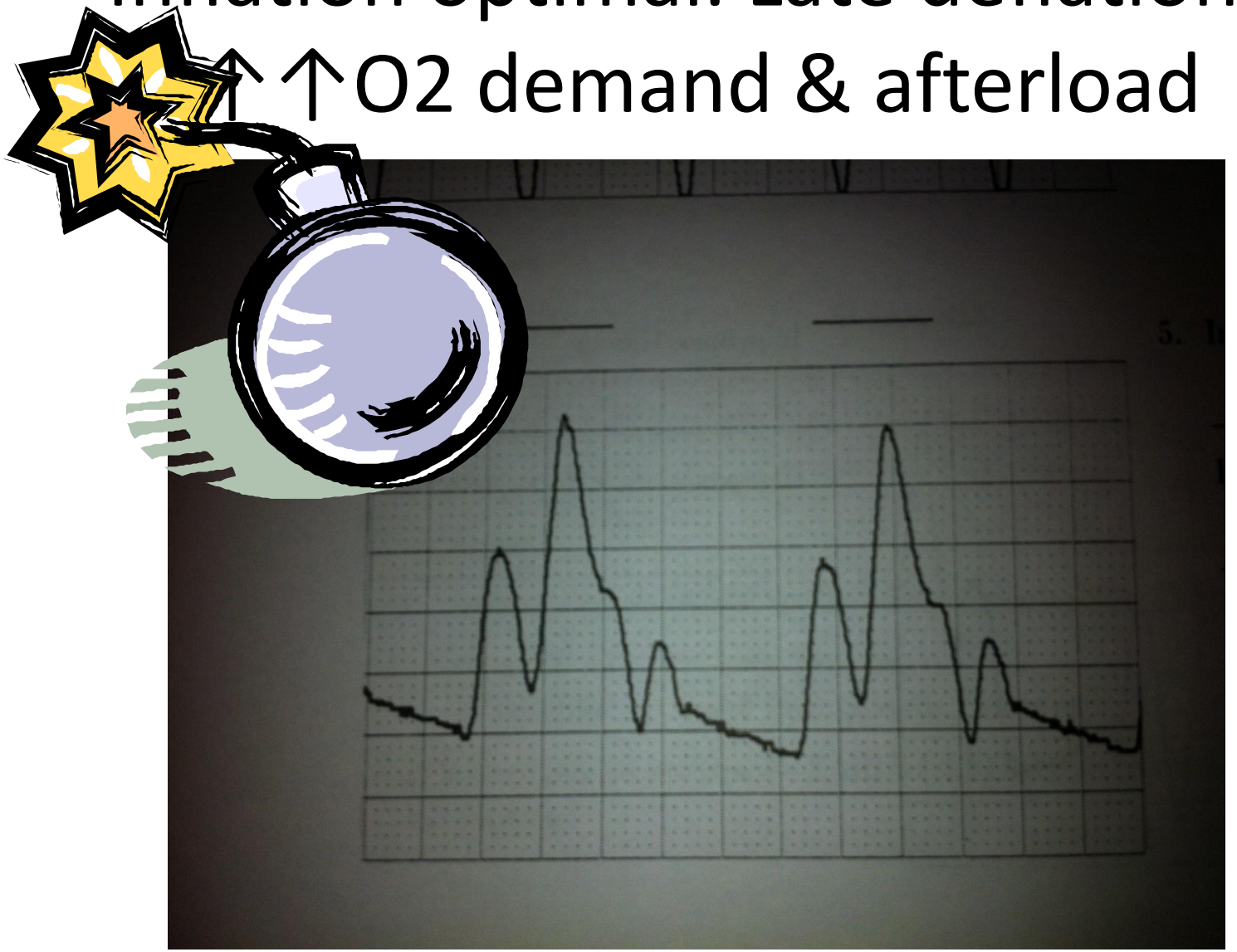
Inflation optimal, early deflation – poor afterload reduction



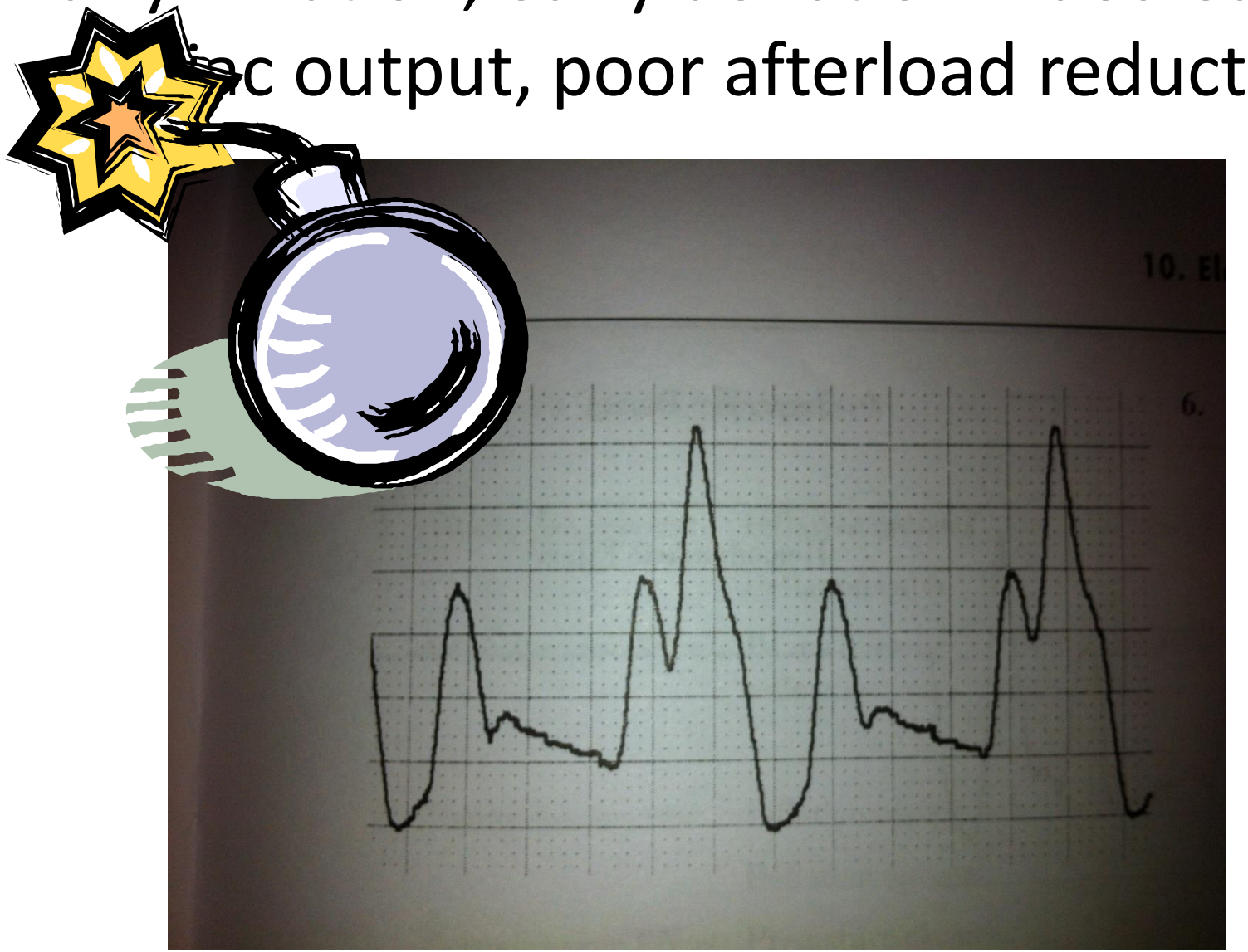
Early inflation, deflation optimal. Premature cl[illegible]f aortic valve, decreased cardiac output



Inflation optimal. Late deflation - ↑↑O2 demand & afterload

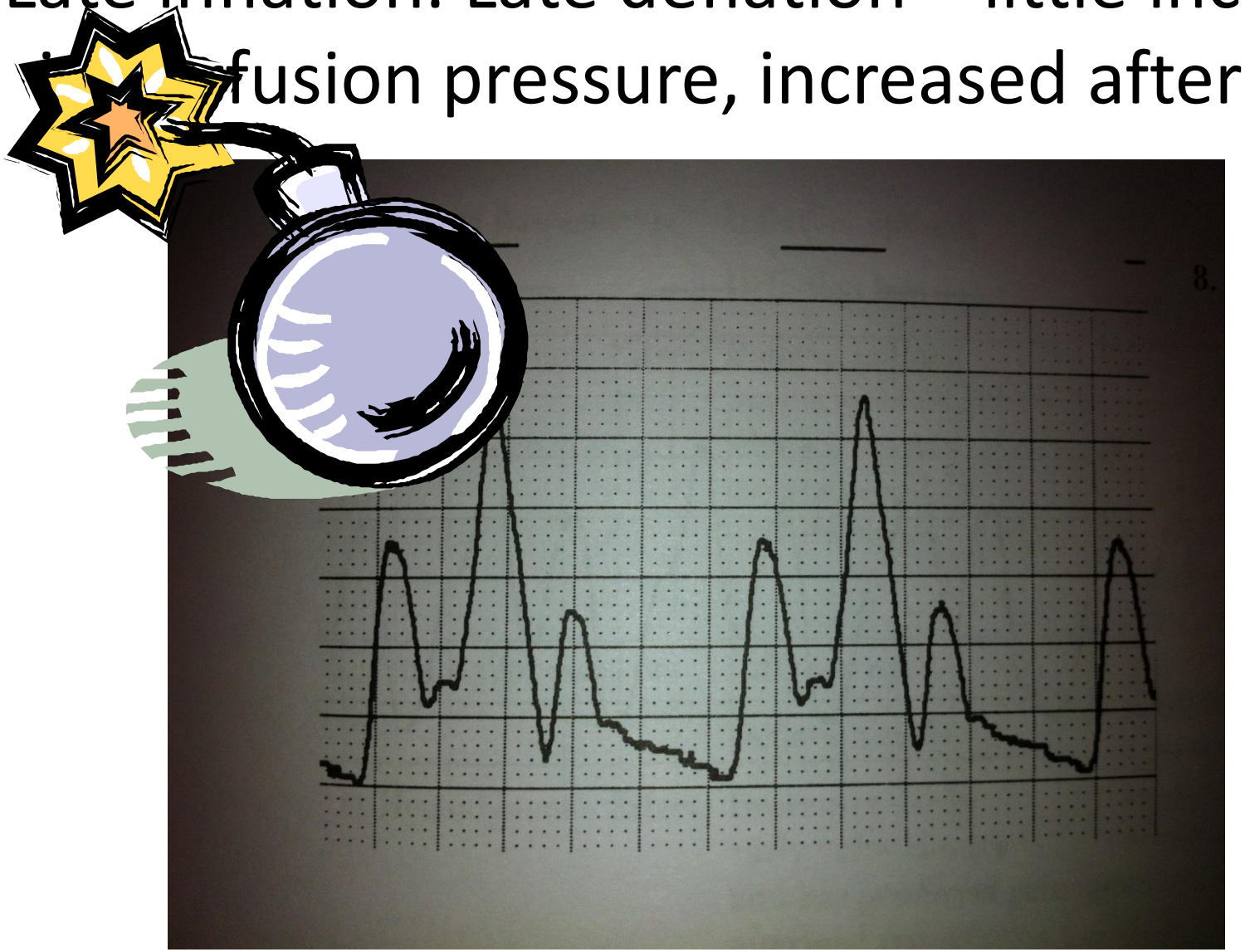


Early inflation, early deflation – decreased ...ac output, poor afterload reduction



Late inflation. Deflation optimal – little increase in perfusion pressure

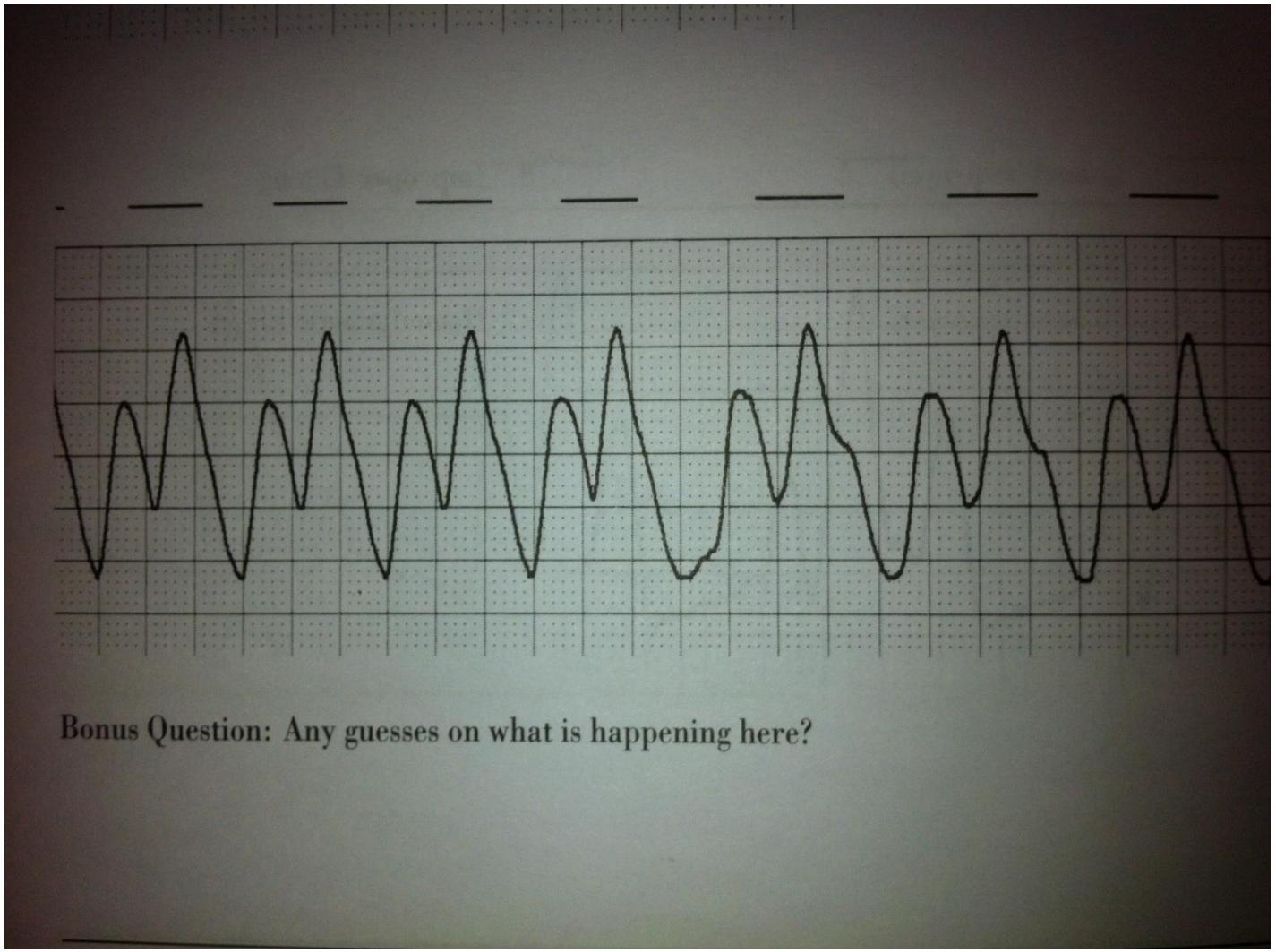
Late inflation. Late deflation – little increase in infusion pressure, increased afterload



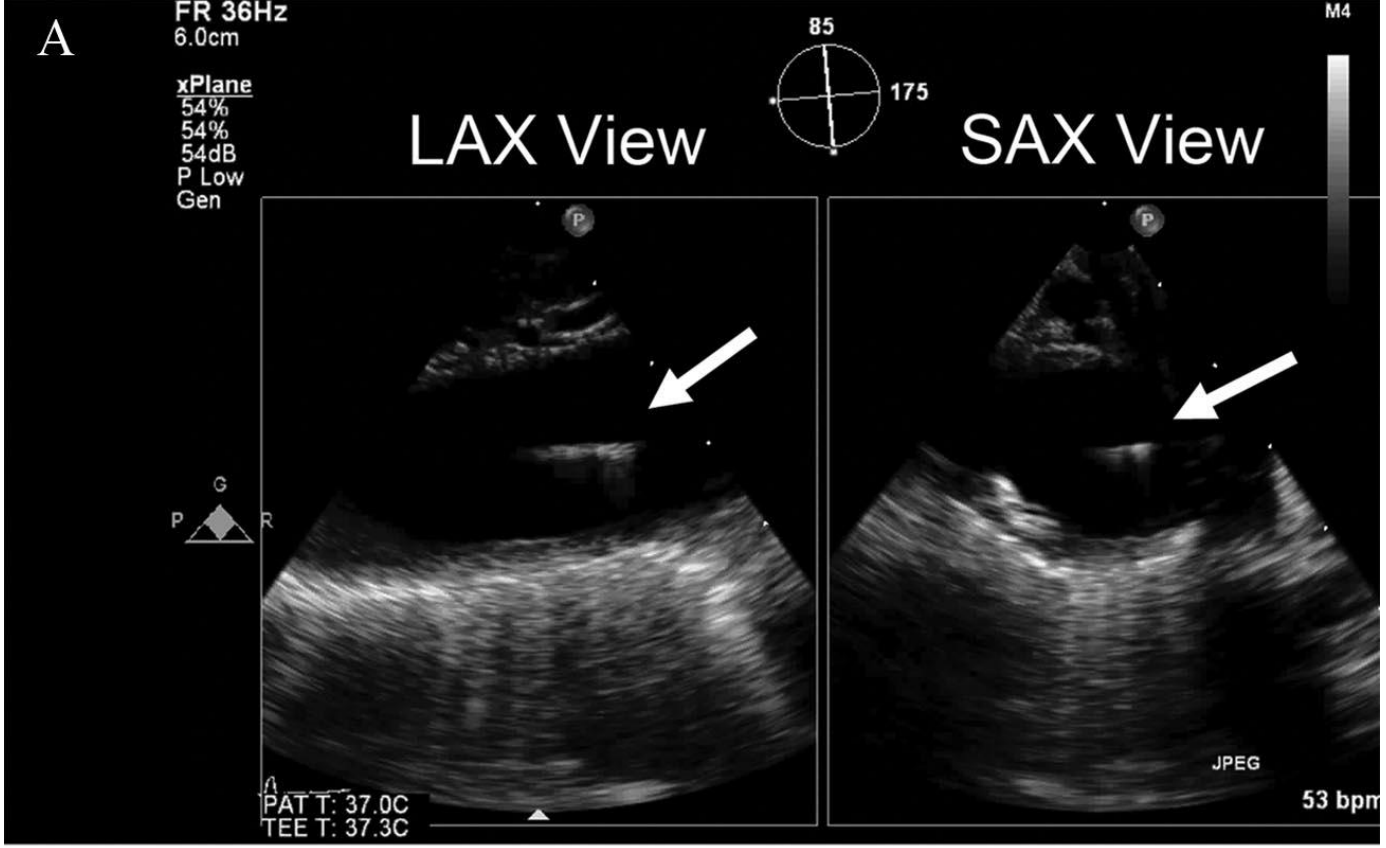
Late inflation, early deflation – why bother having an IABP?

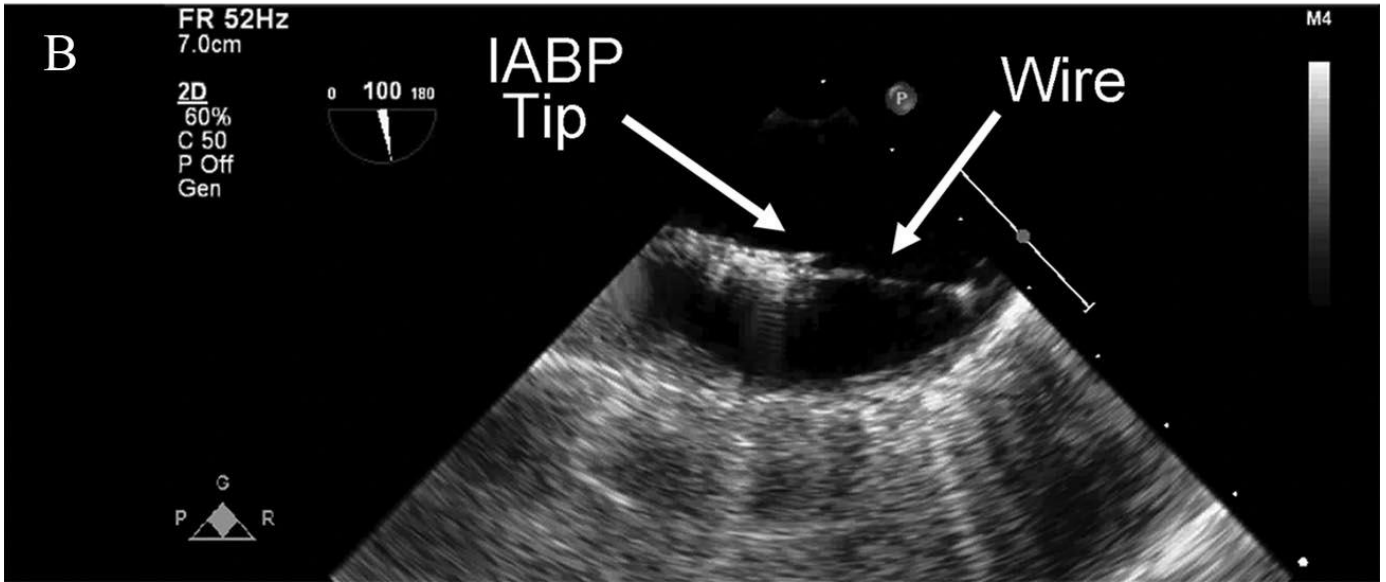
Ea

ad



Heart rate slowed, deflation initially early, then corrected


A
FR 36Hz
6.0cm
xPlane
54%
54%
54dB
P Low
Gen
85
175
M4
LAX View
SAX View
G
P
R
PAT T: 37.0C
TEE T: 37.3C
JPEG
53 bpm


B
FR 52Hz
7.0cm
2D
60%
C 50
P Off
Gen
0
100
180
M4
IABP
Tip
Wire
G
P
R

Trouble shooting in OR

- ECG trigger may not be functioning properly
  - Check slave cable connections
  - Check patient leads
  - Change ECG lead source
- Autofill may fail
  - Check helium and refill, then check balloon
- Balloon may not augment CO adequately
  - Check balloon position
  - Reposition balloon is necessary

38) Mécanisme IABP, lequel ne diminue pas:

a) LVEDV

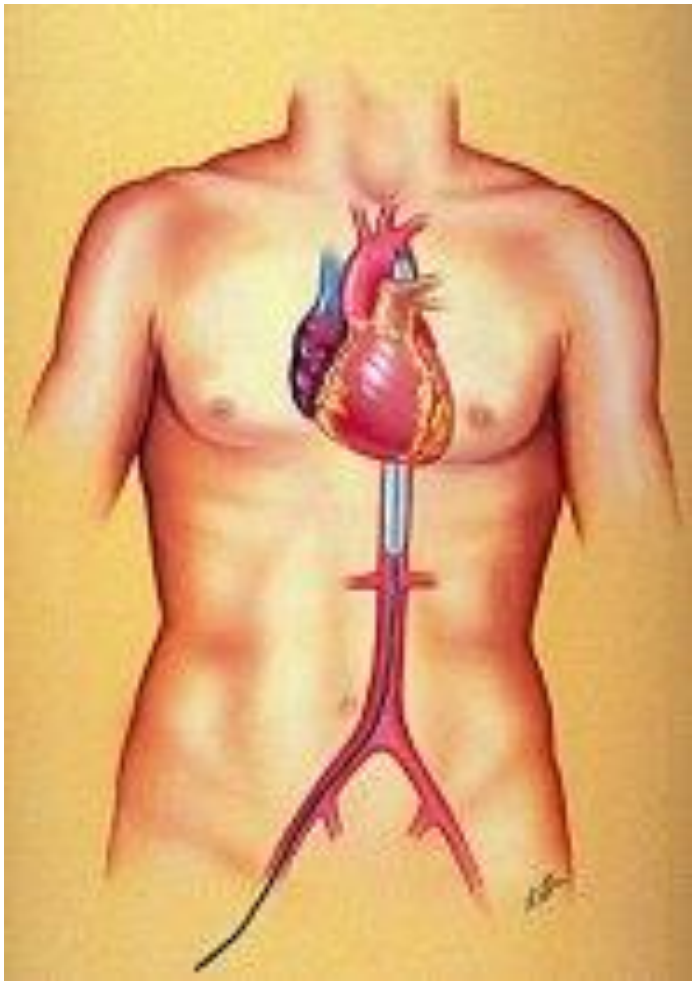
b) Pression diastolique a/n racine aortique

c) Pression systolique a/n racine aortique

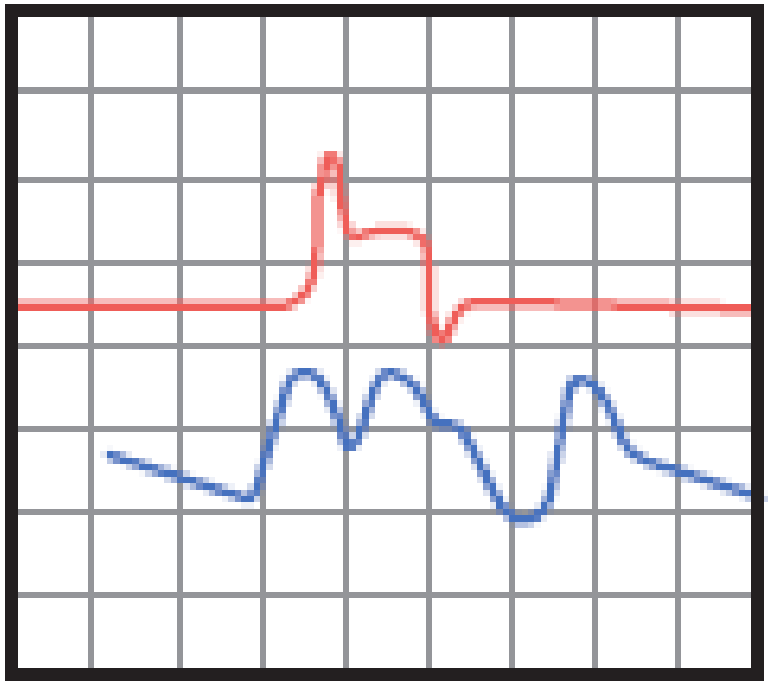
d) MVO2

39) Regarding IABP, all of the following are contraindications **EXCEPT**:

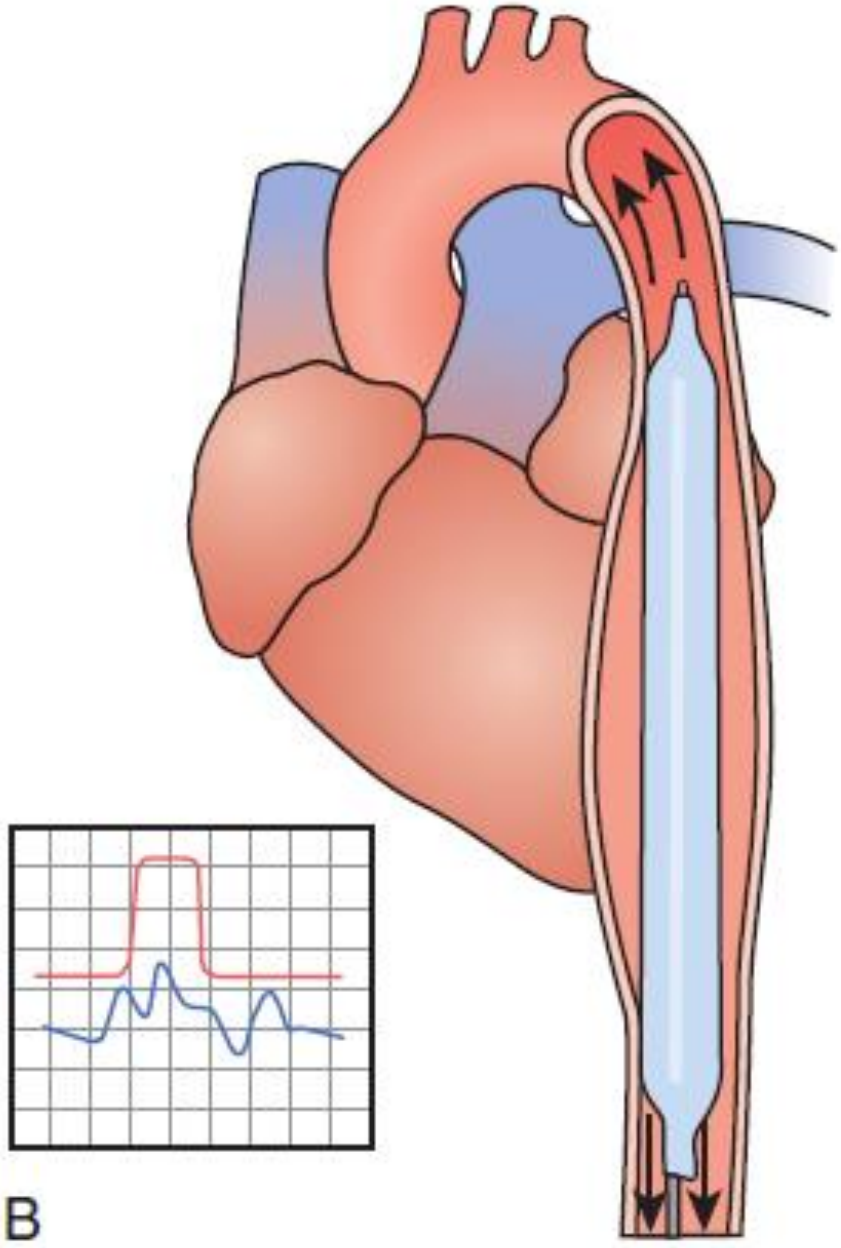
- Xa) Thrombocytopenia,
- b) Aortic insufficiency
- c) Thoracic aortic aneurysm
- d) Atherosclerosis,



Proper timing, but….



- Balloon is too small
- Patient's stroke volume is much higher or lower than balloon volume
- Balloon is too low
- Severe hypovolemia
- Low systemic vascular resistance
- Catheter kinked



Proper timing, but…

- Balloon too large
- Balloon pressure waveform – height reflects pressure in aorta