STRESS AND HEART.

- HISTORY.
- PATHOPHYSIOLOGY.
- ACUTE STRESS, EVIDENCE FOR CARDIAC INVOLVEMENT.
- CHRONIC STRESS, EVIDENCE FOR CARDIAC INVOLVEMENT.
- TREATMENT APPROACHES.

STRESS AND HEART.

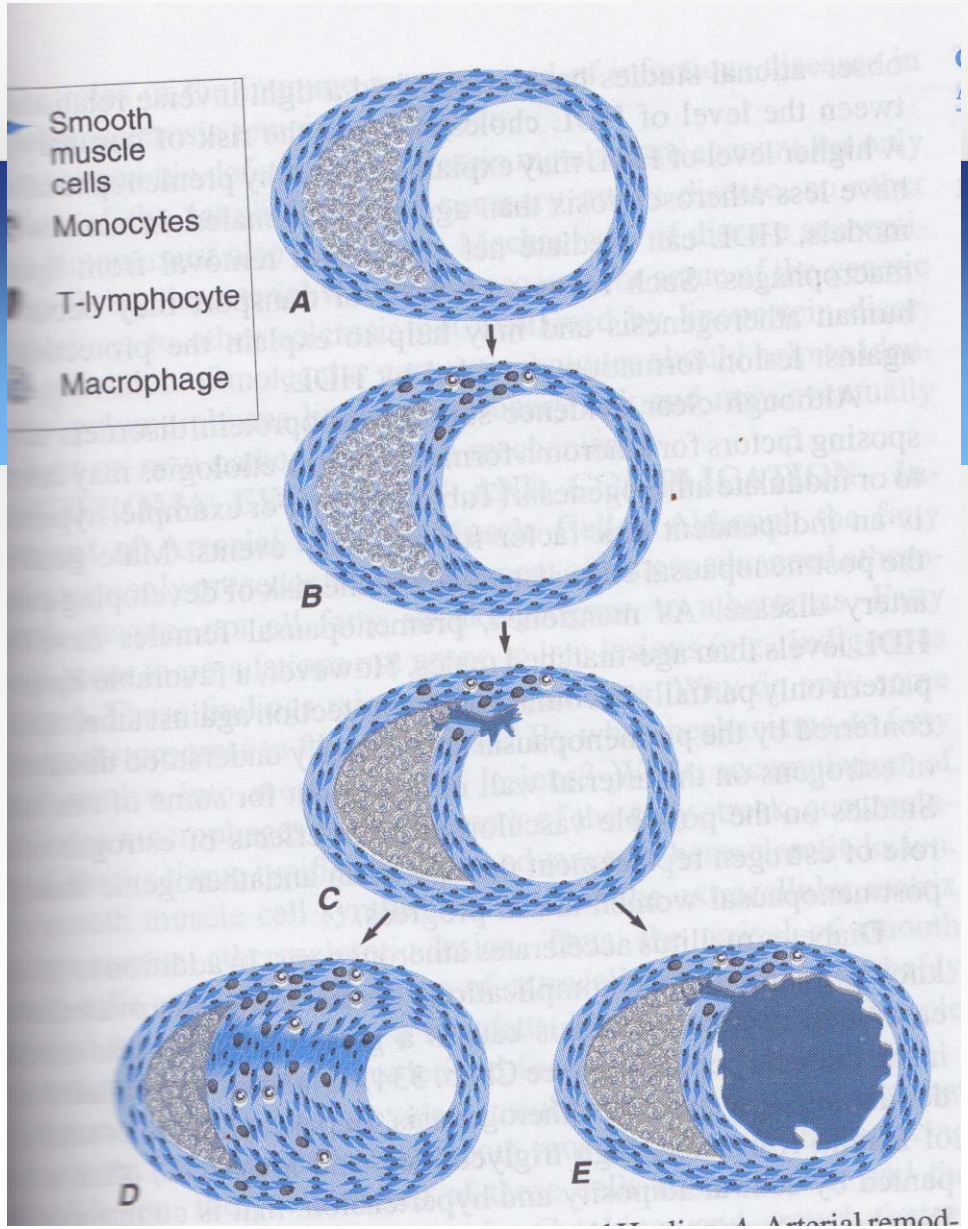
- In engineering “stress” leads to “strain”.
- In physiology, one thinks of stress as both the cause “stressor” as well as response to the stressor.
- Stress can be acute(less than a week) or chronic.
- Stress can be eustress-desirable in certain amount. joy exhilaration, relieves monotony and feeling of job well done.
- Distress- bad stress prejudicial to health and well being. Associated with frustration, anger, anxiety, fatigue or a general feeling that something is wrong.

HISTORY

- During the 18th century, John Hunter, surgeon who suffered from angina, complained, “my life is in the hands of any rascal who chooses to annoy and tease me.” he turned out to be somewhat of a prophet, since it was a heated argument with a colleague that precipitated his sudden death from a heart attack.
- But annoying people and events don’t create stress and heart disease. WE DO. Stress isn’t what happens, but how we respond to what happens.
- The evolutionary mechanism was handy for our cave dwelling ancestors during saber-toothed tiger attack. The problem is, thousands of years later, the nervous system still turns on the stress response when you’re arguing with your spouse, stuck in traffic or the boss says “boo”.

RESPONSES TO STRESS

- PHYSICAL- facial tautness, muscle aches, sweating, flushing, cold clammy hands, facial tics, tapping foot, sleep problems, gastrointestinal symptoms, fatigue, asthma, back pain, dry mouth, palpitations.
- EMOTIONAL- withdrawal, depression, anxiety, fears, phobias, panic attacks, irritablity, forgetfulness, excessive crying.
- BEHAVIORAL- chain smoking, rapid speaking, excessive drinking, teeth grinding, nail biting, picking at skin on face or around nails, sexual problems.


Smooth muscle cells
Monocytes
T-lymphocyte
Macrophage
A
B
C
D
E

EFFECTS ON THE HEART.

- Demand / supply ratio is altered.
- Stress hormones cause the heart to pump harder and faster.
- If the blockage in the coronary arteries is severe enough, the heart may reach a point where its work cannot be supported by the amount of blood that can pass through them.
- Moreover, while the stress hormones cause a normal, healthy artery to dilate they may cause a diseased artery to become narrower, reducing the flow even further.

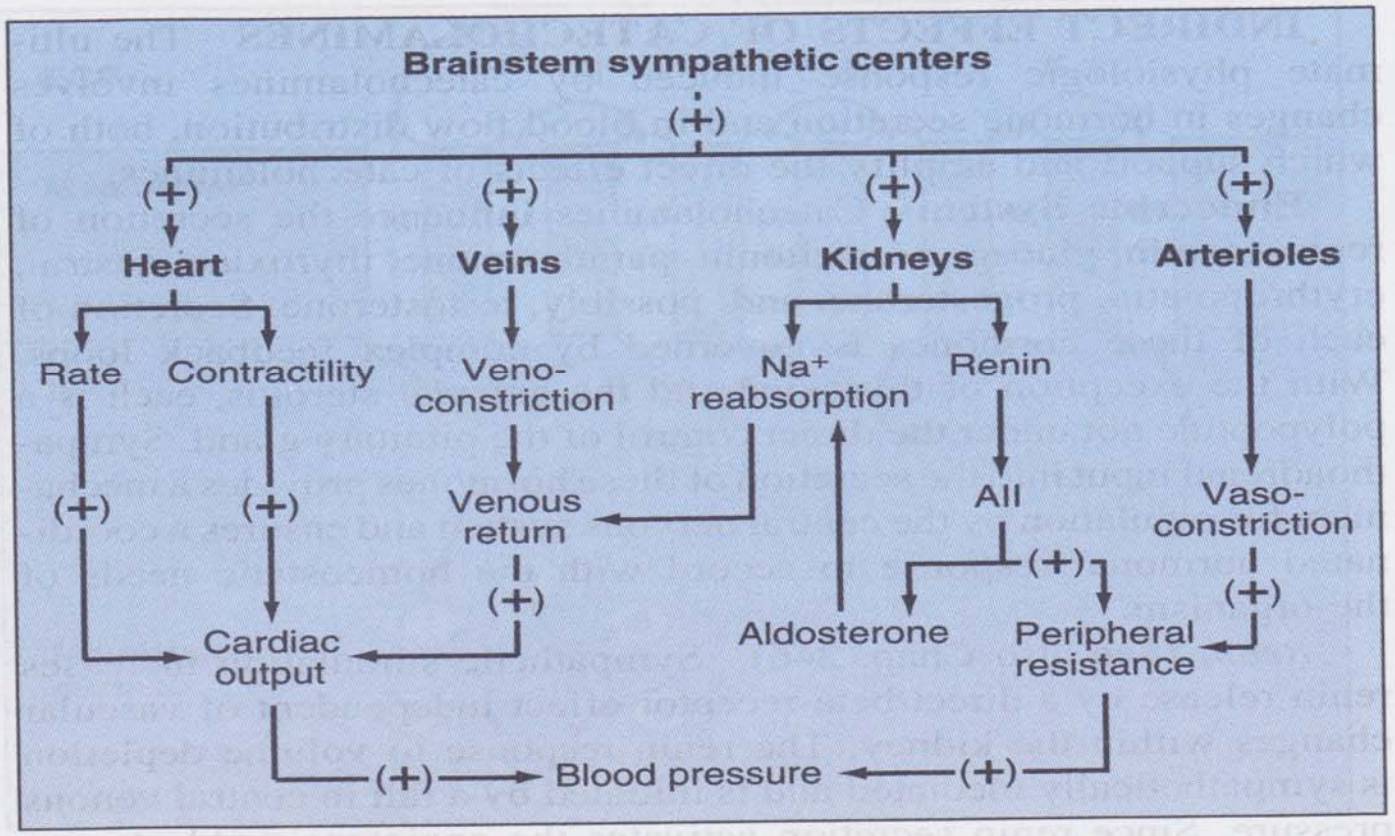
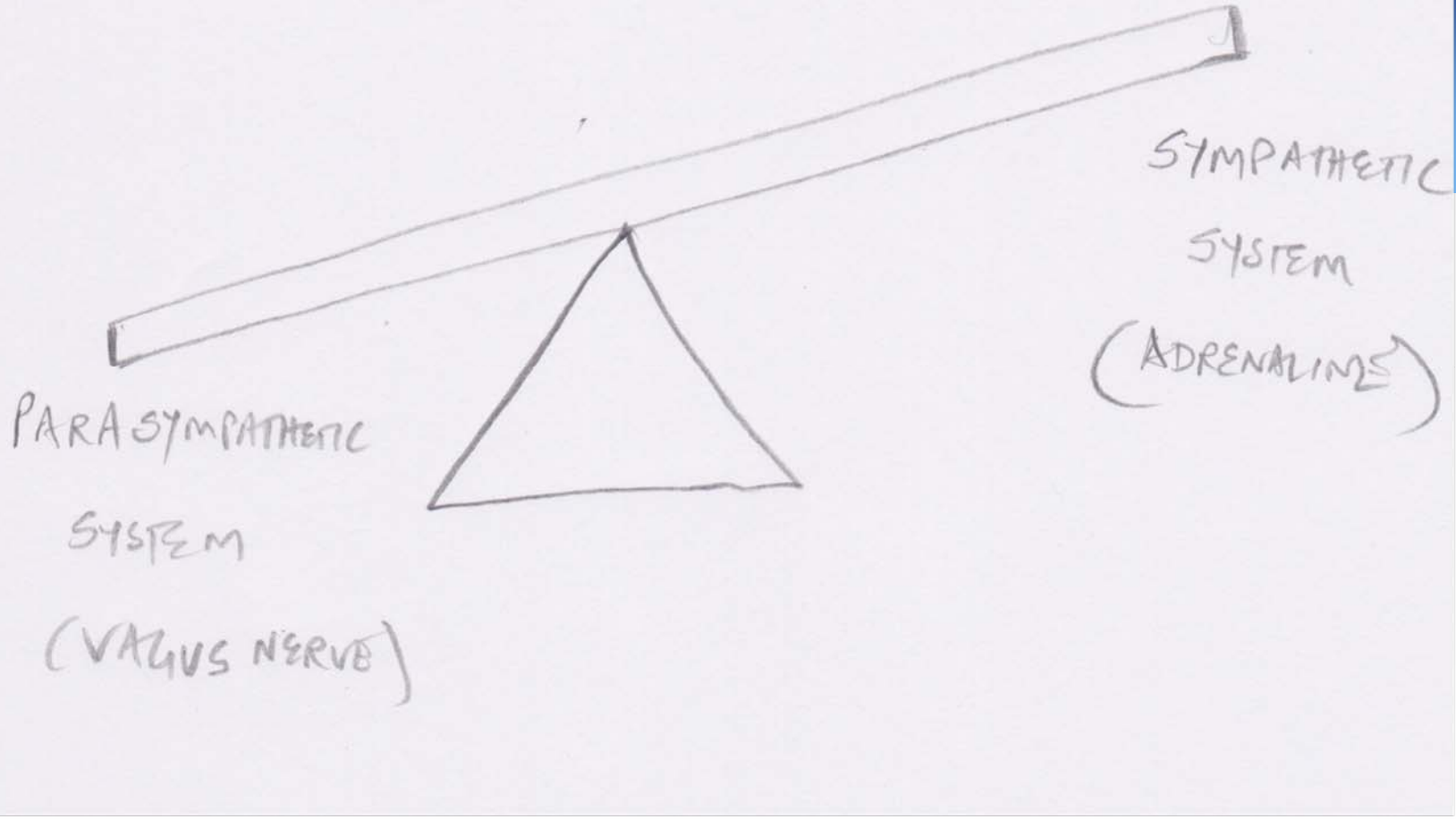


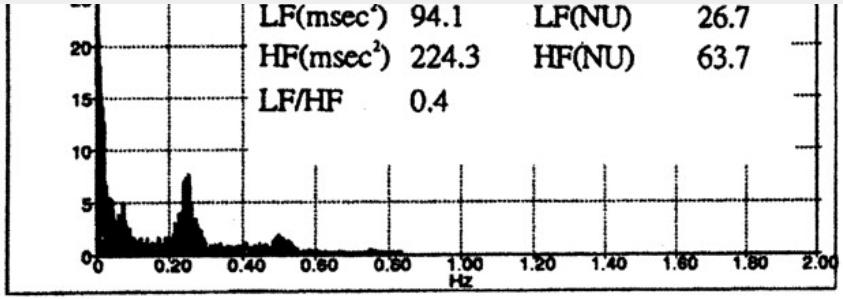
FIGURE 70-6 Sympathetic nervous system effects on blood pressure. Sympathetic stimulation (+) increases blood pressure by effects on the heart, the veins, the kidneys, and the arterioles. The net result of sympathetic stimulation is an increase in both cardiac output and peripheral resistance. AII = angiotensin II. *[From JB Young, L Landsberg, in P Sleight et al (eds), Scientific Foundations of Cardiology, London, Heinemann, 1981.]*

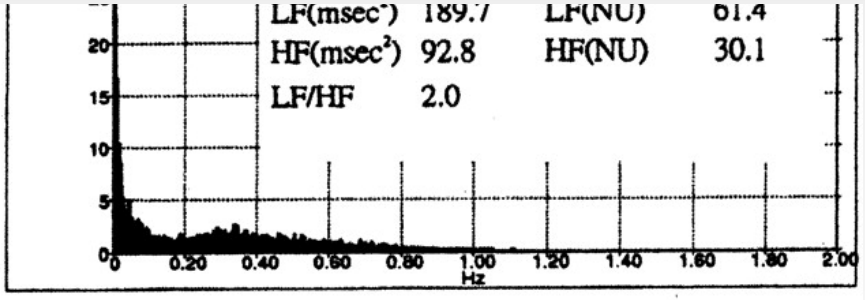

SYMPATHETIC
SYSTEM
(ADRENALINE)
PARASYMPATHETIC
SYSTEM
(VAGUS NERVE)

EFFECT OF EARTHQUAKES ON HEART

- Minutes after the earthquake, pronounced increases in HR upto160bpm.
- HR variability changed reflecting increase in the sympathetic nervous system activity.
- BP increased and in addition nocturnal BP no longer “dipped”.
- Blood viscosity increased with increased risk of clots.

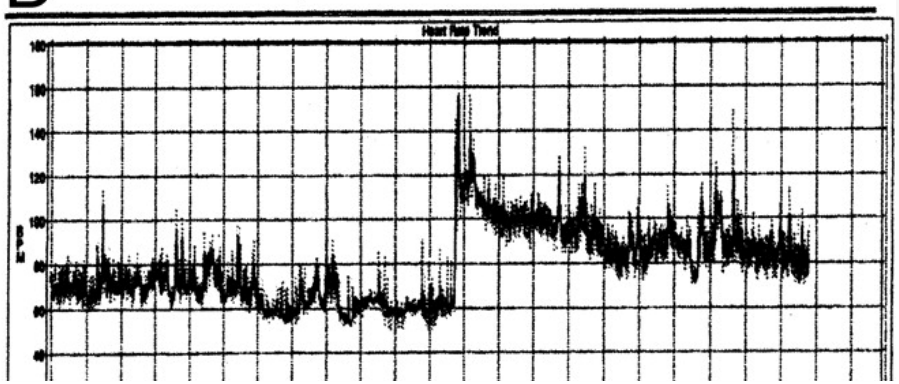
EARTHQUAKE AS ACUTE STRESS AND HR.



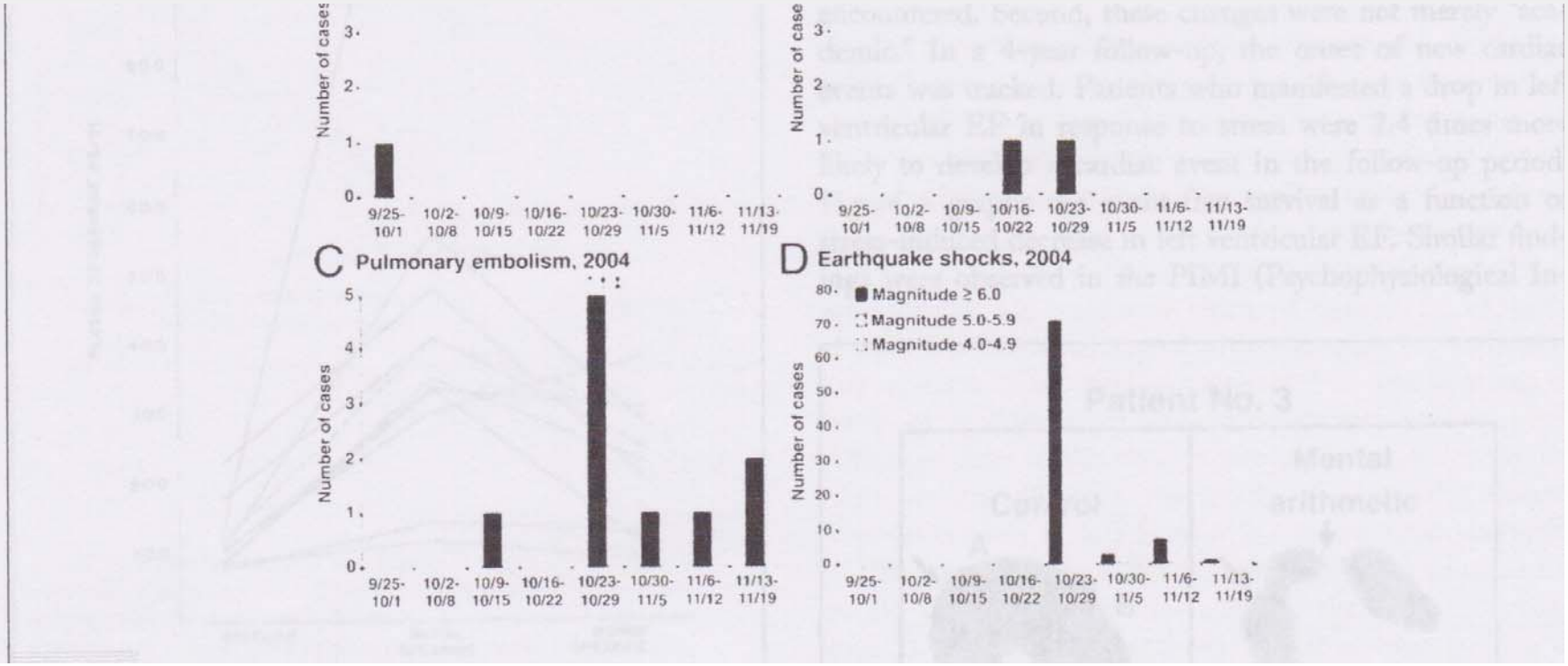


C

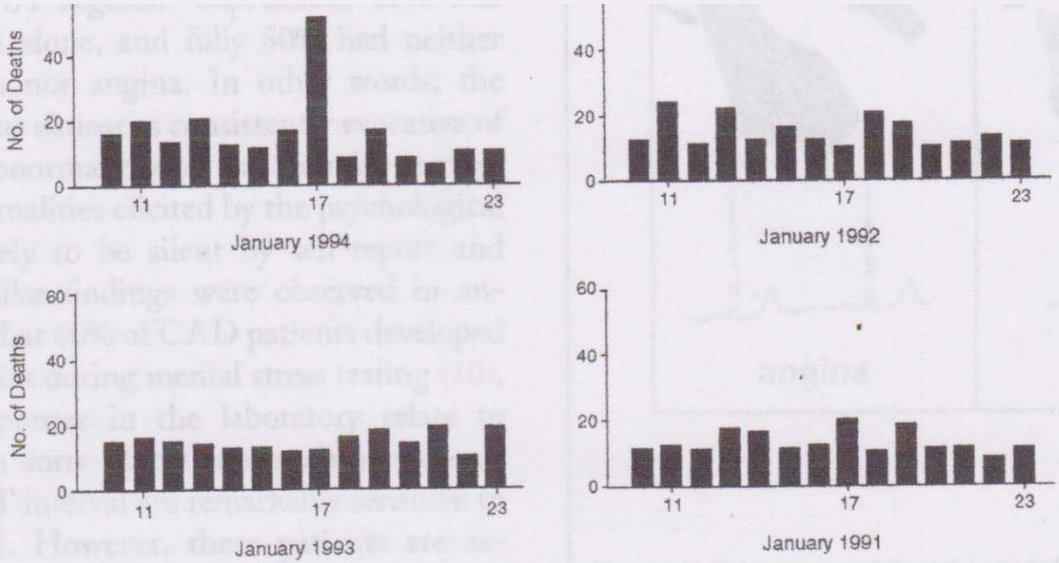
D



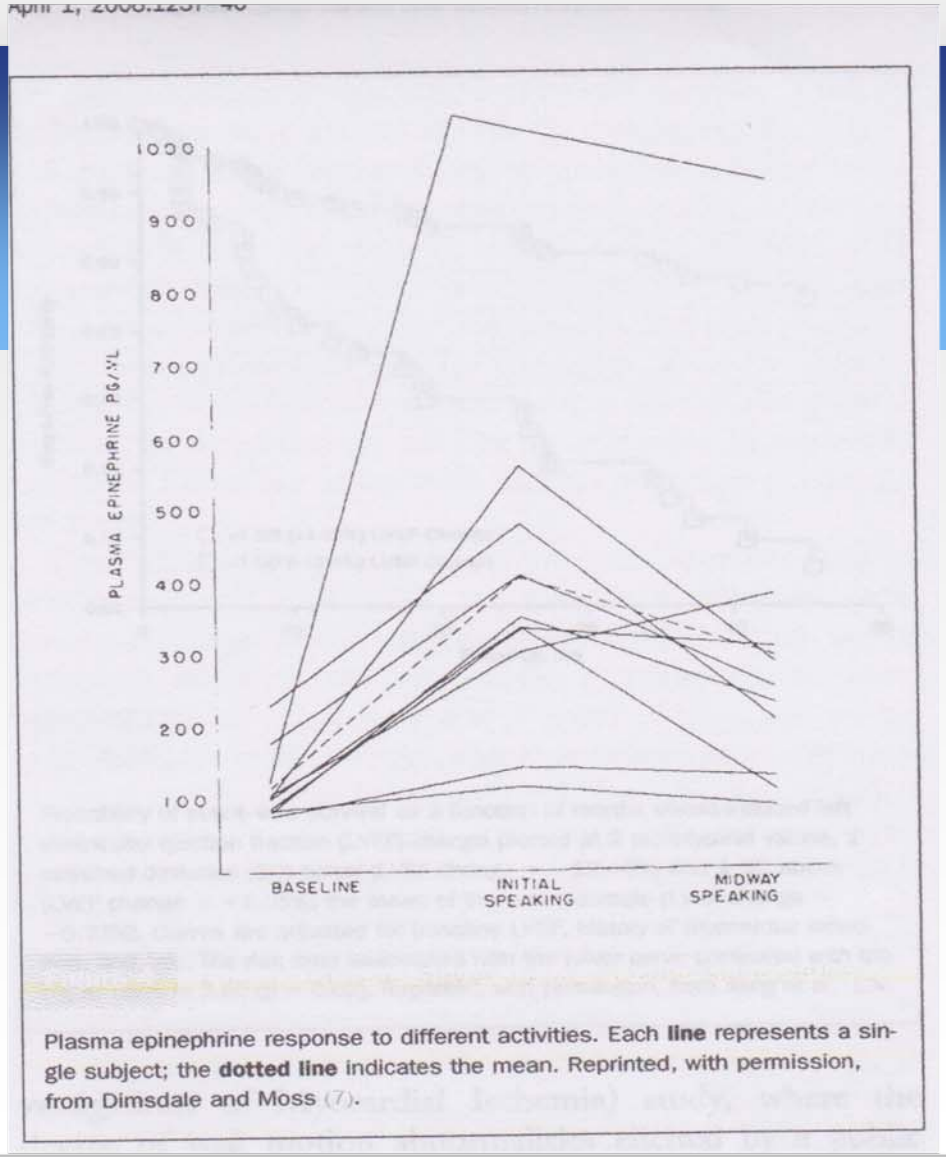
PULMONARY EMBOLISM



HEART ATTACKS.



On the day of the earthquake (January 17, 1994), there was a sharp rise in the number of deaths related to atherosclerotic cardiovascular disease (n = 51, relative risk 2.6, 95% confidence interval 1.8 to 3.7). The daily number of deaths related to atherosclerotic cardiovascular disease declined in the 6 days after the earthquake (*z* =



Plasma epinephrine response to different activities. Each **line** represents a single subject; the **dotted line** indicates the mean. Reprinted, with permission, from Dimsdale and Moss (7).

BROKEN HEART SYNDROME(TAKO-STUBO)

CHRONIC STRESS

- Siege of Leningrad- Sept 41 to Feb 43, 871 days. Extreme weather and extreme starvation. Even 50 years later survivors of the siege had increased BP and increased mortality from cardiovascular disease compared with Russians in other cities.

- INTERHEART study investigated the relation of chronic stressors to incidence of MI in a sample of 25,000 people from 52 countries. Stress was defined as feeling irritable, filled with anxiety, or as having sleeping difficulties as a result of conditions at work or at home. After adjusting for age, gender, geographic region and smoking, those who reported “permanent stress” at work or at home had >2.1 times risk of developing MI.

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CHRONIC STRESS

- Job stress: effort-reward imbalance, lack of control.
- Whitehall study found 2.15 fold increased risk for new coronary heart disease in men who experienced effort/reward mismatch at work.
- Impact of work stress and marital stress on subsequent incidence of CAD in a cohort of Stockholm women followed for 5 years. Marital stress was associated with 2.9 fold increased risk of recurrent events, whereas work stress did not predict subsequent coronary events.
- Similar data available for men followed for 9 years found that chronic work stress and marital dissolution increased risk of cardiovascular mortality.

CHRONIC STRESS

- “What’s a man to do, where can he go if he is unhappy at work AND at home?”…….. “to an early grave”…….. Dutch internist Johannes Groen.

- Care giver health study. Followed 400 caregivers and 400 matched control subjects. In a 4-yr period, caregivers had a 63%higher mortlity rate than non caregiving control subjects – particularly in known cardiovascular disease.

TYPE A PERSONALITY

and painfully slow, monotonous manner. "Mr. Smith, (two second pause), most people, when they go to work during the week - that is, Monday through Friday-, get up early (two second pause), - say around 6:30 to 7 AM. That is probably because it necessary to provide enough time for them to shower, brush their teeth, (two second pause) and so forth, get dressed, have something to eat, and then they travel by car, bus or train so they can get to work by a certain time (two second pause), which is often between 8:30 and 9 AM. Now, in your case* (three second pause), what time do you usually get up (two second pause) during the week, that is Monday through Friday? How do you travel to work and what time do you usually get there? Unknown to the subject, the interviewer starts a stopwatch as noted by the asterisk above after asking " Now in your case". A flaming Type A would interrupt almost immediately before the question was finished to quickly explain his usual daily routine. In contrast, a Type B would listen to the entire recitation, reflect for a few moments, and then slowly respond with something like "Well, on Mondays, I tend to get up at 6 or a little later but on other days it is usually closer to 7 " and continue on with a leisurely narration of possible variations on subsequent weekday habits.

The Bortner Type A Rating Scale

Check the space that most clearly describes where you fall on each dimension.

1. Never late.	_ _ _ _ _	Casual about appointments.
2. Very competitive.	_ _ _ _ _	Not competitive.
3. Anticipate what others are going to say (nod, interrupt, finish for them).	_ _ _ _ _	Good listener. Hear others out.
4. Always rushed.	_ _ _ _ _	Never feel rushed, even under pressure.
5. Impatient when waiting.	_ _ _ _ _	Can wait patiently.
6. Go "all out."	_ _ _ _ _	Casual.
7. Try to do many things at once, think about what to do next.	_ _ _ _ _	Take things one at a time.
8. Emphatic in speech (may pound desk).	_ _ _ _ _	Slow, deliberate talker.
9. Want good job recognized by others.	_ _ _ _ _	Only care about satisfying myself, no matter what others think.
10. Fast (eating, walking, etc.).	_ _ _ _ _	Slow doing things.
11. Hard-driving.	_ _ _ _ _	Easygoing.
12. Express feelings.	_ _ _ _ _	"Sit" on feelings.
13. Few interests outside work.	_ _ _ _ _	Many interests.
14. Ambitious.	_ _ _ _ _	Satisfied with job.

Source: Bortner, "A Short Rate Scale as a Potential Measure of Pattern A Behavior, *Journal of Chronic Diseases*, 1969, vol.22, pp. 87–91.

ADRENALINE ADDICTION?

- Stress related neurohumoral secretions such as serotonin, dopamine or beta-endorphin have potential for inducing addiction.
- “Opponent-process theory of acquired motivation”- man is by nature susceptible to various habits and addictions that provide a sense of pleasure. However, when deprived of the thing that is craved, an opposing emotional state often results.
- Exhilarating feeling of being in love changes to melancholy when deprived contact with their beloved. People hooked to skydiving become depressed if weather interferes for few days. Withdrawal from cigarettes, alcohol or recreational drugs produces an emotional state directly opposite from the pleasurable sensations those substances induce.

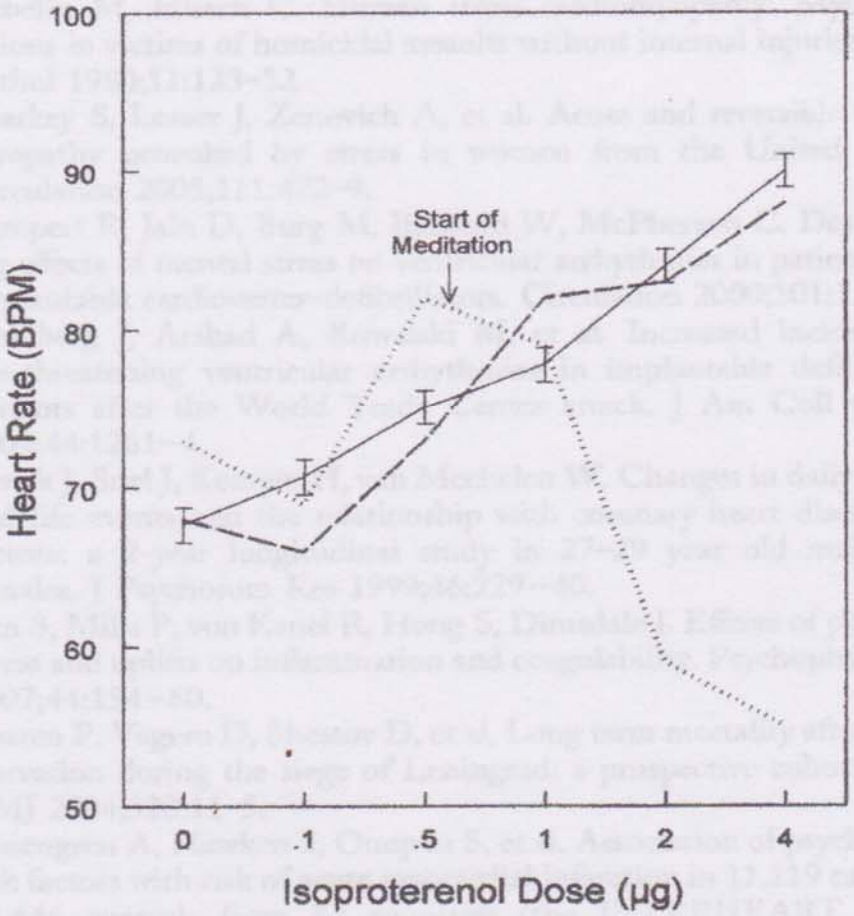
Adrenaline addiction?

- Type A who have become addicted to surges of their stress related hormonal secretions might unconsciously seek ways to induce their associated “highs”. That could come in form of constructing contests and challenges, like getting to the airport shortly before takeoff to avoid waiting, turning a car trip into a race by predicting specific times at which checkpoints must be reached, delaying assignment to the last minute- just so there will be some sort of time urgent, last minute challenge.

When deprived of such stimuli, type A”s are apt to be irritable and depressed. Thus, recuperating from a heart attack by spending 2 weeks on a deserted tropical beach might be perfect for many patients but a dangerous prescription for some type A’s, who would likely be agitated within an hour if they were unable to get back to their work or contact their office to see what was going on.

IS THERE A SOLUTION?

- Because stress is everywhere, what good does it do to identify a risk factor that cannot be modified?
- Stress is no different from other background cardiac risk factors such as genetics and age.
- However stress CAN be modified through numerous approaches.
- Majority of these intervention programs improve patient morale and functioning and decrease suffering.
- It remains to be proven if such stress modifications consistently decrease risk of MI and cardiac death. Increasingly, such programs are tracking markers of cardiovascular risk (endothelial function) and found positive effects.



Effects of meditation on chronotropic responses to isoproterenol. **(Solid line)** Mean ± standard error response to isoproterenol in 93 women; **(dotted line)** patient's response while meditating; **(dashed line)** patient's response while instructed not to meditate. BPM = beats/min; HR = heart rate. Reprinted, with permission, from Dimsdale and Mills (39).

MEDITATION

- Can lower BP as effectively as medication and better than stress management training health-education classes as per NIH.
- Choose a quiet interruption-free spot. Sit comfortably in a chair or cushion on the floor with good posture, hands on your thighs or clasped in your lap.
- Light a candle and focus on it, watching the flame move, grow, flicker and change colors. When your mind wanders, bring your attention back to the flame.
- Start with meditation sessions of 5-10 mins and gradually build to longer periods . Aim for 20 mins, the mayo clinic suggests.

ART THERAPY

- Powerful ally against stress and heart disease. Creative pursuits- writing, music, dance, painting, sculpting, sketching, collage, quilt making- can decrease anxiety, stress and mood disturbances.
- With a backdrop of meditative environment, candles and soothing sounds, classical music for example lowers heart rate and breathing rates- 2001 australian study.

DEEP BREATHING

- Breath is a powerful indicator of stress levels. During stress breath shortens and quickens. Deep breaths calm you-lowering BP, reducing anxiety, slowing HR and easing tension. Deep breathing is a “stress relief kit we carry within us.”

- Think of two calming words i.e “relax”, “joy”, “peace”, “calm”, ”clarity”. Fully inhale and silently say on of the words; then fully exhale and silently say the other word. Language is generated by the brain’s left hemisphere and breathing and images activate the right hemisphere. By using words with breathing, both sides of the brain simultaneously move toward relaxation.

- Feel your ribcage and belly expand as you inhale and contract as youexhale. Feel the air travelling trough your nostrils, down your throatand into the lungs in an easy, comfortable rhythm. Continue for 3 minutes.

THINK POSITIVELY.

- Positive thinking counteracts the effects of stress and heart disease.
- It can cut your risk of heart disease in half- per 2001 Johns Hopkins study. Optimistic folks were half as likely to have a heart attack or chest pain, regardless of age, race or sex.
- GIVE YOURSELF PEP TALK. Be your own good buddy and talk your fine skills and characteristics. Write down a frequent negative thought. Then write the emotion that accompanies it. Find a positive, alternative view to your negative script. “I don’t have computer skills” to “I like learning and can take a computer class.”
- CULTIVATE A GRATITUDE ATTITUDE. Make lists of things for which you’re grateful.

Think positively…. Perception of control.

- DON'T JUDGE YOURSELF. Every time the words "should' or "shouldn't" enter your mind, write the thought on a piece of paper. Restate the thought with a confident positive spin.
- "I shouldn't have eaten that second piece of cake" to "I choose to have fresh fruit for dessert tomorrow". " I should exercise more" to " I want to exercise because I'll feel better and be healthier. Such thoughts aren't judgmental, don't dwell on mistakes and put you back in control.