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L-10 Pressure in body

Pressure in the Digestive System

-Opening through the body, over 6 m length ,closed in the lower end and has several restrictions

-Valves and sphincters permit unidirectional flow of food.

Pressure in the gastrointestinal (GI) system greater than atmospheric pressure in most parts.

Pressure caused by various muscle actions drives food and waste through the digestive system.

Stomach pressure behaves much like bladder pressure and is tied to the sensation of hunger.

Pressure in the relaxed esophagus is normally negative because pressure in the chest cavity is normally negative. Positive pressure in the stomach may thus force acid into the esophagus, causing "heartburn."

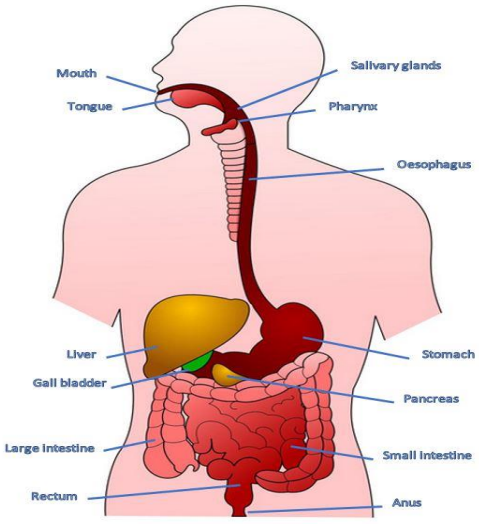
- **Esophagus pressure is usually less than atmospheric pressure**
- **Pressure in the stomach**
  - **Eating increases the pressure in the stomach slowly due to increased volume**
  - **Air swallowed during eating increases the pressure in the stomach → burping or belching**
- **Pressure in the gut**
  - **Bacteria action generates gas (flatus) →increase gut pressure**
  - **Belts, girdles, or swimming → affect gut pressure**

Pylorus: valve

- **Prevents the flow of food back into the stomach from the small intestine**
- **blockage in the small or large intestine → high pressure between the blockage and the pylorus→ blockage of blood flow to critical organs → death**

Treatment

1. **Intubation: a hollow tube though the nose, stomach, and pylorus**
2. **Surgery in a pressure-controlled operating room.**



Pressure s in the Skeletal System

The skeletal system works as a support structure for your body.

- **It gives the body its shape,**
- **Allows movement,**
- **Makes blood cells,**
- **Provides protection for organs and stores minerals**

The highest pressures in the body are found in the weight bearing bone (joints). These pressures are the largest in the body, due both to the high values of initial force, and the small areas to which this force is applied, such as in the joints .It is may be more than 10 atm in the knee joint.

The surface area of a bone at the joint is greater than its area either above or below the joint. The larger area at the joint distributes the force, thus reducing the pressure, according to equation P= F/A

Bone has adapted in another way to reduce pressure, the finger bones are flat rather force is spread over a larger surface, this reducing the tissues over the bones according to P=F/A.

For example, when a person lifts an object improperly, a force of 5000 N may be created between vertebrae in the spine, and this may be applied to an area as small as 10 cm^2.

The pressure created is $P = F/A$ = (5000 N)/($10^{-3}m^2$) = 5.0×10^6 N/m^2 or about 50 atm!

This pressure can damage both the spinal discs (the cartilage between vertebrae), as well as the bony vertebrae themselves. Even under normal circumstances, forces between vertebrae in the spine are large enough to create pressures of several atmospheres. Most causes of excessive pressure in the skeletal system can be avoided by lifting properly and avoiding extreme physical activity.

Pressure in the urinary bladder

The bladder is the hollow organ in the lower abdomen that stores urine. As the bladder fills, muscles in its walls relax so that it can expand. As the bladder empties during urination, the muscles contract to squeeze the urine out through the urethra.

Bladder pressure climbs steadily from zero to about 30cmH_2O as the bladder fills to its normal capacity of 500 cm^3 (The interval pressure in the bladder is due to the accumulation of urine. For adult, the typical maximum volume in the bladder before voiding is 500ml.) This pressure triggers the *micturition reflex*, which stimulates the feeling of needing to urinate. , it also causes muscles around the bladder to contract(resulting sizable muscular contraction in the bladder), The resulting sizable muscular contraction in the bladder wall produces a momentary pressure of up to 150cmH_2O.

Accentuating the sensation. Coughing, straining, tensing in cold weather, wearing tight clothes, and experiencing simple nervous tension all can increase bladder

pressure and trigger this reflex. So can the weight of a pregnant woman's fetus, especially if it is kicking vigorously or pushing down with its head!

The figure below shows the typical pressure volume curves for the bladder, which stretches as the volume increase.

- **Normal voiding pressure is fairly low (20 – 40) cm H_2O but for men who suffer from prostate obstruction of the urinary passage it may be over 100 cm H_2O**
- **Probably the most typical reason for bladder pressure is cystitis or inflammation of the bladder, prostatitis, Uterine fibroids, Ovarian cancer and Urinary system infection.**

One hazard of high bladder pressure (sometimes created by an obstruction), is that such pressure can force urine back into the kidneys, causing potentially severe damage.

The pressure in the bladder can be measured:

1. **By passing a catheter with a pressure sensor into the bladder through the urinary passage (urethra).**
2. **By a needle inserted through the wall of the abdomen directly into the bladder, and transmitting the pressure to an appropriate measuring device.. This technique gives information about the function of the exit valves that cannot be obtained with the catheter technique.**