

# Calculi

*Calculi/concretions* are solid formations ("stones") formed in organ outlets, especially in the places of their enlargement (gallbladder, renal pelvis, bladder, etc.). Concretions can occur in the body in various numbers (individually, multiple). Their size can range from a grain of sand to an object several centimeters in size. Their chemical composition depends on the place of their origin.

*Lithiasis* is defined by the presence of stones in the body. Several types of lithiasis are known according to the place where the stones occur.

## Real concretions

- **Cholelithiasis** (gallstones) - cholecystolithiasis + choledocholithiasis - mainly affects women;
- **Choledocholithiasis** - bile ducts (in the ductus choledochus);
- **Nephrolithiasis** - in the renal pelvis;
- **Urolithiasis** (urinary stones) - pyelolithiasis + ureterolithiasis + urocystolithiasis - mainly affects men;
- **Pancreatolithiasis** - pancreatic ducts;
- **Sialolithiasis** - pancreas, salivary glands;
- **Prostatolithiasis** - prostate.

The shape of the stone is usually spherical or elliptical when stored loosely. If the formation completely fills the cavity of their origin, it takes the shape of the cavity. If there are more stones in one cavity pushing on each other with their surfaces in contact, the stones will be flattened, the so-called *faceted concretions*.



Sialolithiasis

## The composition of urinary stones

- *Uricite* - uric acid,
- *whewellite* - calcium oxalate · H<sub>2</sub>O,
- *weddellite* - calcium oxalate · 2H<sub>2</sub>O,
- *apatite* - calcium phosphate,
- *dahllite* - carbonate apatite,
- *brushite* - calcium hydrogen phosphate · 2H<sub>2</sub>O,
- *struvite* - magnesium ammonium phosphate · 6H<sub>2</sub>O [1].

## Pseudo concretions

- **Concentrated content:**
  - *coprolite* - intestine, especially appendix and diverticula;
  - *corpora amylacea* - prostate, lungs, brain - concentrically layered bodies (iodine dyes them blue-green, similar to starch, PAS +), they are formed by condensation proteins from prostate secretion on the surface of peeled off epithelium.
- **Foreign bodies:**
  - *broncholith* - bronchus;
  - *rhinolith* - nasal cavity;
  - *flebolith* - calcified thrombus;
  - *trichobezoar* - stomach, from swallowed hair.
- **Microscopic calcification of blood vessels:**
  - psammoma bodies (calcospherites, dystrophic calcification).



Coprolite

## Formation of stones and its causes

- The substance which the concretion is composed of is called **stone-forming**.
- Under normal conditions, this substance is dispersed in the solution and the protective colloid prevents precipitation.
- As the colloid condenses, the solution is supersaturated and the aggregate precipitates out of solution to form a stone.
- Colloid condensation occurs on any wetting surface (normal mucous membranes are considered non-wettable) - eg. foreign body, necrotic tissue, peeled epithelium, coagulum, cluster of bacteria or parasite eggs, etc.
- The concretion itself then forms a wettable surface. By settling further layers on it, the concretion gets bigger.

## Causes of stone-formation

- Increased concentration of stone-forming substances (diathesis stones);
- colloidal medium disorder (inflammatory stones);
- change of pH.

## Increase in concentration of stone-forming substances

The increase in the concentration of the stone-inducing substance is mostly caused by *endogenously* (metabolic disorders - diathesis), but factors may also be involved *exogenously* (dehydration urolithiasis, diet with excess cholesterol in cholelithiasis, increased production of bilirubin in hemolysis).

- Cholelithiasis – cholesterol and pigment (black and brown) stones.
- Urolithiasis – oxalate, urate, xanthine, cystine, phosphate, calcium stones.

## Colloidal medium disorder

It is caused during inflammation - either by mixing the colloid with exudate or by getting in touch with a wettable surface (peeled epithelium, bacterial colonies, necrotic tissue, etc.).

- Mixed stones in the gallbladder.

## Change of pH

- It changes the solubility of stone-forming substances.
- Most often in urolithiasis, caused by ascending bacterial infection (especially genus *Proteus*), which breaks down urea to form ammonia (alkalization of the environment - increase in solubility of urates, decrease in solubility of calcium salts calcium).
- On the contrary, infection often occurs due to diathesis urolithiasis - then calcium salts can settle on other nuclei (eg urate) and mixed stones are formed.

## Complications of concretions

In general, the manifestations and complications of stones in the body are referred to as lithiasis.

- **clogging of the cavity in which they were formed** – congestion of the content (cholestasis, hydronephrosis), possibility of ascending infection - purulent cholangitis to liver abscess in cholelithiasis, purulent pyelonephritis in urolithiasis,
- **pressure necrosis of mucous membrane** – Pressure ulcers in the gallbladder and bile ducts, ulceration - perforation - chemical peritonitis, or penetration (penetration by fibrous adhesions to the surrounding organs - gallstones can get into the small intestine, gets stuck in the ileocecal orifice and causes ileus),
- **colic** (renal colic, gallbladder colic, intestinal colic) - peristalsis can get stones into narrow outlets and block them completely. Colic is a paroxysmal pain, which is caused by alternating contraction and relaxation of smooth muscle (defense mechanism to overcome an obstacle).

## Links

### Related links

- Urolithiasis
- Cholelithiasis
- Sialolithiasis

### References

1. BARTONÍČKOVÁ, K. Urolithiasis. *Postgraduate medicine* [online]. -, vol. 2, p. -, Available from <<https://zdravi.euro.cz/clanek/postgradualni-medicina/urolitiaza-172263>>.

### Source

- PASTOR, J. *Langenbeck's medical web page* [online]. [cit. 17.08.2009]. <<https://www.freewebs.com/langenbeck/>>.

### Bibliography

- STŘÍTESKÝ, Jan. *Patologie*. 1. edition. Epava, 2001. 338 pp. ISBN 80-86297-06-3.