MUNI
MED

Contrast agents

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Learning objective

- Student will learn most comon contrast agents used in radiology and their adverse effects

Classification of contrast agents

- By modality
  - US
  - MRI
  - Methods using X-rays
- By way of application
  - i.v., i.a., p.o., intrathecally, intravesically, into fistulas…
- By type of contrast
  - Positive
  - Negative

Contrast agent for US

- **Mikrobubbles** of sulphur hexafluorid (SF_6) stabilized by phospholipids (SonoVue)
- Contrast created by differences of impedance on interface gas/liquid
- Administered i.v., is strictly **intravascular** – shows microcirculation
- **Eliminated through lung capillaries** (in cca 15 minutes)
- Can be administered to patients with renal failure, adverse reactions are extremely rare
- Contraindications: significant right-left shunts, severe lung hypertension, recent heart attack…

C.a. for methods using X-rays

- **I.v. and any other way of administration**
  - **Iodine c.a.** (viz dále)
- **P.o. podání** (event. per rectum, sondami do GIT)
  - *Positive*

    Baryum k.l. ($BaSO_4$) – in CT, fluoroscopy. Can not be used in suspected GIT perforation
  - *Negative*

    Water – in CT for distension of upper GIT (water is absorbed aborally)
    Mannitol – in CT for distension of lower GIT (it is hyperosmolar)
    Gas – CO_2 - in CT colonoscopy (administered p.r.), efervescent powder in fluoroscopy of oesophagus and stomach – for distension

Iodine c.a. 1

- Positive – **iodine absorbs X rays** (high nucleon number)
- **Administered anywere:** i.a., i.v., p.o., intravesically, into tubes, drains, fistulas…
- Moves to interstitium, does not move through normal hematoencephalic barrier
- Mostly **eliminated by kidneys** (normally in cca 2h), elimination depends on glomerular filtration, critical for adverse reaction to kidney function is the first pass through kidneys, they can removed by dialysis
- Now only non-ionic c.a. used
- Main characteristics of iodine c.a. – **concentration, osmolality, viscosity**

Iodine c.a. 2

- **Adverse effects**
  - **Acute adverse reaction** – different types (allergic, alergoid, chemotoxic…)
    Different severity: nauzea, vomiting, erythema, urticaria, seizures, arrythmias, anaphylaxis…
  - **Post contrast acute kidney injury**
    = increase of serum creatinin by more than 26,5 umol/l 48-72h after administration of c.a., many different factors
- **Contraidications** *are* ***relative*** – considering risk/benefit
  - **Alergic reaction to iodine c.a. in personal history**
  - **Renal failure**
  - **Metformin** – when renal function decreases, metformin excretion is impeded and can cause lactic acidosis

Contrast agents for MRI

- **I.v.**
  - **Gadolinium c.a.**
- **P.o.**
  - **Blueberry/pineapple juice**
    Negative contrast - Negative contrast in MRCP to cancel artifacts from stomach contents
  - **Mannitol**
    In MR enterography – mainly for distension of bowels

Gadolinium c.a. 1

- Gd is **paramagnetic,** we do not see c.a. itself but how it influences magnetic field around it, it mainly **shortens T1 time** (= increase of signal on T1 weighted images = positive contrast)
- **Chelated** Gd (Gd by itself is heavy toxic metal)
- Moves into interstitium, does not move through normal hematoencephalic barrier, can be removed by dialysis
- **Excreted by kidneys**, elimination halftime in normal renal functions is cca 90 min
- There is a **tissue specific Gd c.a.** that is excreted half by kidneys, half by bile ducts, used for liver lesions and bile ducts imaging

Gadolinium c.a. 2

- **Adverse effects**
  - **Acute adverse reaction** – analogically to iodine c.a., compared to them are less frequent (Gd c.a. are less hyperosmolar, chelated, there are smaller volumes administered…)
  - Postcontrast acute kidney injury – minimal risk compared to iodine c.a.
  - **Nefrogenic systemic fibrosis (NSF)**

    Rare systemic disease – thickening and induration of skin, pruritus, contractures, multiple organs affected, proved link to Gd c.a

    At risk patients – on dialysis, GF less than 15ml/min (Gd is released from chelates and causes damage) – carefully consider the indication

Take home message

- Referring physician should know adverse effects of commonly used contrast agents and provide relevant info = **history of allergic reactions, current values of creatinin, use of metformin**, can patient have p.o. c.a.?, is there GIT perforation suspected…

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