PATHOLOGY
OF THE URINARY TRACT

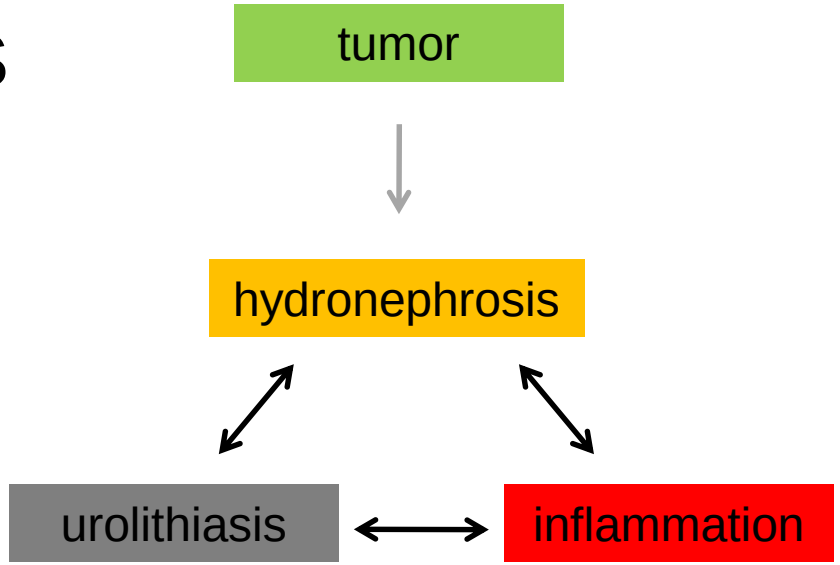
COLLECTING SYSTEM

- RENAL PELVIS
- URETHER
- URINARY BLADDER
- URETHRA

  - urotelium
  - squamous epithelium

COLLECTING SYSTEM

- HYDRONEPHROSIS
- UROLITHIASIS
- INFLAMMATION
- TUMORS



URINARY TRACT OBSTRUCTION

- dilatation of renal pelvis *(hydronephrosis)* and ureter *(ureteronephrosis)*
- consequent involvement of kidney
  - *acute renal failure*
  - *acute tubulointerstitial nephritis = pyelonephritis (ascendent infection)*
  - *chronic tubulointerstitial nephritis, renal atrophy (obstructive uropathy)*
  - *calculi formation*

URINARY TRACT OBSTRUCTION

causes

- malformations (stenosis of ureteropelvic junction)
- urolithiasis
- inflammation, retroperitoneal fibrosis
- tumors (urinary tract or extrinsic – colon, ovary, uterus, prostate…)
- prostate hyperplasia
- pregnancy
- neurogenic

UROLITHIASIS

- formation of calculi in urinary tract
  - high level of calculi components in urine
  - obstruction (stasis of urine)
  - alcalisation of urine (inflammation)
  - detachment of epithelial cells (inflammation)

UROLITHIASIS
types of calculi

- **CALCIUM (70%)** (calcium oxalate, calcium phosphate)
  - hypercalcemia+hypercalciuria (hyperparatyroidism, bone diseases, sarcoidosis…), hyperoxaluria
- **STRUVITE (15 %)** (magnesium ammonium phosphate)
  - after infections (bacteria convert urea to ammonia – alcalisation of urine)
  - big, staghorn calculi
- **URIC ACID (10 %)**
  - hyperuricemia – gout, leukemia
  - ovoidní hnědavé měkké
- **CYSTIN (2 %)**
  - cystinuria (genetic defect of renal reabsorption of aminoacids)

UROLITHIASIS
clinic, complications

- hematuria
- renal colic !
- obstruction – hydronephrosis
- inflammation, pyelonephritis, urosepsis

INFLAMMATION

- ascending infection
- may progress to renal parenchyma – pyelonefritis, urosepsis

INFLAMMATION

etiopatogenesis

- women – short uretra, pregnancy
- men – prostate hyperplasia, bladder diverticulosis
- diabetes mellitus
- urolithiasis
- cathetrisation, immunosupressive therapy, radiotherapy, …

- *E. coli, Proteus, Klebsiella, Enterobacter, Neisseria gonorrhoeae, Chlamydia, TBC*
- *Schistosoma haematobium*
- *viruses (adenovirus, CMV)*

INFLAMMATION
clinical signs

- frequency
- dysuria – pain or burning on urination
- lower abdominal pain

- bacteriuria, hematuria, pyuria

INFLAMMATION

morphology

- mucosal hyperemia and edema
- exsudate (cataral / purulent / pseudomembranous / ulcerative cystitis)
- hemorrhagic cystitis (after radiation, chemotherapy, adenovirus cystitis)

INFLAMMATION
histology

- acute cystitis
  - hyperemia, edema, leukocytes
  - regressive and reactive changes of urothelium
- chronic cystitis
  - fibrosis, lymphocytes, plasma cells
  - urothelial hyperplasia, metaplasia (squamous, glangular)
    - Brunn nests, cystitis (ureteritis cystica)

INFLAMMATION
malacoplakia

- chronic bacterial infection (E. coli, Proteus), often immunosupressed patients
- morphology: soft, yellow, raised mucosal plaques
- infiltration with large foamy macrophages, giant cells and lymphocytes
  - *Michaelis-Gutmann bodies in macrophages*

INFLAMMATION

interstitial cystitis

- unclear etiology
- usually women
- intermitent severe suprapubic pain + frequency, urgency, dysuria, hematuria
- no signs of bacterial infection
- morphology – fissures, punctate hemorrhages, chronic ulcers, bladder contraction
- chronic inflammation, mastocystes, transmural fibrosis
- dif. dg. CIS

TUMORS

- EPITHELIAL
  - UROTHELIAL (90%)
  - squamous, glandular (usually metaplastic origin)
- MESENCHYMAL (rare)
  - benig – leiomyoma…
  - malignant – sarcomas…
- SECONDARY

UROTHELIAL TUMORS

etiopatogenesis

- cigarette smoking
- industrial exposition to arylamines
- long term use of some analgetics
- radiation
- schistosomiasis, chronic inflammation (squamous cell ca)

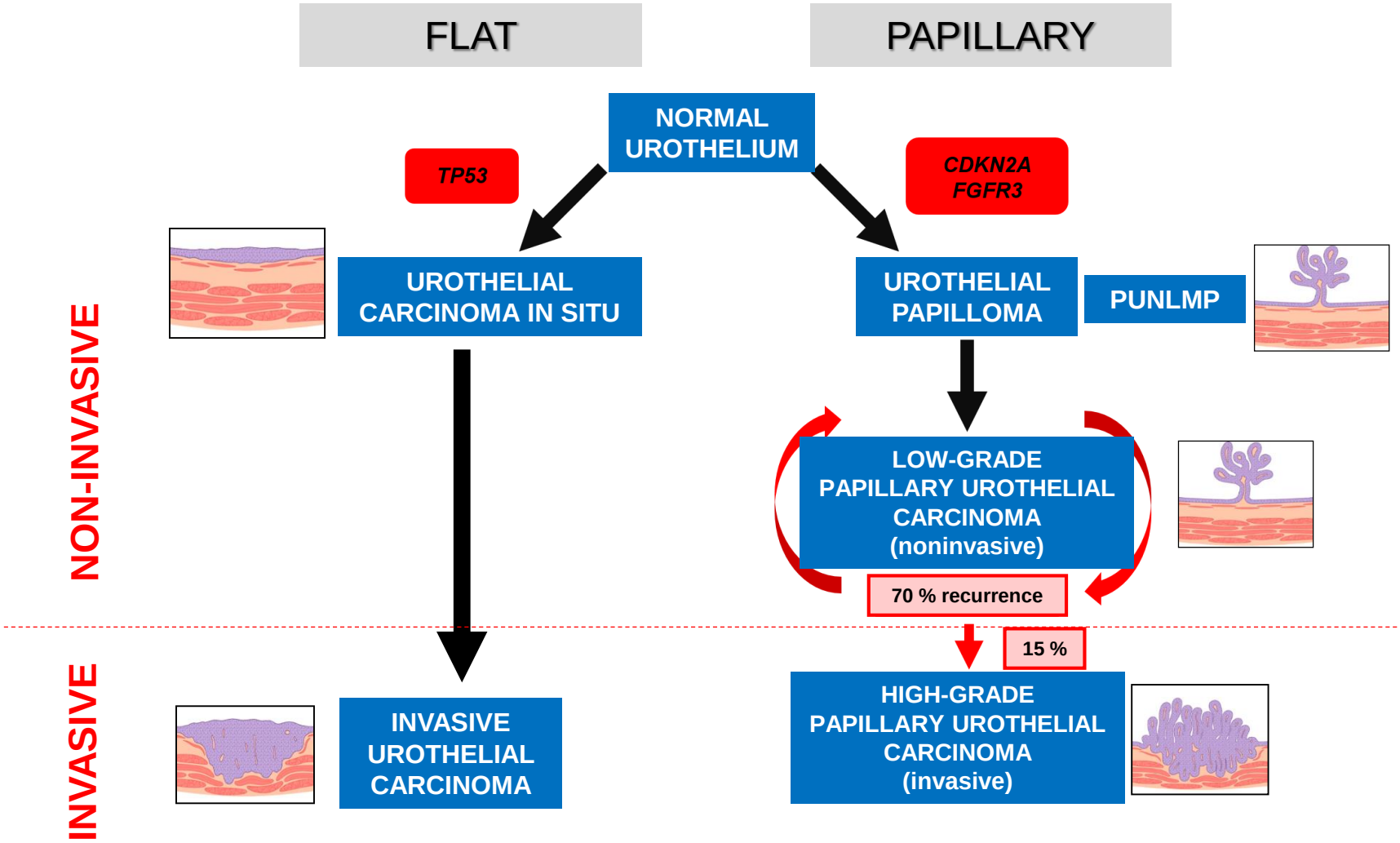
- common tumors (5. in males, 9. in females), but often no aggressive

UROTHELIAL TUMORS

clinical course

- hematuria
- frequency, dysuria
- hydronephrosis, pyelonephritis
- more frequently in men
- **recurrence, increase of grade !**

- therapy: transuretral resection, intravesical chemotherapy, cystectomy


FLAT
PAPILLARY
NORMAL UROTHELIUM
TP53
CDKN2A
FGFR3
UROTHELIAL CARCINOMA IN SITU
UROTHELIAL PAPILLOMA
PUNLMP
NON-INVASIVE
LOW-GRADE PAPILLARY UROTHELIAL CARCINOMA (noninvasive)
70 % recurrence
15 %
INVASIVE
INVASIVE UROTHELIAL CARCINOMA
HIGH-GRADE PAPILLARY UROTHELIAL CARCINOMA (invasive)

UROTHELIAL TUMORS

papilloma

- papillary tumor
- **non invasive**
- **no recurrence**
- benign
- papillae covered with normal urothelium

UROTHELIAL TUMORS
low-grade papillary carcinoma

- papillary tumor
- **usually non invasive** (90 %)
- **recurrence is common**
- **may progress to high-grade carcinoma (10-15 %)**
- urothelium has normal architecture, but mild cellular and nuclear atypia
- few mitoses

UROTHELIAL TUMORS
high-grade papillary carcinoma

- papillary tumor
- **usually invasive**
- progressive infiltrative growth into bladder wall
- urothelium with loss of polarity, marked cellular and nuclear atypia
- frequent mitoses
- may metastase

UROTHELIAL TUMORS

carcinoma in situ - CIS

- flat lesion,
- **non invasive**
- **precancerosis**
- high-grade dysplastic changes of urothelium
  - loss of polarity and cohession of cells
  - anisokaryosis, anisocytosis
  - hyperchromatic nuclei
  - mitoses

UROTHELIAL TUMORS
prognostic factors

- depth of invasion
  - non muscle invasive tumors
    - non invasive
    - subepithelial invasion

  ⟹ treated by transurethral resection
  (+intravesical chemotherapy)

  - muscle invasive tumors
    - infiltration of detrusor muscle

  ⟹ treated by cystectomy
  (+ systemic chemotherapy)

URINARY BLADDER TUMORS
other epithelial tumors

- squamocellular carcinoma
- adenocarcinoma
  - arising from metaplastic lesions
  - no adjacent urothelial CIS or structures of UC in tumor (dif. dg. UC with squamous/glandular differentiation)
- urachal adenocarcinoma
  - localised in apex of bladder
  - from urachal remnants

URINARY BLADDER TUMORS

mesenchymal tumors

- …rare tumors
- LEIOMYOMA
- LEIOMYOSARCOMA

- EMBRYONAL RHABDOMYOSARCOMA
  - polypoid mass prominent into bladder (sarcoma botryoides)
  - the most common bladder tumor in children

SECONDARY TUMORS

- Direct growth from other organs…
  - Colorectal adenocarcinoma
  - Prostatic adenocarcinoma
  - Squamous cell carcinoma of uteral cervix

! Dif. dg.: primary bladder tumors