Imaging of the pelvis

Angela Csomor
Female pelvis

- **Pregnancy**
  - normal
  - pathologic
  - ectopic

- **Uterus**
  - congenital disorders
  - inflammation, infection
  - neoplasm

- **Adnexes**
  - inflammation, infection, abscess
  - cyst
  - endometriosis
  - neoplasm

- **No pelvic X-ray/CT in fertile females (except emergency)**

- **US** (max 3 in normal pregnancy incl baby movie)
  - transabdominal
  - transvaginal

- **MR** (limit its use in first trimester)
  - pelvic

- **Intervention**
  - selective embolisation/chemotherapy
Decrease risks of ionizing radiation

- **Fertile female, not pregnant:** (except emergency)
  - avoid direct pelvic examination any time
  - X-ray/CT of other regions in first two weeks of the cycle only

- **Pregnancy:** (except emergency)
  - avoid direct pelvic examination any time
  - emergency X-ray/CT of other regions in second/third trimester only
  - direct pelvic radiation in first trimester of unknown pregnancy: consider termination

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Decrease risks of ionizing radiation

- **Xray, CT, CTA**
  - NO in pregnant!
  - Only when it is really indicated in fertile women!
Transabdominal sonography

Provides overview of the pelvis
Well distended bladder
  • acoustic window
  • displacement of bowel loops from pelvic region
Normal endometrium

Premenopausal patients
depends on the phase of the menstrual cycle
during menstruation: 2-4mm
proliferative, secretory phase: 5-16mm
Postmenopausal patients: <5mm
Transvaginal sonography

- empty bladder
- US probe is closer to the examined structures
- provides better resolution

gestational sack

ovarian follicula
• outer myometrium (intermediate intensity)
• inner myometrium or junctional zone (low intensity)
• endometrium (high intensity)
• the T2 contrast between the outer myometrium and the junctional zone becomes less marked in the postmenopausal uterus
Pregnancy, sonography

- gestational sac (5-6. week)
- fetal node (6-7. week)
- heart beat (7. week)
- head (14. week)
Pregnancy, 28th week - MRI
Female pelvis

- **Pregnancy**
  - Normal
  - Pathologic
  - Ectopic

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Arnold-Chiari,
20th week
Duplication cyst of the stomach
Female pelvis

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Ectopic pregnancy

- tubal ring sign
- ring of fire sign
- empty uterine cavity

- transabdominal, transvaginal US
- transabdominal scan provides a wider overview of the abdomen
- transvaginal scan is more sensitive
Female pelvis

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Abnormal fusion of the pair of Müllerian ducts

arcuate, bicornuate uterus
uterus duplex

normal uterine
zonal anatomy.
Female pelvis

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• diagnose the presence and monitor the growth of fibroids
• uncomplicated leiomyomas are usually hypoechoic, but can be isoechoic, or even hyperechoic compared to normal myometrium
• calcification - echogenic foci with shadowing
• necrosis - cystic areas
Leiomyomas

Localisation
- subserosal
- intramural
- submucosal

Enhancement
- variable

Signal intensity
- no degeneration
  - T1 intermediate
  - T2 low
- degeneration
  - necrotic
  - cystic
  - calcification
Endometrial cc

US transvaginal

tickening of the endometrium or polypoid mass

- premenopausal patients
depends on the phase of the menstrual cycle
during menstruation: 2-4mm
proliferative, secretory phase: 5-16mm
- postmenopausal patients: <5mm
Endometrial cc MRI

invasion of parametrium

local staging:
  MRI is superior to CT
distant metastasis:
  CT, MRI

disruption of junctional zone
invasion of myometrium

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Cervix tumor MRI

- Hyperintensity, more enhancement relative to the cervical stroma

- Local staging: MRI is superior to CT
- Distant metastasis: CT, MRI

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Female pelvis

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Hysterosalpingography (HSG)

infertility

evaluation
  of the shape of the uterine cavity
  patency of the tubes

injection of a contrast material into
the cervical canal under fluoroscopic control

normal result:
  • filling of the uterine cavity
  • bilateral filling of the fallopian tube
HSG

normal

2 sided intramural blockage of tubas

2 sided hydrosalpings
Female pelvis

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Tubo-ovarial abscess
Inflammation

intrauterine device
Female pelvis

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Simple cyst

- anechoic
- unilocular
- thin, smooth walls
- no solid or vascularized part
Cystic ovarian lesions-US

Premenopausa
- simple cyst <30mm - normal physiologic finding.
  - no follow-up

Pre- and postmenopausa:
- simple cyst <70mm almost certainly benign
  - follow-up, CT, MRI

Simple cysts > 70mm, or any other cyst
- possible neoplasm
  - MR and surgical evaluation

http://www.radiologyassistant.nl/en/p4cdf9b5de7d3b/
Ovarial cancer
Mucinous adenocarcinoma
Krukenberg tumour

metastasis in the ovary (usually) from the gastrointestinal tract
Teratoma-mature

X ray

CT

Contains:
mature tissues from at least two of the three germ cell layers (ectoderm, mesoderm, and endoderm).

skin, hair, blood, fat, bone, nails, thyroid tissue, teeth
diameter < 10 cm
Teratoma-immature

large, encapsulated masses
Contains:
solid part + components seen in a mature teratoma
Female pelvis

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  – Endometriosis
Endometriosis

presence of endometrial tissue outside the uterine cavity

T2- and T1-weighted:
low to intermediate signal intensity

T1-weighted images with fat saturation:
High signal- indicating the presence of hemorrhage

http://www.radiologyassistant.nl/en/p4da490c32edcc/
Endometriosis of the rectal wall
Endometrioma (chocolate cyst) of the ovary
Male pelvis

- **Prostate**
  - Acute inflammation, abscess
  - Chr. inflammation, hypertrophy
  - Tumor

- **Testicle**
  - Congenital disorder
  - Inflammation
  - Trauma, torsion
  - Tumor

- **US**
  - Transabdominal
  - Transrectal

- **MRI**
  - Pelvic
  - Transrectal

- **DSA, CT**
  - Of little use
Male pelvis

- **Prostata**
  - acute inflammation, abscessus
  - chronic inflammation
  - hyperplasia
  - tumor

- **Testis**
  - congenitalis abnormalities
  - inflammation
  - trauma, torsio
  - tumor
Transrectal sonography
hyperplasia (normal volume < 40 cm3)
retention cyst
Male pelvis

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  - Tumor

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  - Tumor
Abscess, transrectal ultrasound

retential cyst
anechoic
sharp contour

abscess
internal echoes
irregular or lobulated borders
Male pelvis

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  - Tumor

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Benign prostatic hyperplasia

hyperplasia - the transition zone next to the urethra - compression of the urethra

lower urinary tract symptoms

normal size : 3.8 x 2.5 x 3.2 cm
normal volume < 40 cm³
Male pelvis

- **Prostate**
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  - Chr. inflammation, hypertrophy
  - **Tumor**

- **Testicle**
  - Congenital disorder
  - Inflammation
  - Trauma, torsion
  - **Tumor**
Prostate tumor US

Usually:
• outer gland (peripheral zone)
• hypoechoic relative to prostatic parenchyma

Indication:
• elevated serum PSA level or abnormal DRE
• core biopsies

Limitation:
• not all hypoechoic prostatic nodules are malignant
• poor sensitivity in detection of capsular penetration
Prostate tumor MRI

- determine if there is extracapsular extension
- detect and localize cancer when the PSA is persistently elevated, but TRUS biopsy is negative.
- T1: useful for detection of prostate contour, extracapsular extension
- T2: low signal within a normally high signal peripheral zone
Prostata tumor MRI

Male pelvis

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  - Tumor
Normal testicle US

- primary imaging method
- 9-15 MHz
- homogeneous echogenicity
- low resistance arterial flow
Male pelvis

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  - Tumor
Retentio testis

- undescended testicle (inguinalis, abdominalis)
- risk factor for testicular cancer
- early diagnosis and treatment is important
  preserve fertility
  prevent for testis cancer
  reduce the risk of torsion
Varicocele

- dilatation (>2-3mm) and serpentine appearance of many small veins in the spermatic cord
- impairment of sperm production and function
- treatment: embolization
Male pelvis

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  - Tumor
Orchidoepididymitis

- testis, epididymys
  inhomogeneity
  enlargement
  hypervascularization
- hydrocele
- skin
  thickening
  hypervascularization
Male pelvis

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• **Testicle**
  - Congenital disorder
  - Inflammation
  - Trauma, torsion
  - Tumor
Testicle injury

- contusion
  heterogenous echotexture fluid
- ruptura
testicular contour abnormality
disruption of the echogenic line of tunica albugenia
absence of vascularity
Testicular torsion

result: cutting off of blood supply.

- impaired or absence of blood flow
- increase in size of the testis and epididymis
- homogeneous echotexture - before necrosis
- heterogeneous echotexture – after necrosis
- reactive hydrocoele
- reactive thickening of the scrotal skin with hyperaemia

- < 6 hours: ~100% salvage
- 6-12 hours: 50%
- 12-24 hours: 20%
Male pelvis

- **Prostate**
  - Acute inflammation, abscess
  - Chr. inflammation, hypertrophy
  - Tumor

- **Testicle**
  - Congenital disorder
  - Inflammation
  - Trauma, torsion
  - Tumor
Testicular seminoma

- risk factors
  - undescended testis
  - testicular misrolithiasis
  - infections
- homogeneous intratesticular mass of low echogenicity
Retentio testis - seminoma