MRI OF TESTICULAR MALIGNANCIES

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Learning Objectives

• to review clinical indications for MRI of the scrotum in cases of testicular malignancies

• to discuss the role of functional MRI in characterizing intratesticular masses
Testicular malignancies: clinical indications for MRI

- characterization of testicular lesions *(primary)*
- local staging of TGCTs *(primary)*
- characterization of the histological type of TGCTs *(in selected cases)*
- differentiation between TGCTs and non-germ cell neoplasms *(evolving)*
Intratesticular masses: Benign vs malignant

- in patients with equivocal US findings, MRI is recommended as a second-line technique for characterization of intratesticular masses (Grade C)

- confident characterization of the benign nature of intratesticular masses
- MRI may provide important information in the preoperative characterization of the histological nature of various benign intratesticular mass lesions in terms of morphological information and by showing the presence of fat, fluid, hemorrhage, fibrous tissue and solid contrast-enhancing tissue (LE2)
- decrease the number of unnecessary radical surgical procedures
Local staging of TGCTs

- MRI is recommended for local staging of TGCTs (Grade C)
- in patients who are candidates for organ-sparing surgery
- although organ-sparing surgery is not indicated in the presence of non-tumoural contralateral testis, it can be attempted in special cases with all the necessary precautions
  
  ✓ synchronous bilateral testicular tumours
  ✓ metachronous contralateral tumours
  ✓ tumour in a solitary testis, normal pre-operative testosterone levels
  ✓ tumour volume < 30% of TV
  ✓ small US-detected, nonpalpable intratesticular lesion; the incidence of benign definitive histology is high: 80%
  ✓ patients with symptoms of gynaecomastia or hormonal disorders

EAU guidelines 2016
Seminoma, pT3
Characterization of the histologic type of TGCTs

- MRI is recommended to differentiate seminomas from nonseminomatous testicular neoplasms in selected cases (Grade C)
  - in cases of disseminated disease and/or life-threatening metastases: chemotherapy is the first treatment

EAU guidelines 2016

- conventional MRI features: closely correlate with the histopathologic characteristics of TGCTs (LE4)
- ADC: additional tool (LE4)

Teratocarcinoma
Differentiating between TGCTs and non-germ cell neoplasms

- Increase of incidentally discovered nonpalpable small testicular tumors
  - Up to 80%: benign

- Leydig cell tumors (LCTs): most frequent
  - Organ-sparing surgery may be recommended

MRI may help in the characterization of LCTs (Grade B)
Diffusion-weighted imaging (DWI)

- included in routine MRI protocol (Grade B)
- improvement in the characterization of intratesticular lesions with the addition of DWI (LE2)
  - conventional MRI: 91%
  - DWI: 87%
  - conventional + DWI: 100%
• ADC of TGCTs < normal testis and various benign testicular lesions
  - cut-off ADC <0.99
    - sensitivity: 93.3%, specificity: 90%
• lower ADC for seminomas compared to nonseminomas
  - cut-off ADC <0.68
    - sensitivity: 63.6%, specificity: 80%

Tsili et al, Asian J Androl 2012
Algebally et al, Pol J Radiol 2015
Tsili et al, Eur J Radiol 2015
Dynamic Contrast-Enhanced (DCE) MRI

- Subtracted DCE-MRI is recommended in the evaluation of scrotal diseases (Grade B)

✓ when further tissue of intratesticular lesions is needed (LE2)
DCE-MRI

✓ types of contrast enhancement patterns: **differentiation of testicular lesions**
  ➢ **type I**: gradual linear increase of enhancement throughout the examination
    normal testis
  ➢ **type II**: brisk upstroke enhancement, followed by either a plateau or a slight further
    increase in enhancement  benign lesions
  ➢ **type III**: brisk enhancement, followed by gradual washout of the contrast medium
    malignancies
  ➢ **type 0**: little or no enhancement  benign lesions

➢ relative percentages of maximum time to peak: most important discriminating
  factor in characterizing testicular mass lesions
Diffusion tensor imaging (DTI)

- both ADC and FA significantly differ between testicular lesions and normal testis

✓ TGCTs have low ADC and high FA values

Tsili et al, Eur J Radiol 2017
Testicular seminoma

Tumor
ADC 0.70/ FA 0.20
Magnetization transfer imaging (MTI)

• MTI may be useful in the diagnostic work-up of testicular lesions

☑ TGCTs have high MTR compared to benign testicular lesions and normal testicular parenchyma

Tsili et al, Eur Radiol 2016
Embryonal carcinoma

MTR (tumor): 57.9%
LT testis: 46%
1H-MR spectroscopy

- abnormal testes ??

- elevated Cho peak: most important MRS hallmark for the diagnosis of cancer

- few data

- sensitivity and specificity in differentiating normal testis from various testicular diseases: 80%, using differences between Cho levels and ratio of Cho/lipids

- decreased Cho peak in testicular malignancies

- is this associated with impairment in spermatogenesis or concomitant difficulties in detecting Cho peaks in tumors within the adult testis, which normally has high Cho levels?

Tsili et al, Eur Radiol 2016

Baleato-Gonzalez et al, Clin Radiol 2015
Seminoma

ADC (tumor): 0.54

MTR (tumor): 56.7%
Conclusion

• MRI of the scrotum, including a multiparametric protocol represents an efficient, complimentary diagnostic tool for testicular imaging

• recommended for the characterization of intratesticular masses with indeterminate findings, based on clinical and US examination, helping to narrow the differential diagnosis and to determine more precise treatment strategies (primary)

• for local staging of TGCTs in cases which may be candidates for organ-sparing surgery (primary)

• for the classification of the histologic type of TGCTs (in selected cases)

• in differentiating TGCTs from non-germ cell neoplasms, especially in cases of small, impalpable incidentally discovered testicular tumors (work in progress)