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SPECIAL REPORT

Abdominopelvic imaging in the follow-up of testicular germ-cell tumors in adults: recommendations of the Scrotal and Penile Imaging Working Group of the European Society of Urogenital Radiology

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Abstract

Objectives The Scrotal and Penile Imaging Working Group (SPIWG) of the European Society of Urogenital Radiology (ESUR) aimed to formulate recommendations on the imaging modalities and minimal technical requirements for abdominopelvic imaging in the follow-up of adult patients treated for testicular germ-cell tumors (TGCT).

Methods The SPIWG members performed an extensive literature search, reviewed the current clinical practice, and reached a consensus based on the opinions of experts in the field.

Results Recurrence in patients treated for TGCT mainly occurs in retroperitoneal lymph nodes (LNs). Abdominopelvic CT and MRI are equivalent assessing retroperitoneal LNs. MRI has the advantage of avoiding radiation exposure, and moreover, diffusion-weighted images (DWI) may increase the detection rates without the need for contrast administration. In patients treated for stage I TGCT, the ESUR-SPIWG recommends MRI over CT for the detection of retroperitoneal LNs during the follow-up after treatment. CT, however, remains the follow-up imaging of choice in patients with advanced disease. When MRI is used, the recommended minimal requirements are at least one high-quality anatomical sequence (T1-WI or T2-WI) in axial and coronal planes, and DWI in the same axial plane, ≤ 4 mm contiguous slices from the diaphragm to the perineum. When CT is used, the recommended minimal requirement is a standard-dose contrast-enhanced CT in the portal-venous phase, scanned from the diaphragm to the perineum.

Conclusions In this paper, the ESUR-SPIWG provides recommendations on the imaging modalities and minimal technical requirements for abdominopelvic imaging in the follow-up of adult patients treated for TGCT.

Pieter De Visschere and Michele Bertolotto contributed equally to this work.

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Key Points

Question *There are no recommendations on the preferred imaging modality or scan sequences required for abdominopelvic imaging in the follow-up after treatment for testicular cancers.*

Findings *The European Society of Urogenital Radiology Scrotal and Penile Imaging Working Group (ESUR-SPIWG) provides recommendations for abdominopelvic imaging in follow-up after treatment for testicular cancers.*

Clinical relevance *Recurrence of testicular germ-cell tumors mainly occurs in retroperitoneal lymph nodes. Both CT and MRI provide similar morphological assessments, but radiation exposure can be avoided by using MRI instead of CT.*

Keywords Testicular cancer, Seminoma, Non-seminoma, Follow-up, Germ-cell tumor

Introduction

Surveillance plays a crucial role in managing patients who have undergone surgery and oncological therapies for testicular germ-cell tumors (TGCT). Regular follow-up appointments, including physical examinations, serum markers, and imaging studies, are scheduled to ensure early detection of any potential recurrence. The imaging surveillance strategy should be based on the initial tumor histology and prognosis [1–5]. At diagnosis, 85% of seminomatous germ-cell tumors (SGCT) and 60% of non-seminomatous germ cell tumors (NSGCT) are at clinical stage I, and the survival rate is about 99% after curative radical orchidectomy [1]. Advanced disease with multiple visceral metastases is rare [1]. TGCT spread, and disease recurrence proceed predictably through the lymph nodes (LNs) of the retroperitoneum, with the exception of choriocarcinoma and a small subset of aggressive NSGCT [6–8].

The purpose of follow-up imaging is, therefore, mainly targeted at detecting retroperitoneal LNs. Traditionally, follow-up imaging involves abdominopelvic Computed Tomography (CT) and either plain radiographs or CT of the chest. These methods, however, expose patients to radiation, which should be minimized for this population of young men, considering the frequency and duration of follow-up imaging based on their life expectancy. Alternative imaging techniques include magnetic resonance imaging (MRI) and low-dose CT [9]. In March 2022, the Trial of Imaging and Surveillance in Seminoma Testis (TRISST) results were published [10], showing that abdominopelvic MRI is a safe alternative to CT in the follow-up of patients with stage I SGCT. The European Association of Urology (EAU) [4] currently mentions both abdominopelvic MRI and CT as possible follow-up imaging modalities. However, there are no formal recommendations on the preferred modality according to stage or which scan sequences are minimally required when choosing abdominopelvic MRI. Therefore, the Scrotal and Penile Imaging Working Group of the European Society of Urogenital Radiology (ESUR-SPIWG) established an expert task force to review the current literature and to formulate recommendations for abdominopelvic imaging in the follow-up of adult patients with TGCT.

Evidence base and expert opinion base

First, an extensive literature search was performed by all the co-authors on all the imaging modalities used to follow-up patients treated for TGCT. There were no restrictions regarding the date of publication. Original and review articles, as well as international guidelines, were considered. Second, the current daily clinical practice of the follow-up imaging of patients treated for TGCT among the ESUR-SPIWG members was reviewed. Finally, recommendations regarding using the different imaging modalities and minimal technical requirements for abdominopelvic MRI and CT in the follow-up of TGCT were formulated. The results and recommendations were discussed with experts in the field during the ESUR Annual meeting in Lisbon in September 2024, and consensus was reached among the members of the ESUR-SPIWG.

Recommendations on imaging modalities in the follow-up Of TGCT

The international guidelines provide recommendations on the timing and investigations necessary to follow up patients treated for TGCT. The EAU and the European Society of Medical Oncology (ESMO) define three major follow-up groups, based on different risks of relapse depending on the tumor characteristics at initial diagnosis and treatment [1, 4, 11]: patients with SGCT stage 1 on active surveillance or after adjuvant treatment (Table 1), patients with NSGCT stage 1 (Table 2) and patients after adjuvant treatment or complete remission for advanced disease (Table 3). Patients not achieving complete remission or who present with poor prognoses are excluded from these major follow-up groups and should be followed individually in specialized centers. Poor prognosis is defined in the EAU guidelines as NSGCT with mediastinal primary tumor, non-pulmonary visceral metastasis, alpha-fetoprotein > 10,000 ng/mL, β-human chorionic gonadotrophin > 50,000 IU/L, or lactate dehydrogenase > 10 × ULN (upper limit of normal). They have a 5-year progression-free survival of 54% or a 5-year survival of 67% [4, 11].

Due to its non-invasive nature and absence of radiation, MRI is a safer choice for recurrent imaging, especially in

Table 1 EAU-ESMO, AUA and NCCN guidelines recommendations on abdominopelvic imaging in the follow-up of SGCT stage I on active surveillance or after adjuvant treatment

	Abdominopelvic imaging modality	Year 1	Year 2	Year 3	Years 4 and 5	After 5 years
EAU-ESMO	Abdominopelvic MRI/CT	2 times	2 times	Once at 36 months	Once at 60 months	Further management according to survivorship care plan
AUA	CT abdomen +/− Pelvis	Every 6 months	Every 6 months	Every 6–12 months	Every 6–12 months	If clinically indicated
NCCN	CT or MRI of Abdomen +/− Pelvis	At 4–6, and 12 months	Every 6 months	Every 6–12 months	Every 12–24 months	May be extended at the discretion of the physician

Table 2 EAU-ESMO, AUA and NCCN guidelines recommendations on abdominopelvic imaging in the follow-up of NSGCT stage I on active surveillance or after adjuvant treatment

	Abdominopelvic imaging modality	Year 1	Year 2	Year 3	Years 4 and 5	After 5 years
EAU-ESMO	Abdominopelvic MRI/CT	2 times	At 24 months	Once at 36 months	Once at 60 months	Further management according to survivorship care plan
AUA	CT abdomen +/− Pelvis	Every 3–6 months	Every 4–12 months	Once	Annually	If clinically indicated
NCCN	CT or MRI of Abdomen +/− Pelvis	Every 4–6 months	Every 4–6 months	Annually	Annually	May be extended at the discretion of the physician

Table 3 EAU-ESMO and NCCN guidelines* recommendations on abdominopelvic imaging in the follow-up after adjuvant treatment or complete remission for advance disease (excluded: poor prognosis and no remission)

	Abdominopelvic imaging modality	Year 1	Year 2	Year 3	Years 4 and 5	After 5 years
EAU-ESMO	Abdominopelvic MRI/CT	1–2 times	At 24 months	Once at 36 months	Once at 60 months	Further management according to survivorship care plan
NCCN	CT or MRI of Abdomen +/− Pelvis	Every 6 months	Every 6–12 months	Annually	As clinically indicated	May be extended at the discretion of the physician

* The AUA guidelines do not provide clear recommendations on abdominopelvic imaging in the follow-up of these patients

young adults. Although literature is limited, studies have shown that abdominopelvic MRI and CT provide similar accuracy when assessing metastatic LNs [7, 12–15] with sensitivity between 78% and 96% [10, 13, 16–18]. According to Sohaib et al CT and MRI are comparable when read by radiologists with more than 10 years of experience [13]. For the assessment of retroperitoneal recurrence, MRI and CT provide a similar morphological assessment of LNs, based on size criteria, together with features such as necrosis and irregular shape (Figs. 1 and 2). The short-axis size is used to discriminate benign and malignant LN. Sensitivity decreases and specificity increases with increasing LN short-axis cut-off size. With an LN size cut-off of ≥ 10 mm, specificity reaches 100% [19], although a size cut-off for recognizing LNs as pathological is undetermined. Laukka et al established 7 mm as the threshold value [12], while Sohaib et al [13] and Ellis et al [14] proposed 10 mm. Thus, it seems crucial to include the morphology/intrinsic appearance of the node as well as the size in the evaluation. Given the lack of a validated consensus, a short axis of 8 mm is usually recommended to consider a node suspicious providing a similar sensitivity and specificity of around 70%. The expected patterns of nodal spread in GCTC should be considered when evaluating small and borderline nodes [20, 21].

The EAU guidelines currently mention both abdominopelvic MRI and CT as possible follow-up imaging modalities but suggest that it is preferable to use MRI in

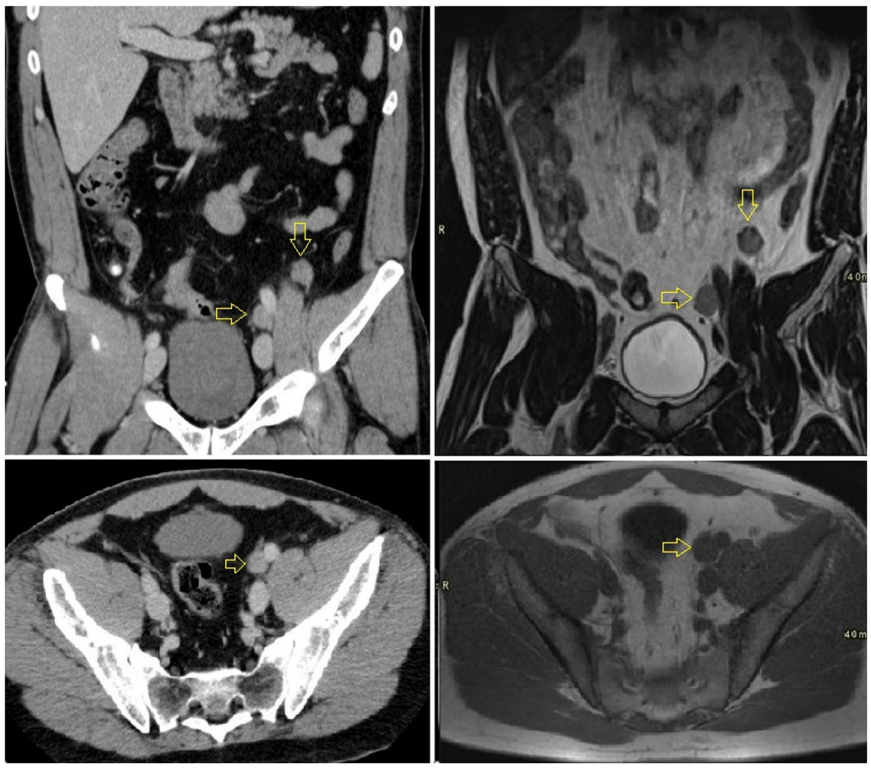

Fig. 1 For assessment of recurrence in retroperitoneal LN, contrast-enhanced CT (left images, coronal and axial) and MRI (right images, coronal T2-Weighted and axial T1-weighted) provide similar morphological assessment of LNs, based on size criteria. Enlarged LNs (yellow arrows) can readily be detected as suspicious on both imaging modalities

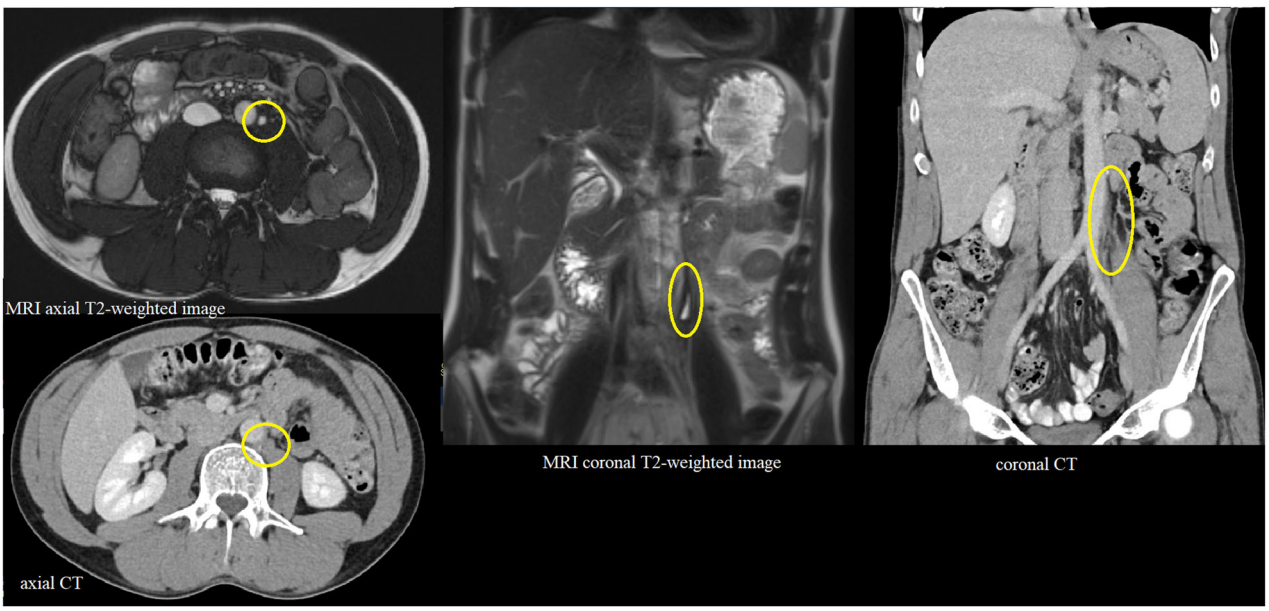

Fig. 2 A 33-year-old man treated for a NSGCT with left radical orchidectomy, retroperitoneal lymphadenectomy and chemotherapy. On follow-up CT, a suspicious left-para-aortic retroperitoneal nodule was detected, but on MRI this turned out to be a T2-hyperintense post-operative seroma (white circle and oval). The CT findings were false-positive in this case

experienced centers only, as the sensitivity of detection is decreased in general hospitals when reported by the trainees and general radiologists instead of radiologists with particular expertise in oncological imaging [19]. The American Urological Association (AUA) guidelines recommend similar follow-up imaging as the EAU guidelines. They mention abdominopelvic MRI as an alternative if CT is contraindicated in the initial staging. Still, there is no explicit discussion about MRI as an alternative to CT in the follow-up of TGCT after the treatment [22]. The National Comprehensive Cancer Network (NCCN) clinical practice guidelines recommend contrast-enhanced MRI as an appropriate alternative to contrast-enhanced CT of the abdomen and pelvis in both SGCT and NSGCT. They state that the MRI protocol should be able to visualize both retroperitoneal and pelvic LNs and that the same imaging modality should be used throughout the surveillance [23]. Notably, assessing retroperitoneal LNs with ultrasound (US) is not recommended as CT and MRI offer superior capabilities in detecting nodal disease [24]. Scrotal US is the primary imaging modality for the assessment of testicular lesions and to check for metachronous contralateral disease [25–29], but in the surveillance after curative treatment, routine scrotal US of the contralateral testis is generally not recommended [4, 11].

Follow-up of patients with stage I TGCT

The EAU and ESMO guidelines recommend extending cross-sectional imaging to the retroperitoneum during the follow-up of stage I TGCT. Chest imaging is not recommended in SGCT, and chest radiography is recommended and considered sufficient in NSGCT [30, 31]. Since the cure rate of stage I TGCT is very high, with survival rates approaching 100% [1, 4], minimizing toxicity is the priority, and for repeated CT investigations, the risk of radiation-associated malignancies is not negligible. Tarin et al estimated a risk ranging between 1.2% and 1.9% at 5 years of follow-up and a 15-fold risk of malignancy compared with patients who underwent a single CT scan [32]. Although other investigators reported a lower incidence [33, 34], keeping the risk of radiation-associated malignancies as low as reasonably achievable (ALARA) is prudent. It should be acknowledged that higher radiation doses correspond to an increased risk of experiencing adverse effects and the risk is cumulative. Furthermore, age plays a crucial role in sensitivity to ionizing radiation. Younger people are more sensitive to ionizing radiation than the elderly.

Different strategies have been suggested to minimize or remove this potential risk of radiation burden. A possible approach is to reduce the number of CT scans. With a reduced schedule, no adverse impact on long-term outcomes was seen [10]. Another strategy is to optimize the CT protocol. Various options have been suggested [35], such as the omission of the pelvic part of the abdominopelvic CT scan in stage I disease since isolated pelvic metastases are rare [36–39]. In patients with a low risk of recurrence, several studies have proposed abdominopelvic MRI as an alternative to CT with comparable results in experienced centers [9, 10, 12–15, 17–20, 40–49]. The comparable diagnostic accuracy of MRI with the superior soft tissue contrast resolution, combined with the advantage of eliminating radiation exposure, supports its integration into clinical practice. The ESMO, the Swedish-Norwegian Testicular Cancer Project and the German Testicular Germ Cell Tumor guidelines already recommend MRI for detecting retroperitoneal LNs in the follow-up of TGCT [1, 19]. The TRISTT trial, a large prospective, randomized, multicenter non-inferiority trial, demonstrated that the sensitivity of MRI in stage I SGCT is comparable to CT in detecting retroperitoneal LNs [10]. Other studies come to the same conclusion also for stage I NSGCT, although the level of evidence is lower [9, 12–14, 19, 42].

> **ESUR-SPIWG recommendation**: Within accordance with the ALARA principle, the pool of the literature, and considering the predictability of abdominal relapse, the ESUR-SPIWG recommends MRI instead of CT as the abdominopelvic imaging modality of choice for the surveillance and detection of retroperitoneal LN recurrence in the follow-up of adult patients with stage I TGCT.

Follow-up after curative treatment for advanced disease

In patients with advanced disease at diagnosis, the ALARA principle is less applicable during follow-up. The detection of recurrence is far more critical to the patient than concerns about radiation exposure. Even though life expectancy after curative treatment extends over several decades [4], there is evidence that the toxicity of adjuvant treatments overpasses several times the radiation risk of developing secondary cancer [50–54]. Most importantly, the risk of developing recurrence in the lung and visceral organs is non-negligible in these patients. This requires chest CT and abdominopelvic cross-sectional imaging to detect nodal and visceral metastases. According to the ESMO and EAU guidelines, abdominopelvic MRI can be used as an alternative to CT in experienced centers reported by an experienced radiologist [1, 4]. The non-inferiority of MRI to CT for detection of visceral metastases, however, needs to be substantiated [49], since the pool of comparison studies are focused on the detection

of retroperitoneal LNs only. Also, MRI is more time-consuming, since a complete MRI protocol including T1-weighted imaging (T1-WI), T2-weighted imaging (T2-WI), DWI, and contrast-enhanced T1-WI, is necessary to identify both nodal and visceral recurrences.

ESUR-SPIWG recommendation: After curative treatment of adult patients with advanced TGCT, the ESUR-SPIWG recommends CT as the abdominopelvic imaging modality of choice in the follow-up.

Follow-up of patients with poor prognosis or not achieving a complete disease remission

In accordance with the guidelines, these patients should be followed up in specialized centers with tailored protocols [1, 4]. Disease management and imaging investigations should be personalized for each patient based on the response to treatment. They may include CT, MRI and/or FDG-PET-CT, when indicated by histology. FDG-PET-CT may identify subclinical metastases in primary staging [55, 56]. NSGCT shows lower SUV values than SGCT; therefore, FDG-PET-CT is less reliable in NSGCT [57]. The available literature on using FDG-PET-CT in the follow-up of patients with TGCT is scarce [40, 58]. Most studies focus on the application of FDG-PET-CT in residual post-chemotherapy disease. Unlike CT and MR, FDG-PET-CT can assess the viability of residual tumor and distinguish it from necrotic and fibrotic tissue. FDG-PET-CT is recommended in SGCT patients with post-chemotherapy residual masses > 3 cm in largest diameter [4]. As FDG-PET-CT has a NPV of approximately 90% in men with residual masses > 3 cm, it may provide information on disease viability and help to avoid unnecessary surgical treatment [59]. FDG-PET-CT should be performed in these cases at least 2 months after completion of chemotherapy as earlier scans may cause false-positive findings due to inflammation and strong desmoplastic reaction, which are frequent after chemotherapy in SGCT [60, 61]. False-negative results can occur in cases of small volumes of viable tumor [57, 62].

Teratoma merits special attention. Growing teratoma syndrome, most commonly presenting in the retroperitoneum, must be suspected in patients with enlarging masses during or after systemic chemotherapy for NSGCT, normalization of previously elevated serum tumor markers, and mature teratoma in pre-existing histological analysis [63–65]. Teratomas do not respond to chemotherapy. MRI shows masses with high, fluid-like signal intensity on T2-WI due to cystic or necrotic content, high signal intensity on T1-WI due to proteinaceous content and enhancing septations [63–65]. Malignant transformation has been described [66], presenting at imaging as increasing solid and enhancing tissue [63].

ESUR-SPIWG recommendation: In adult TGCT patients with poor prognosis or not achieving complete disease remission, the imaging investigations should be overseen by specialist centers and personalized for each patient and may include CT, MRI and/or FDG-PET-CT, when indicated by histology.

Recommendations on minimal technical requirements for abdominopelvic MRI and CT in the follow-up of TGCT

Abdominopelvic MRI

In the literature, different MRI protocols include T1-WI and/or T2-WI, scanned in axial planes only or axial along with coronal planes, with different slice thicknesses, gaps, and scan time. No studies compare the performance of T1-WI with T2-WI and/or proton-density (PD) images in the detection of retroperitoneal LNs. No studies investigate images obtained with respiratory triggering or in breath hold. All the reported protocols seem to be effective in the detection of retroperitoneal LNs since non-inferiority to CT has been demonstrated. Comparative studies are, however, needed to recommend an evidence-based standard. Using abdominopelvic MRI instead of CT for the follow-up of patients with TGCT can easily be implemented in most radiology departments, as 1.5-T–3.0-T MRI is available in most centers and radiologists have experience in assessing retroperitoneal LNs in other oncological settings. Disadvantages include higher cost, longer examination time and less availability compared to CT. A relatively short acquisition time is preferred, in which at least the retroperitoneum should be covered. Axial and at least one coronal sequence should be acquired. Axial images should be acquired on corresponding planes and should be matched in terms of field of view and slice thickness, to ease comparison of different sequences. Contiguous slices from the diaphragm to the perineum with a slice thickness of ≤ 4 mm are considered a minimal requirement. Intravenous contrast agent administration may be used, but it is not considered necessary.

Several studies that demonstrate the non-inferiority of MRI compared to CT do not use DWI [10, 13, 14]. The use of DWI increases the detection of pathological LNs (Figs. 3 and 4), although there is a significant overlap between benign and malignant LNs [12, 19, 42] (Fig. 5). DWI-MRI shows 93.8% sensitivity, 97.4% specificity, 99.7% NPV, 59.9% PPV, and an accuracy of 97.3% in the detection of relapse [12, 13, 15, 17–20, 40, 42–49]. DWI may also have added value in the detection and assessment of the

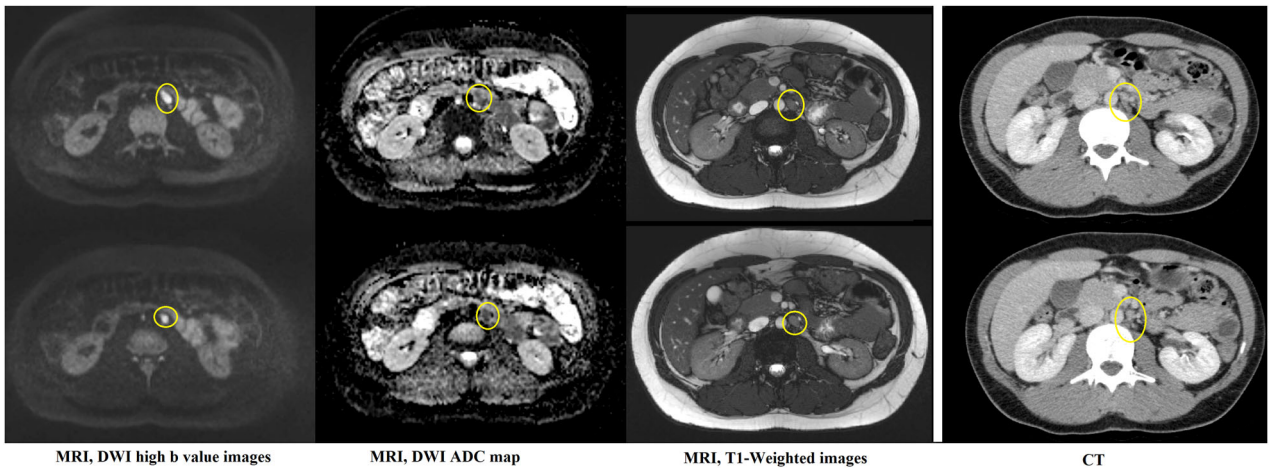

Fig. 3 A 27-year-old man treated for a stage III SGCT pT1 with left radical orchidectomy and chemotherapy. Follow-up imaging 2 years later shows a round retroperitoneal LN of 1 cm. The LN was overlooked on the CT but detected on MRI, mainly because of the marked restricted diffusion (yellow circles)

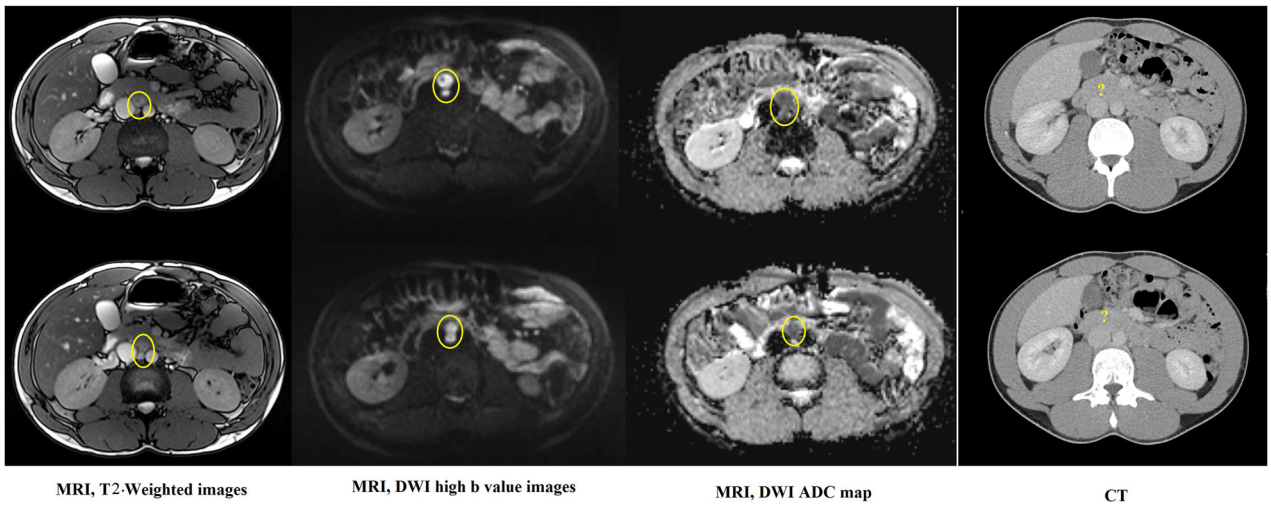

Fig. 4 A 29-year-old man treated for a NSGCT pT2 with right radical orchidectomy and chemotherapy. Follow-up imaging 6 months later showed a round retroperitoneal aortocaval LN of 1.5 cm. The LN was not visible on the CT because it was a patient with minimal intra-abdominal fat and the LN had the same density as the adjacent pancreas. The LN was detected on MRI due to the marked restricted diffusion (yellow circles). A laparoscopic lymphadenectomy confirmed LN metastasis of the NSGCT

activity of residual masses [19, 67]. In studies in which DWI is acquired different *b*-values are used [12, 19, 42], but a *b*-value of at least 1000 s/mm^2 seems to be a minimal requirement. Pasoglou et al showed that whole-body MRI, including DWI, was as good as CT in detecting retroperitoneal LN metastases in patients with TGCT [7]. The same study reported an accuracy of 95% in the detection of supra-diaphragmatic metastases [7]. Although MRI cannot assess lung parenchyma [12, 19, 20], it has been reported that MRI with DWI has 80–83% sensitivity and 80–93% specificity in detecting pulmonary nodules [68, 69]. The abovementioned data, however, require further external validity, larger sample size and randomization before whole-body MRI might replace thoraco-abdominopelvic CT in the follow-up of TGCT [7].

ESUR-SPIWG recommendation: When MRI is used for abdominopelvic imaging in the follow-up of adult patients with TGCT, at least one high-quality anatomical sequence (T1-WI or T2-WI) in axial and coronal planes, and DWI with a *b*-value of at least 1000 s/mm^2 in the same axial plane, ≤ 4 mm contiguous slices from

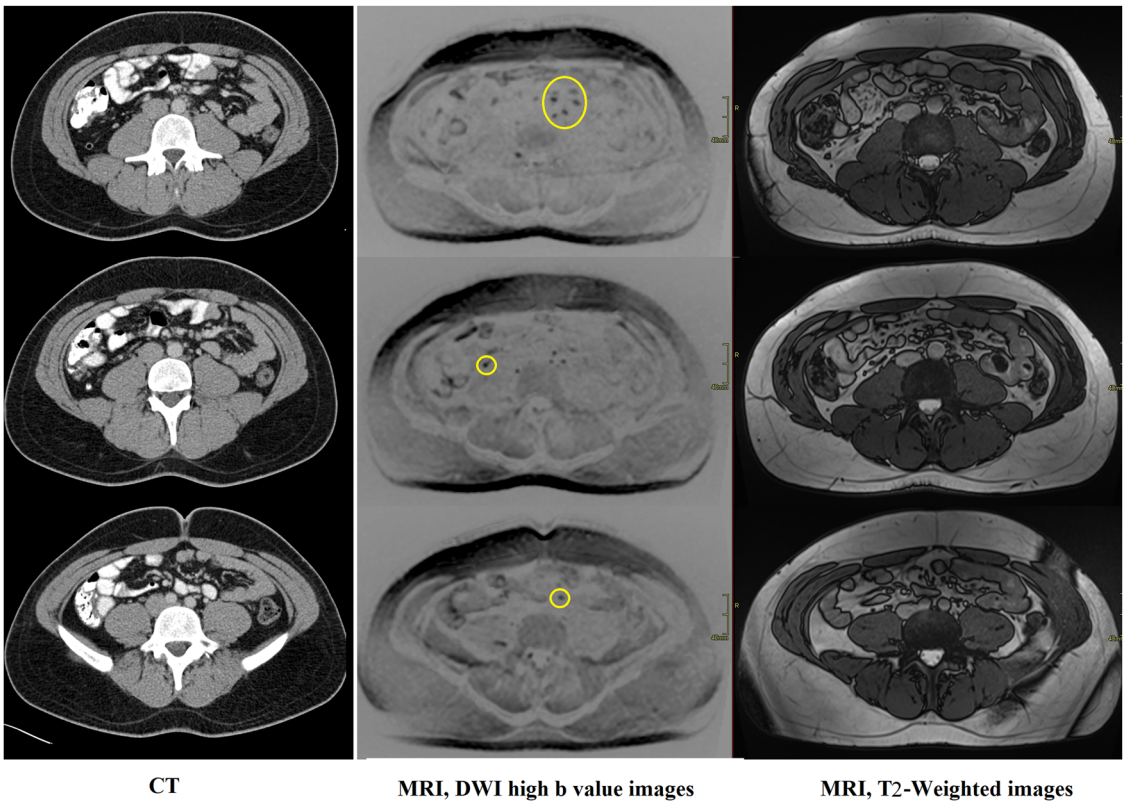

Fig. 5 A 25-year-old man treated for a stage 1 NSGCT. On follow-up MRI, several sub-centimeter mesenteric LNs were observed, showing restricted diffusion (yellow circles). On CT, these mesenteric LNs were unremarkable. Patient was followed up, and the LNs remained stable, indicating benign nature. The MRI findings were considered false-positive in this case

the diaphragm to the perineum are recommended as minimal requirement.

Abdominopelvic CT

CT is traditionally the reference standard for imaging in the surveillance of TGCT. Morphological criteria are used to identify lymph node recurrence. A standard-dose CT with portal-venous phase only, covering the entire abdomen and pelvis, is used in most practices. No oral contrast preparation is needed. Slice thickness ranges between 1.5 and 2.5 mm. Contrast-enhanced CT of the thorax and abdomen can also assess metastatic disease outside the retroperitoneum. The main disadvantage of CT in young patients during follow-up following treatment for TGCT is the risk of carcinogenesis due to ionizing radiation. The radiation dose of a standard CT ranges between DLP 450 and 800 mGy-cm, corresponding to an abdominopelvic CT with an effective dose of 6–12 mSv. Low-dose (LD) or ultralow-dose (ULD) CT protocols reaching effective doses to about 1 mSv aim to minimize radiation exposure while preserving the image quality. An initial study on 16 patients obtained a dose reduction of 67% compared to standard-dose CT with similar or superior diagnostic yield [70]. In another study, including 33/257 retroperitoneal LN relapse patients, LDCT proved safe and effective [71]. LD and ULD chest CT have a similar sensitivity for detecting micronodules as compared to standard-dose CT, but further studies are needed to substantiate the non-inferiority of LD or ULD CT protocols in abdominopelvic imaging in the follow-up of TGCT [12, 71]. New dose reduction techniques such as photon-counting CT may be promising, but up to date no studies have reported on its use in the follow-up imaging of TGCT.

ESUR-SPIWG recommendation: When CT is used for abdominopelvic imaging in the follow-up of adult patients with TGCT, the recommended minimal requirement is a contrast-enhanced standard-dose CT in portal-venous phase, scanned from the diaphragm to the perineum.

Table 4 provides an overview of the abovementioned ESUR-SPWIG recommendations

Table 4 ESUR-SPIWG recommendations on abdominopelvic imaging in the follow-up of TGCT in adults

Follow up of stage I TGCT	MRI instead of CT is recommended as the abdominopelvic imaging modality of choice for the surveillance and detection of retroperitoneal LN recurrence
Follow-up after curative treatment of advanced TGCT	CT is recommended as the abdominopelvic imaging modality of choice.
Follow-up of patients with poor prognosis or not achieving complete disease remission	The imaging investigations should be overseen by specialist centers and personalized for each patient and may include CT, MRI and/or FDG-PET-CT when indicated by histology.
MRI minimal requirements	At least one high-quality anatomical sequence(T1-WI or T2-WI) in axial and coronal planes, and DWI with a *b*-value of at least 1000 s/mm^2 in the same axial plane, ≤ 4 mm contiguous slices from the diaphragm to the perineum.
CT minimal requirements	A contrast-enhanced standard-dose CT in the portal-venous phase, scanned from the diaphragm to the perineum.

Conclusion

In this paper, the ESUR-SPIWG provides recommendations for imaging in the follow-up of adult patients treated for TGCT. Both CT and MRI provide adequate morphological assessment of retroperitoneal LNs. In patients treated for stage I TGCT, MRI is preferred over CT as imaging modality, but in patients with advanced disease, CT remains the mainstay. Minimal technical requirements for MRI and CT scanning in the follow-up of patients treated for TGCT are provided.

Abbreviations

ESUR	European Society of Urogenital Radiology
LNs	Lymph nodes
NSGCT	Non-seminomatous germ cell tumors
SGCT	Seminomatous germ-cell tumors
SPIWG	Scrotal and Penile Imaging Working Group
TGCT	Testicular germ-cell tumors

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Compliance with ethical standards

Guarantor

The scientific guarantor of this publication is Pieter De Visschere.

Conflict of interest

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Statistics and biometry

No complex statistical methods were necessary for this paper.

Informed consent

Written informed consent was not required for this paper because no patients were involved.

Ethical approval

Institutional Review Board approval was not required because no patients were involved.

Study subjects or cohorts overlap

Not applicable.

Methodology

- Evidence-based expert opinion

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