American College of Radiology
ACR Appropriateness Criteria®
Hematospermia

Variant: 1 Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
TRUS prostate	Usually Not Appropriate	O
US scrotum	Usually Not Appropriate	O
MRI abdomen and pelvis without and with IV contrast	Usually Not Appropriate	O
MRI abdomen and pelvis without IV contrast	Usually Not Appropriate	O
MRI pelvis without and with IV contrast	Usually Not Appropriate	O
MRI pelvis without IV contrast	Usually Not Appropriate	O
MRU without and with IV contrast	Usually Not Appropriate	O
MRU without IV contrast	Usually Not Appropriate	O
CT abdomen and pelvis with IV contrast	Usually Not Appropriate	☢☢☢
CT abdomen and pelvis without IV contrast	Usually Not Appropriate	☢☢☢
CT pelvis with IV contrast	Usually Not Appropriate	☢☢☢
CT pelvis without IV contrast	Usually Not Appropriate	☢☢☢
Fluciclovine PET/MRI skull base to mid-thigh	Usually Not Appropriate	☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CT pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CTA abdomen and pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
CTA abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CTA pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
CTU without and with IV contrast	Usually Not Appropriate	☢☢☢☢
Fluciclovine PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
PSMA PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢

Variant: 2 Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI pelvis without and with IV contrast	Usually Appropriate	O
TRUS prostate	May Be Appropriate	O
US scrotum	May Be Appropriate	O
MRI pelvis without IV contrast	May Be Appropriate	O
MRU without and with IV contrast	May Be Appropriate	O
MRU without IV contrast	May Be Appropriate	O
CT abdomen and pelvis with IV contrast	May Be Appropriate	☢☢☢
CT pelvis with IV contrast	May Be Appropriate	☢☢☢
CT pelvis without IV contrast	May Be Appropriate	☢☢☢
CT abdomen and pelvis without and with IV contrast	May Be Appropriate	☢☢☢☢

CT pelvis without and with IV contrast	May Be Appropriate	☢☢☢☢
CTU without and with IV contrast	May Be Appropriate	☢☢☢☢
MRI abdomen and pelvis without and with IV contrast	Usually Not Appropriate	O
MRI abdomen and pelvis without IV contrast	Usually Not Appropriate	O
CT abdomen and pelvis without IV contrast	Usually Not Appropriate	☢☢☢
Fluciclovine PET/MRI skull base to mid-thigh	Usually Not Appropriate	☢☢☢
CTA abdomen and pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
CTA abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CTA pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
Fluciclovine PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
PSMA PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢

Panel Members

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Summary of Literature Review

Introduction/Background

Hematospermia (HS), also referred to as haematospermia, hemospermia, or haemospermia, is the presence of blood products in the ejaculate. Although the exact incidence is unknown, because most times the ejaculate is not visualized as it occurs during intercourse, it is estimated to have an incidence of approximately 1% to 1.5% of urological referrals [1-9]. Although usually self-limiting and mostly secondary to benign etiologies, it is a symptom that causes fear and anxiety in patients, who usually associate it with the possibility of cancer and sexually transmitted diseases. Historically, it has been described for centuries, and it most commonly affects the younger population (<40 years of age). Understanding the anatomy and physiology of the organs involved in the production of the ejaculate contents and the ejaculation process is necessary for assessing possible etiologies of HS. Diseases affecting the testes, epididymides, vas deferens, seminal vesicles, ejaculatory ducts, prostate, urinary bladder, accessory glands such as Cowper glands, and urethra are potential etiologies for HS [5,6,10-12].

Most cases of HS have been labeled as idiopathic, which may be the result of its usually benign self-limited course, for which no further evaluation is performed. With advances in imaging, several of the previously labeled idiopathic cases are found to have an etiology, most commonly bleeding in the seminal vesicles. Of the identified specific etiologies of HS, infectious/inflammatory processes are the most common [5,6,8,10,11,13,14], including seminal vesiculitis and prostatitis. Iatrogenic HS, due to prostate biopsies, has been increasingly seen as sextant prostate biopsies prevalent in the older patient population (>40 years of age) as a diagnostic method for prostate cancer.

Additional etiologies include calculi and obstruction from congenital or acquired cysts, congenital malformations such as Zinner syndrome, systemic causes, and malignancies. Although malignancy is the most feared etiology for HS, it is uncommon, specifically in the younger population (<40

years of age), with a higher incidence in the older patient population. The risk of malignancy in HS is of approximately 3.5% in the general population [8,15], with a wide range in some studies (0%-13.1%). The most prevalent malignancy in HS is prostate cancer, and in some cohorts reporting a higher prevalence, HS was assessed as a symptom in the setting of elevated prostate-specific antigen [9]. Few cases of testicular cancer, and other rare tumors involving the seminal vesicles and pelvis, are reported sporadically. Therefore, patients ≥40 years of age presenting with HS should be screened for prostate cancer.

This document addresses HS in cisgender men (assigned male at birth with a male gender identity).

Special Imaging Considerations

Prostate MRI is an imaging modality tailored for the evaluation of the prostate gland and adjacent structures [16]. Although the main current use of prostate MRI is to evaluate prostate cancer, it is an optimal modality to visualize the adjacent organs involved in spermatogenesis in the pelvis. In addition, given the association of prostate cancer and HS in patients >40 years of age, MRI has a role in the assessment of potential prostate lesions [13,17].

For the purposes of distinguishing between CT and CT angiography (CTA), ACR Appropriateness Criteria topics use the definition in the ACR–NASCI–SIR–SPR Practice Parameter for the Performance and Interpretation of Body Computed Tomography Angiography (CTA) [18]:

"CTA uses a thin-section CT acquisition that is timed to coincide with peak arterial and/or venous enhancement, depending on the vascular structures to be analyzed. The resultant volumetric data set is interpreted using primary transverse reconstructions as well as multiplanar reformations and 3-D renderings."

All elements are essential: 1) timing, 2) reconstructions/reformats, and 3) 3-D renderings. Standard CTs with contrast also include timing issues and reconstructions/reformats. Only in CTA, however, is 3-D rendering a **required** element. This corresponds to the definitions that the CMS has applied to the Current Procedural Terminology codes.

CT urography (CTU) is an imaging study that is tailored to improve visualization of both the upper and lower urinary tracts. There is variability in the specific parameters, but it usually involves unenhanced images followed by intravenous (IV) contrast-enhanced images, including nephrographic and excretory phases acquired at least 5 minutes after contrast injection. Alternatively, a split-bolus technique uses an initial loading dose of IV contrast and then obtains a combined nephrographic-excretory phase after a second IV contrast dose; some sites include the arterial phase. CTU should use thin-slice acquisition. Reconstruction methods commonly include maximum intensity projection or 3-D volume rendering. For the purposes of this document, we make a distinction between CTU and CT abdomen and pelvis without and with IV contrast. CT abdomen and pelvis without and with IV contrast is defined as any protocol not specifically tailored for evaluation of the upper and lower urinary tracts and without both the precontrast and excretory phases.

MR urography (MRU) is also tailored to improve imaging of the urinary system. Unenhanced MRU relies upon heavily T2-weighted imaging of the intrinsic high signal intensity from urine for

evaluation of the urinary tract. IV contrast is administered to provide additional information regarding obstruction, urothelial thickening, focal lesions, and stones. A contrast-enhanced T1-weighted series should include corticomedullary, nephrographic, and excretory phases. Thin-slice acquisition and multiplanar imaging should be obtained. For the purposes of this document, we make a distinction between MRU and MRI abdomen and pelvis without and with IV contrast. MRI abdomen and pelvis without and with IV contrast is defined as any protocol not specifically tailored for evaluation of the upper and lower urinary tracts, without both the precontrast and excretory phases, and without heavily T2-weighted images of the urinary tract.

Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously wherein each procedure provides unique clinical information to effectively manage the patient's care).

Discussion of Procedures by Variant

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.

Imaging evaluation is usually not recommended for the patient population of <40 years of age, with a transient HS episode without associated signs or symptoms of disease. A thorough history, physical examination, and laboratory workup, with or without empiric treatment for infection is usually sufficient for this group. Assessment of the possible etiology of the bleeding, excluding partner's blood in the urethra in the postcoital setting, and differentiation from hematuria are important to guide the need for further investigation. Assessment of the patient's blood pressure and coagulation profile, as well as semen analysis, urinalysis, and microbiology evaluation of urine and semen, may guide the appropriate treatment, if necessary [8,10,15,19]. There is a lack of evidence for the benefit of imaging studies in the evaluation of HS in this variant. On a United States claims data report in 2010 [20], up to 70% of all HS cases had no identifiable cause. In addition, the data demonstrated that the incidence of malignancy was 0.1% overall, 0.01% in patients ≤40 years of age, and 0.11% for older patients. Additional studies also corroborate the above findings, with no identifiable causes for HS in up to 81% of cases and a low rate of malignancy in patients ≤40 years of age [17]. The goal of imaging in this setting might be to identify a potential etiology, although most of these are benign with no imaging correlation. The information could be used to reassure the patient and treating provider.

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
A. CT abdomen and pelvis with IV contrast

There is no evidence to support the use of CT abdomen and pelvis with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
B. CT abdomen and pelvis without and with IV contrast

There is no evidence to support the use of CT abdomen and pelvis without and with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
C. CT abdomen and pelvis without IV contrast

There is no evidence to support the use of CT abdomen and pelvis without IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
D. CT pelvis with IV contrast

There is no evidence to support the use of CT pelvis with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
E. CT pelvis without and with IV contrast

There is no evidence to support the use of CT pelvis without and with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
F. CT pelvis without IV contrast

There is no evidence to support the use of CT pelvis without IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
G. CTA abdomen and pelvis with IV contrast

There is no evidence to support the use of imaging CTA abdomen and pelvis with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
H. CTA abdomen and pelvis without and with IV contrast

There is no evidence to support the use of CTA abdomen and pelvis without and with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
I. CTA pelvis with IV contrast

There is no evidence to support the use of CTA pelvis with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
J. CTU without and with IV contrast

There is no evidence to support the use of CTU without and with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
K. Fluciclovine PET/CT skull base to mid-thigh

There is no evidence to support the use of PET/CT skull base to mid-thigh in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
L. Fluciclovine PET/MRI skull base to mid-thigh

There is no evidence to support the use of PET/MRI skull base to mid-thigh in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
M. MRI abdomen and pelvis without and with IV contrast

There is no evidence to support the use of MRI abdomen and pelvis without and with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
N. MRI abdomen and pelvis without IV contrast

There is no evidence to support the use of MRI abdomen and pelvis without IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
O. MRI pelvis without and with IV contrast

There is no evidence to support the use of MRI pelvis without and with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
P. MRI pelvis without IV contrast

There is no evidence to support the use of MRI pelvis without IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
Q. MRU without and with IV contrast

There is no evidence to support the use of MRU without and with IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.

R. MRU without IV contrast

There is no evidence to support the use of MRU without IV contrast in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
S. PSMA PET/CT skull base to mid-thigh

There is no evidence to support the use of prostate-specific membrane antigen (PSMA) PET/CT skull base to mid-thigh in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
T. TRUS prostate

There is no evidence to support the use of transrectal ultrasound (TRUS) in the evaluation of transient HS in the patient population of adults <40 years of age [2,3,8,21-24].

Variant 1: Male. Less than 40 years of age. Transient hematospermia. No associated signs or symptoms of disease. Initial imaging.
U. US scrotum

There is no evidence to support the use of US of the scrotum in the routine evaluation of HS in the setting of transient HS and no associated signs or symptoms of disease. If there are clinical or physical examination findings of scrotal disease, please refer to Variant 2 [1,2,10,19,20,22,25].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.

In this patient population, a more thorough investigation of the etiology of HS is indicated. Apart from the thorough clinical history, physical examination, and laboratory workup, imaging may be a part of this investigation, to evaluate for congenital anomalies, seminal vesicle, or ejaculatory duct obstruction, as well as malignancy, such as prostate cancer, given the slight higher prevalence in this group of patients with HS [2,6-10,15,17,19,20,24,26,27]. Several studies demonstrated a low, but existing, association of urologic malignancy in this patient population, ranging from 0.11% to 6.2% [8,9,15,17,28], predominantly involving the prostate gland. In this setting, the goal of imaging is the identification of abnormalities, as well as guidance for procedures, such as seminal vesiculostomy and biopsy of suspicious lesions. When HS presents with associated symptoms, such as pain, fever, leukocytosis, or hematuria, imaging may be useful in confirming the possible associated pathologies, such as urinary tract stones, epididymitis, and prostatic abscess, among others. In the setting of trauma with associated HS, imaging can be of value in addressing traumatic injuries to the organs involved in spermatogenesis [6,7,10,15,19,24].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
A. CT abdomen and pelvis with IV contrast

CT abdomen and pelvis with IV contrast is usually obtained in the portal venous phase. This modality has limited value on the evaluation of the organs involved in the spermatogenesis and ejaculation. Although CT has excellent spatial resolution, there is limited soft tissue contrast for detailed evaluation of structures such as the seminal vesicles and prostate gland. The goal of this

modality in the evaluation of this group of patients may be limited to the detection of calculi and pelvic masses, as well as the evaluation of associated symptoms that may be present in concomitance with HS. This modality may be helpful in the evaluation of associated pathologies in the setting of symptomatic HS, including congenital anomalies, such as cysts in the seminal vesicles, masses involving the urogenital organs, calculi in the seminal vesicles, vascular anomalies, abscesses, and traumatic changes [29,30].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
B. CT abdomen and pelvis without and with IV contrast

CT abdomen and pelvis without and with IV contrast, separate from CTU, could potentially be useful in the setting of symptomatic HS; the addition of a noncontrast phase could enhance visualization of calculi of the renal collecting system, bladder, and urethra. Although soft tissue contrast is limited, congenital anomalies such as cysts in the seminal vesicles, masses involving the urogenital organs, calculi in the seminal vesicles, vascular anomalies, abscesses, and traumatic changes may be identified [29,30].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
C. CT abdomen and pelvis without IV contrast

Although CT without IV contrast can confidently identify calculi in the region of the prostate gland and seminal vesicles, the lack of soft tissue resolution makes the modality limited. In the setting of symptomatic HS associated with hematuria, this modality may be useful in assessing for associated etiologies such as calculi of the renal collecting system, bladder, and urethra. The lack of IV contrast would limit the evaluation of congenital anomalies such as cysts in the seminal vesicles, masses involving the urogenital organs, calculi in the seminal vesicles, vascular anomalies, abscesses, and traumatic changes [29,30].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
D. CT pelvis with IV contrast

In the setting of symptomatic HS, this modality may be useful in identifying etiologies, including stones in the bladder, urethra, and seminal vesicles; congenital anomalies such as cysts in the seminal vesicles; masses involving the urogenital organs; calculi in the seminal vesicles; vascular anomalies; abscesses; and traumatic changes [29,30].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
E. CT pelvis without and with IV contrast

The addition of a noncontrast phase to the CT evaluation of the pelvis (separate from CTU) may improve the visualization of calcifications in the prostate gland and seminal vesicles. In the setting of symptomatic HS, this modality may be useful in identifying etiologies, including stones in the bladder, urethra, and seminal vesicles; congenital anomalies such as cysts in the seminal vesicles; masses involving the urogenital organs; calculi in the seminal vesicles; vascular anomalies; abscesses; and traumatic changes [29,30].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
F. CT pelvis without IV contrast

In the setting of symptomatic HS, this modality may be useful in identifying etiologies, including stones in the bladder, urethra, and seminal vesicles. The lack of IV contrast would limit the evaluation of congenital anomalies such as cysts in the seminal vesicles, masses involving the urogenital organs, calculi in the seminal vesicles, vascular anomalies, abscesses, and traumatic changes [29,30].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
G. CTA abdomen and pelvis with IV contrast

CTA is performed in the early arterial phase of enhancement following IV contrast administration. This modality has excellent contrast and spatial resolution and thin slice acquisitions with the ability to perform multiplanar and 3-D reconstructions, which allows for optimal visualization of the arterial vasculature. However, there is no evidence to support CTA of the abdomen and pelvis as the initial imaging modality for the evaluation of HS. In select cases of suspected active vascular extravasation or vascular malformation as the etiology of refractory HS, CTA of the pelvis may be indicated because it may have a role as a subsequent problem-solving tool or as a road map for possible intervention in these select cases.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
H. CTA abdomen and pelvis without and with IV contrast

CTA without and with IV contrast includes an unenhanced CT of the abdomen and pelvis and can be useful for the identification of stones in the bladder, urethra, or seminal vesicles. CTA is performed in the early arterial phase of enhancement following IV contrast administration. This modality has excellent contrast and spatial resolution and thin slice acquisitions with the ability to perform multiplanar and 3-D reconstructions, which allows for optimal visualization of the arterial vasculature. However, there is no evidence to support CTA of the abdomen and pelvis without and with IV contrast as the initial imaging modality for the evaluation of HS. In select cases of suspected active vascular extravasation or vascular malformation as the etiology of refractory HS, CTA of the abdomen and pelvis may be indicated because it may have a role as a subsequent problem-solving tool or as a road map for possible intervention in these select cases.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
I. CTA pelvis with IV contrast

CTA of the pelvis is usually not indicated as the initial modality for the evaluation of HS. It may have a limited role in the evaluation of HS when there is suspicion of active vascular contrast extravasation or vascular malformation, as a subsequent imaging test.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.

J. CTU without and with IV contrast

CTU involves the addition of a delayed, excretory phase images that opacifies the upper and lower urinary tracts and allows for more complete evaluation of these structures relative to nonurogram CT techniques [31]. In the setting of symptomatic HS with associated hematuria, this modality may be useful in assessing for associated etiologies such as calculi of the renal collecting system, bladder, and urethra. The modality may also be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles, masses involving the urogenital organs, calculi in the seminal vesicles, vascular anomalies, abscesses, and traumatic changes [29,30].

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
K. Fluciclovine PET/CT skull base to mid-thigh

Fluciclovine PET/CT is an examination with high specificity for the detection of prostate cancer metastases [32]. Although there is an association of HS and prostate cancer [10,15,20], there is no evidence for the initial evaluation of HS with this modality.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
L. Fluciclovine PET/MRI skull base to mid-thigh

Fluciclovine PET/MRI combined the high specificity of the fluciclovine PET examination with the high tissue resolution of MRI in the evaluation of prostate cancer and metastases. Although there is an association of HS and prostate cancer [10,15,20], there is no evidence for the initial evaluation of HS with this modality.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
M. MRI abdomen and pelvis without and with IV contrast

MRI of the abdomen and pelvis without and with IV contrast (separate from MRU) has a high tissue resolution that enables visualization of the organs associated with spermatogenesis and ejaculate production; however, concomitant MRI of the abdomen is typically not useful for the evaluation of isolated HS as an initial imaging test.

With regard to MRI of the pelvis, in a cohort of 305 patients with recurrent and refractory HS, 86.2% of the patients demonstrated MRI findings [5], the majority related to seminal vesicle hemorrhage. A study comparing the use of MRI pelvis versus US for the evaluation of intractable HS demonstrated slight benefit for MRI over US for the detection of seminal vesicle bleeding [13]. Multiparametric MRI of the pelvis with dedicated prostate protocol may be indicated in the cases of suspected prostate cancer [3,17]. In addition, MRI may be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles and masses involving the urogenital organs, vascular anomalies, abscesses, and traumatic changes.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
N. MRI abdomen and pelvis without IV contrast

MRI of the abdomen and pelvis without IV contrast (separate from MRU) has a high tissue resolution that enables visualization of the organs associated with spermatogenesis and ejaculate production; however, concomitant MRI of the abdomen is typically not useful for the evaluation of isolated HS. The absence of IV contrast is a viable option because blood products can be readily identified.

With regard to MRI of the pelvis, in a cohort of 305 patients with recurrent and refractory HS, 86.2% of the patients demonstrated MRI findings [5], the majority related to seminal vesicle hemorrhage. A study comparing the use of MRI versus US for the evaluation of intractable HS demonstrated slight benefit for MRI over US for the detection of seminal vesicle bleeding [13]. MRI without IV contrast may be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
O. MRI pelvis without and with IV contrast

MRI of the pelvis is usually appropriate in the evaluation of HS given its superior tissue resolution for the visualization of the organs associated with spermatogenesis and ejaculate production. In a cohort of 305 patients with recurrent and refractory HS, 86.2% of the patients demonstrated MRI findings [5], the majority related to seminal vesicle hemorrhage. A study comparing the use of MRI versus US for the evaluation of intractable HS demonstrated slight benefit for MRI over US for the detection of seminal vesicle bleeding [13]. Multiparametric MRI of the pelvis with dedicated prostate protocol may be indicated in the cases of suspected prostate cancer [3,17]. In the setting of symptomatic HS, MRI may be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles and masses involving the urogenital organs, obstruction of the ejaculatory ducts, vascular anomalies, abscesses, and traumatic changes. MRI is limited in the evaluation of small calculi in the distal ureters and bladder.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
P. MRI pelvis without IV contrast

MRI of the pelvis may be indicated in the evaluation of HS given its superior tissue resolution for the visualization of the organs associated with spermatogenesis and ejaculate production. The absence of contrast is a viable option because blood products can be readily identified. In a cohort of 305 patients with recurrent and refractory HS, 86.2% of the patients demonstrated MRI findings [5], the majority related to seminal vesicle hemorrhage. A study comparing the use of MRI versus US for the evaluation of intractable HS demonstrated slight benefit for MRI over US for the detection of seminal vesicle bleeding [13]. The absence of contrast makes it less useful in the cases of suspected prostate cancer [3,17]. In the setting of symptomatic HS, MRI may be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles, masses involving the urogenital organs, obstruction of the ejaculatory ducts, vascular anomalies, abscesses, and traumatic changes, although absence of contrast may be a limitation. MRI is limited in the evaluation of small calculi in the distal ureters and bladder. It may be helpful in the evaluation of other potential etiologies in the setting of associated hematuria.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by

associated signs or symptoms of disease. Initial imaging.
Q. MRU without and with IV contrast

MRU is an alternative means of obtaining cross-sectional, excretory phase images of the urinary tract [31]. This modality does not provide dedicated imaging of the organs involved in spermatogenesis and ejaculation. In the setting of symptomatic HS with hematuria, MRU may be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles, masses involving the urogenital organs, calculi in the seminal vesicles, obstruction of the ejaculatory ducts, vascular anomalies, abscesses, and traumatic changes. MRI is limited in the evaluation of small calculi in the renal collecting systems.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
R. MRU without IV contrast

MRU can evaluate the urinary system without the use of IV contrast [31]. This modality does not provide dedicated imaging of the organs involved in spermatogenesis and ejaculation. In the setting of symptomatic HS, MRI may be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles, masses involving the urogenital organs, obstruction of the ejaculatory ducts, vascular anomalies, abscesses, and traumatic changes, although the absence of contrast may be a limitation. MRI is limited in the evaluation of small calculi in the renal collecting systems. It may be helpful in the evaluation of other potential etiologies in the setting of associated hematuria.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
S. PSMA PET/CT skull base to mid-thigh

PSMA PET/CT examination has higher diagnostic performance for prostate cancer compared to fluciclovine PET/CT [32]. However, there is no evidence for the use of this modality in the initial evaluation of HS.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
T. TRUS prostate

TRUS of the prostate gland is a modality which allows for the evaluation of the seminal vesicles, portions of the ejaculatory ducts, and prostate gland. TRUS provides adequate evaluation of the seminal vesicles for cysts, calculi, obstruction, and hemorrhage and can guide procedures such as vesiculostomy and retraction of calculi. TRUS also can guide prostate biopsy. TRUS has traditionally been used for the evaluation of HS in this patient population as an initial modality given capability to evaluate common causes of HS, more commonly in locations outside the United States [5-8,13,22,27,33-36]. In the setting of symptomatic HS, this modality can be helpful in identifying etiologies including congenital anomalies such as cysts in the seminal vesicles, masses involving the prostate, portions of the ejaculatory ducts and seminal vesicles, calculi in the seminal vesicles and ejaculatory ducts, vascular anomalies, abscesses, and traumatic changes in the prostate and seminal vesicles. However, TRUS may have a limited field of view for evaluation of the pelvic organs involved in spermatogenesis and ejaculation and is less commonly used an initial imaging test in the United States.

Variant 2: Male. Greater than or equal to 40 years of age with hematospermia; or male of any age with persistent or recurrent hematospermia or hematospermia accompanied by associated signs or symptoms of disease. Initial imaging.
U. US scrotum

Scrotal US may be indicated in the setting of HS, if a concomitant abnormal testicular physical examination is present. A few series demonstrated low prevalence of testicular neoplasm in patients with HS. All the patients had abnormal physical examination. The very low number of cases and limited series preclude assessment of incidental association versus true correlation. Nonetheless, clinical findings and physical examination should guide the use of scrotal US in the setting of HS [1,2,10,19,20,22,25]. In the setting of symptomatic HS, testicular US can aid in the evaluation of epididymitis and orchitis, as well as testicular masses in the appropriate clinical setting.

Summary of Highlights

This is a summary of the key recommendations from the variant tables. Refer to the complete narrative document for more information.

- **Variant 1**: For the evaluation of patients with transient HS without associated signs and symptoms and those <40 years of age, there is no evidence to support imaging evaluation. In this setting, a thorough history, physical examination, laboratory workup with or without empiric treatment for infection, and patient reassurance should suffice.
- **Variant 2**: For the evaluation of patients presenting with HS, who are ≥40 years of age, or who are any age with persistent, recurrent, or symptomatic HS, MRI of the pelvis with or without IV contrast is appropriate for the initial evaluation in order to assess for the presence of abnormalities in the organs involved with spermatogenesis, including congenital anomalies, obstruction, and neoplasm. MRI of the pelvis without IV contrast may be appropriate; however, it is less useful in the evaluation of etiologies such as prostate neoplasm. TRUS may be appropriate for the evaluation of the prostate gland and seminal vesicles, and US of the scrotum may be appropriate if associated signs and symptoms of scrotal pathology such as infection and palpable lesions. CT of the pelvis with IV contrast may provide general anatomic information, but the lower soft tissue resolution may limit the evaluation of the organs involved in spermatogenesis. However, CT with or without IV contrast has superior resolution for stones and may be appropriate in the setting of associated hematuria or obstructing seminal vesical calculi. MRU and CTU may be useful in this setting as well and can be alternate or complementary in the setting of HS associated with hematuria.

Supporting Documents

The evidence table, literature search, and appendix for this topic are available at https://acsearch.acr.org/list. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents, please go to the ACR website at https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria.

Gender Equality and Inclusivity Clause

The ACR acknowledges the limitations in applying inclusive language when citing research studies that predates the use of the current understanding of language inclusive of diversity in sex, intersex, gender, and gender-diverse people. The data variables regarding sex and gender used in the cited literature will not be changed. However, this guideline will use the terminology and definitions as proposed by the National Institutes of Health.

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv

☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."

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Disclaimer

The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

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