Imaging in Practice

SY11-1

Recent advance in adrenal imaging

Ki Choon Sim

Radiology, Korea University Anam Hospital, Seoul, Korea

The widely use of cross-sectional imaging in daily medical practice had led to a proportional increase in the burden of incidentally discovered nodules in the adrenal glands, so-called “incidentaloma”. Adrenal nodules are seen in approximately 5 % of imaging studies, mainly CT scans. Adrenal adenomas represent 75 % of the incidentalomas found on CT. Most incidentally discovered adrenal tumors are nonfunctioning and benign, with fewer than 10 % having detectable endocrine functionality and fewer than 5 % being malignant.

The main focus of adrenal imaging is distinguishing between adenomatous and non-adenomatous lesions to determine which lesions may suspicious malignancy and require evaluation. Recent imaging guidelines suggest that incidentalomas with imaging features diagnostic of a benign mass (i.e. myelolipoma, small cyst, and adenoma) require no additional workup or follow-up, and that stability at imaging of an adrenal mass for 12 months makes a benign diagnosis most likely.

CT is the primary imaging method for evaluating adrenal nodules. To detect small lesions and correct CT attenuation measurement requires thin-section scanning (3 mm or less) through the adrenal fossa using small field-of-view. IV contrast can be used when characterizing delayed-enhancement images. Reformatted images in the sagittal and coronal planes can sometimes help to determine the exact origin of lesions.

MRI is most useful as an alternative to CT in patients who cannot tolerate IV iodinated contrast and/or when confirming a diagnosis of hemorrhage. The study protocol should include T1-weighed gradient echo sequence in- and opposed-phase images. Adenomas that contain significant intracytoplasmic fat show signal loss on the opposed-phase compared to the in-phase with 81-100% sensitivity and 94-100% specificity reported: Qualitative assessment. However, quantitative assessment entails drawing regions of interest on the lesion on the both in-phase and opposed-phase images and then calculating signal drop. The adrenal to spleen ratio (ASR) and signal intensity index (SII) are commonly used. In recent study, diffusion-weighted MRI was used for the characterization of adrenal lesions, especially differentiating adenoma from phechromocytoma.

Adrenal molecular imaging techniques are helpful in some patients. PET/CT with 18F-fluorodeoxyglucose (18F-FDG) is useful for establishing whether an adrenal metastasis is the only lesion, and therefore is available for surgical resection, or if the disease is disseminated. 11C-metomidate PET/CT is currently also used to help diagnose Conn’s adenomas in primary aldosteronism, but further development is needed.

In conclusion, the imaging characterization of adrenal lesions has continued to advance over the past decade. CT, MRI, and PET/CT are frequently used as clinical techniques. However, none of these alone has demonstrated sufficient diagnostic accuracy because of the substantial overlap of imaging findings. Therefore, clinical, laboratory, and pathologic correlation in particular cases are essential.

Keywords : Adrenal imaging, MRI, CT, Adenoma

Imaging in Practice

SY11-2

MR Anatomy in Urologic Imaging

Deuk Jae Sung

Radiology, Anam Hospital, Korea University, Seoul, Korea

The role of MRI in the evaluation of urinary tract is ever increasing, and MRI can be used in case of compromised renal function, severe contrast allergy, or in case radiation exposure is a problem, such as in children and pregnant women, even though MDCT has taken the largest leap. Furthermore, MRI can be used as a problem-solving modality when the CT findings are not diagnostic. Despite recent advances such as multiparametric MRI feasible for the functional evaluation, more experience is required to better understand the basic anatomy that drives some of the macroscopic and microscopic changes that can be detected by MRI.

I. Kidney: T1WI allows for the differentiation between the hyperintense peripheral cortex and the hypointense central medulla. Differentiation between the cortex and medulla can be improved using fat-suppressed T1WI. The cortex is highly vascularized by the arterial network; therefore, dynamic studies following contrast agent injection allows for better differentiation between renal zones and enables the collection of functional information about the kidneys. On T2WI, both the renal cortex and medulla are hyperintense, and does not provide good anatomical information for differentiating the two renal zones.

II. Bladder: On T2WI, the urine has high signal intensity and the bladder wall has low signal intensity, whereas the detrusor muscle has intermediate signal intensity and the adjacent fat has high signal intensity on T1WI. Non-fat-saturated fast SE T2WIs are obtained in the three standard orthogonal planes. Axial spin-echo (SE) T1WI with a large FOV are useful for evaluating the perivesical fat planes. High-resolution fast SE T2WIs obtained in the three orthogonal planes with a small FOV and a large matrix are used to evaluate the detrusor muscle and the surrounding organs.

III. Prostate: The prostate and periprostatic area can be well visualized on T2WI using a pelvic phased-array coil. The prostate can be divided into five zonal components: the nonglandular anterior fibromuscular stroma and four glandular components: the peripheral zone, central zone, transition zone and periurethral glandular tissue. With aging, the periurethral glandular tissue and the transition zone may considerably hypertrophy, gradually compressing the central zone and stretching the peripheral zone. The central gland usually consists of nodular areas of varying signal intensity, depending on the relative amount of stromal and glandular hyperplasia. Low signal intensity areas usually reflect the presence of muscular and fibrous elements in stromal hyperplasia, while high signal intensity corresponds with secretions in acinar and ductal elements in glandular hyperplasia. The normal peripheral zone has high signal intensity, subdivided by several thin stromal septa that peripherally merge with the prostatic capsule. The latter is a thin and firmly adherent nonglandular fibromuscular band that is continuous with the periprostatic connective tissue.

Keywords : MRI, Anatomy, Kidney, Bladder, Prostate

Imaging in Practice

SY11-3

MR Imaging Anatomy of Female Genital Organs

Myoung Seok Lee

Radiology, SMG-SNU Boramae Medical Center, Seoul, Korea

The uterus can be assessed most easily in sagittal plane. On T1-weighted imaging, both the endometrium and the myometrium show similar signal intensity so cannot be differentiated. On T2-weighted imaging, the uterine corpus shows three distinct zones. The endometrium and its secretions show high signal intensity in the center of uterine corpus; the thickness is 3~6mm(proliferative phase) to 5~13mm(secretory phase). The low-signal intensity band(2~8mm) between endometrium and outer myometrium is innermost myometrium, so-called “junctional zone”. The low signal intensity come from abundant myometrial cell, dense muscle fiber, less extracellular matrix and water contents. The appearance of the junctional zone changes with sustained myometrial contractions or uterine peristalsis are important to distinguish from leiomyomas or adenomyosis. The outer myometrium showed intermediate signal intensity on T2WI. The postmenopausal uterus has an indistinct zonal anatomy, and the junctional zone is not consistently visualized. Uterine cervix also shows 3 layers on T2WI: endocervical mucosa, gland and secretion shows high signal intensity; inner fibrous stroma showed low signal intensity and the thickness is 3 to 8mm, forms stromal ring and continues to junctional zone of uterine corpus; outer stroma is loose stroma shows intermediate signal and continue to myometrium.

The vagina also can be visualized in MRI. The upper 1/3 of vagina comes from Mullerian duct fusion, and lower 2/3 from urogenital sinus. On T1WI, the vagina shows intermediate signal intensity. On T2WI, the mucosa and secretion form high signal intensity central core. The middle submucosal and muscular layer shows low signal intensity. The venous plexus in outer adventitial layer shows high signal intensity, due to slow venous flow. The vaginal wall is normally enhanced by Gadolinium-based MR contrast media injection, and the low signal intensity is lumen and/or inner epithelial layer.

Cyst and cystic mass are common pathology of ovary, and MRI can be an important modality for differential diagnosis. Hemorrhage, fat component, mucin and water components have their own characteristic signal intensity on MRI, giving clues for differentiating ovarian masses. The normal ovary contains over two million primary oocytes at birth, about 10 of which mature each menstrual cycle. Of the 10 Graafian follicles that begin to mature, only one becomes the dominant follicle and grows to a size of 18-20 mm by mid-cycle, when it ruptures to release the oocyte. Normal premenopausal ovary appears homogeneous intermediate signal on T1WI, and high signal intensity on T2WI. The high SI on T2WI histologically corresponds to central medullary zone, and peripheral low signal intensity includes peripheral cortical zone, mesovarium and other fibrous supporting tissue. Postmenopausal ovary appears a dark tissue clump near the proximal end of the round ligament on T2WI, devoid of follicles.

Keywords : Anatomy, Female, Uterus, Vagina, Ovary