保險醫學會誌 : 第 15 卷 1996
J. OF KLIMA : Vol. 15, 1996

신종양의 영상법

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Imaging of Renal Tumors

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BENIGN NEOPLASMS OF RENAL PARENCHYMA

1. Adenoma

Bell: Renal cortical glandular tumor

< 3 cm --- adenoma

> 3 cm --- adenocarcinoma

Bennington & Beckwith: No benign renal adenoma

Mostofi: Benign adenoma(single layers of cells, little cytoplasm, small regular nuclei, prominent fibrovascular stalks in tubulopapillary tumors)

Peterson: Small neoplastic nodules(<3 cm) in nephrectomy specimen --- "renal carcinoma of low metastatic potential"

Tumor of any size of significant cellular anaplasia & aggressive invasive behavior(e.g. necrosis) --- malignant

Chronic renal disease on long-term dialysis --> renal cysts & adenomas (malig. with mets)

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KUB or IVU: Mass if sufficient size or calcification

US, CT: DDx of solid renal tumors

Angio : Sharply marginated mass --- suggestive, but need surgery

Tubular adenoma - Hypervascular during capillary phase; Dense during nephrograhic phase

Papillary adenoma - Avascular during capillary phase; Lucent or slight blush during nephrographic phase

2. Oncocytoma(Proximal Tubular Adenoma with Oncocytic Features)

Most frequent clinical type of renal adenoma

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KUB, IVU, RI : No specific features

Angio: 1) Well-defined mass, often "spoke wheel" pattern of vascularity. Orderly vascular pattern, no venous shunting & vascular puddling --- suggesting, not pathognomonic(DDx. renal cell ca.)

2) Hypovascular mass --- less common

CT, US: 1) Well-defined, smooth & relatively homeogenous

2) Central stellate scar --- suggestive, not pathognomonic

MRI: 1) Well-defined, low-intensity, circumferential

capsule(T2W SE). homogeneous, but different intensity from simple cyst

2) Central scar in large tumors --- low intensity area(SE, IR)
3) Unusual larger tumor with extensive central necrosis

3. Angiomyolipoma(Hamartoma)

About 20% of patients with angiomyolipoma have tuberous sclerosis, and about 80% of patients with tuberous sclerosis have renal angiomyolipoma.

Without tuberous sclerosis: commonly symptomatic, unilateral(>90%), women over 40 years old

With tuberous sclerosis: Asymptomatic(most); Bleeding(flank pain, hematuria, flank mass); Hypertension; Can be discovered early due to radiologic exam; Multiple, bilateral; No sex predilection

< Tuberous Sclerosis Syndrome >

Bourneville(1888): mental retardation, epilepsy, adenoma sebaceum of face

Benign tumors of retina or optic n., periungual & subungual fibromas involving toes, multiple benign renal tumors(multiple renal cysts, angiomyolipoma, connective tissue tumors), or renal cell carcinoma

Familial D.--- rare AD gene with incomplete penetrance --- 50% have pos. FH

With lymphangiomatosis: Rare disease; Hamartomatous proliferation of smooth muscle along lymphatic system; Young women

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KUB, IVU, Tomo: Tumor of sufficient size; Large amount of fat--- radiolucency. Large & multiple --- distortion of collecting system(DDx from polycystic renal disease)

Angio: Dx suggesting finding --- multisacculated pseudoaneurysms, absent AV shunts, 'sunburst' appearance of capillary nephrogram, 'onion peel' appearance of peripheral vessels in venous phase

US: Hyperechoic(esp. when fat is abundant)

DDx from small number of hyperechoic renal cell ca.

CT: Hypodense fat in adult kidney --- thin section(5mm - Bosniak). Cf. some cases of fat in Wilms', rare liposarcoma.

Density of nonfatty(vascular, smooth M.) component. Hemorrhage.

MRI: High S.I. of fat on T1WI, fat suppression technique

3. Multilocular Cystic Nephroma

Uncommon renal mass of benign neoplasm; Multiple noncommunicating cysts contained within a prominent, well-defined capsule.

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KUB: If large --- soft tissue mass displacing adjacent structures. If curvilinear or amorphous calcification within mass --- visible. High quality Tomo: Septated mass in nephrographic phase

IVU: May obstruct renal collecting system depending on site & location ---> pyelocaliectasis with delayed or absent excretion of contrast media. Tend to protrude("herniate") into renal pelvis. DDx with Wilms' tumor or renal cell ca.

Angio: Avascular, hypovascular, or hypervascular; Possible neovascularity. DDx from partially necrotic or hypovascular renal cell ca.

US, CT & MRI: Dx suggesting typical findings --- numerous distinct cystic areas within a well defined mass, septations(may be thick as several mm) without significant nodularity(DDx with cystic renal cell ca. or Wilms' tumor) Rare cases of small cysts & predominant solid interstitial components

4. Juxtaglomerular Neoplasms

EU: Normal in many cases

US: Solid tumor; Frequently echogenic

CT: Solid tumor; Tend to be isodense with renal parenchyme on unenhanced scan ---> postcontrast scan is often necessary to demonstrate the tumor.

Angio: Helpful to identify tumor & exclude other causes of hypertension Renal vein sampling; elevated serum renin, helpful to localize tumor

5. Renomedullary Interstitial Cell Tumor (Fibroma)

IVU: Extrinsic mass impressing renal pelvis if mass is large

US, CT: Case reports of calcification in mass. Rare intraparenchymal mass

6. Leimyoma

IVU: Depending on size & location; Can obstruct intrarenal collecting system

US, CT: Sharply demarcated mass

Angio: Sharply marginated; Hypovascular or hypervascular

7. Miscellaneous

Lipoma, Myolipoma, Hemangioma, Hemangiopericytoma, Lymphangioma, Capsuloma, Heterotopic tissue(adrenal or endometrial tissue)

MALIGNANT NEOPLASMS OF RENAL PARENCHYMA

1. Renal Cell Carcinoma(Hypernephroma)

Male preponderance; 50% mortality; peak incidence 45~60 years of age

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EU: Obvious mass; suspected mass with focal bulge of renal outline, displacement of renal sinus or pelvocalyceal system.

CT: Method of choice for detection & staging; isodense mass on nonenhanced scan; lessly enhanced mass on contrast enhanced scan; necrosis or hemorrhage in large carcinomas; CT is suited for detection of calcification; useful for staging

US: Isoechoic solid mass; can detect superior extension of carcinoma in the intrahepatic portion of IVC & right atrium; unable to assess regional LN accurately

MRI: Iso- or somewhat hyperintense mass (compared with renal cortex) with contour bulging on T1WI; hyperintense tumor(comparable with renal cortex) with deformity of renal outline or renal sinus; good for detection of venous propagation(renal vein, IVC etc.) of the tumor; possible multiplanar imaging; inability to display discrete calcification; helpful in patients with allergy to radiographic contrast media; useful for staging

Angio: Seldom used for diagnostic purposes; usually hypervascular, but papi- lary/spindle renal carcinoma may be hypovascular; AV fistular shunts in 5% of tumors; palliative/preoperative embolization to control bleeding

2. Malignant Lymphoma

Very rare primary renal lymphoma

Common secondary renal involvement from generalized dissemination of lymphoma or contiguous extension of retroperitoneal disease

Bilateral renal involvement is 3 timess more frequent than unilateral disease.

More common in non-Hodgkin's lymphoma than Hodgkin's disease

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EU & CT: ① Multiple nodules, ② Solitary renal mass, ③ Extensive multifocal involvement, ④ Renal involvement by contiguous retro- peritoneal disease, ⑤ Abnormalities of the collecting system

US: Hypoechoic homogeneous; Loss of renal sinus

echoes in case of renal sinus infiltration.

Angio: Marked attenuation of the segmental & interlobar arteries without neovascularity; Focal masses may be avascular or hypovascular; No renal invasion

Gallium scan: Focal increased renal uptake

3. Leukemia

The kidney is the most frequently involved organ in all forms of leukemia.

Diffuse or focal(chloroma or granulocytic sarcoma)

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EU & CT: Bilateral diffuse renal enlargement with smooth contours; Normal or attenuated collecting systems; May involve renal sinus; Retroperitoneal adenopathy; High frequency of hemorrhage(renal, subcapsular, perinephric)

4. Renal Plasmacytoma

EU: Focal masses; Sometimes nonfunctioning and enlargement of affected kidney; May be confined to renal sinus and may cause extrinsic compression of collecting system

Angio: Hypovascular, diffuse infiltrating lesions; May show mild to moderate vascularity.

5. Sarcomatoid Renal Cell Carcinoma

Arise from renal tubular epithelium, but show pleomorphic metaplastic transformation of carcinoma cells --- resemble sarcomas histologically

Highly aggressive; Frequently invade renal pelvis, abdominal wall, renal vein, and regional lymph nodes --- poor prognosis(median survival after nepohrectomy: 6 months)

6. Renal Sarcoma: 1.1% of Malignant Renal Parenchymal Tumors

1) Leiomyosarcoma

Most common sarcoma(58%) of the kidney; Most frequent in 4th decade; M:F=1:2

Poor prognosis(death within 5 years of diagnosis); Lung metastasis

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EU: Focal mass or enlarged nonfunctioning kidney; Tumor calcification(10%)

Angio: Often central hypovascularity with splaying of the main renal vessels & peripheral tumor neovascularity; Possible extension to renal vein & IVC

2) Hemangiopericytoma

20% of renal sarcoma; 18~49 year old; Women; Potentially malignant; Most patients die within short period of diagnosis

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EU: Renal masses with displacement & distortion of renal collecting system

Angio: Highly vascular

3) Liposarcoma

20% of renal sarcomas; Usually arise in renal capsule, probably from undifferentiated mesenchymal cells, or in the perinephric fat; Compress but not invade the renal parenchyme

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CT: Well differentiated lipogenic type(fat densities of negative attenuation) Myxoid type(little mature fat; predominant fluid & connective tissue component) Undifferentiated type(high attenuation values)

Angio: Hypovascularity; May show subtle neovascularity & vessel encasement; Enlarged capsular arteries draped around masses that encircle relatively normal renal parenchyme may suggest capsular origin.

4) Rhabdomyosarcoma

3.8% of renal sarcomas in adults; Probably arise from undifferentiated mesenchymal cells; Highly

aggressive

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Angio: Hypovascular with vascular amputation & encasement, splaying of the main renal vessels; Rapidly extend to renal veins, IVC, and right atrium

5) Fibrosarcoma

6) Osteogenic Sarcoma

Exceedingly rare; May originate from undifferentiated mesenchymal cells.

Tumor & tumor metastases often show calcification.

7. Wilms' Tumor [Nephroblastoma] Occurring in Adults

May occur in adolescents & adults.

Adult Wilms' tumor often attain large size; Poor response to the combination chemotherapy, surgery & RT than the childhood tumor --- poor prognosis

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EU: Focal renal masses or nonfunction of the affected kidneys due to renal v. occlusion, ureter encasement, or extensive parenchymal tumor replacement; Common tumor calcification(sometimes very marked)

CT: Inhomogeneous solid renal tumor that may contain low density areas(hemorrhage or necrosis); Determine perinephric or venous extension, or regional LN metastases

Angio: Hypovascular or moderately vascular

MRI: Prolonged T1 & T2 relaxation times; Often variable SI due to tumor necrosis & hemorrhage

8. Renal Metastases

The kidney is the fifth most common site of metastases in the body after lung, liver, bone, and adrenals; via hematogenous route.

Tumors with frequent renal metastases are lung ca., breast ca., and carcinoma of the opposite kidney (carcinomas of colon, stomach, cervix, ovary, pancreas, and prostate; melanoma, sarcomas).

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EU: Large metastases may present focal renal masses.

CT: Multiple(bilateral) homogeneous(if necrosis; low attenuation) nodules. Solitary renal mass(F/U with percutaneous biopsy)

Angio: Lung or breast ca. metastases --- hypovascular, infiltrative renal lesions with minimal or no neovascularity; Often encasement or amputation of intrarenal arterial branches Metastatic choriocarcinoma or melanoma --- may produce hypervascular renal mass; Metastatic choriocarcinoma may cause extensive perinephric hemorrhage.

US: Larger lesions usually present as homogeneous hypoechoic areas with diminished acoustic transmission; Mixed pattern of hypoechoic & echoic areas in case of hemorrhage & necrosis.

9. Direct Renal Invasion by Adjacent malignant Neoplasms

Retropeitoneal tumors or adrenal tumors etc.

CT, sagittal MRI or arteriography are useful to determine the origin of renal masses.

BENIGN NEOPLASMS OF RENAL COLLECTING SYSTEM & PELVIS

1. Epithelial Tumors

1) Inverted Papillomas

A few case reports in kidney & ureter(Cf. common in UB)

Frequent association with synchronous or metachronous transitional cell carcinoma(TCCA); Usually

elderly

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indistinguishable from TCCA or papilloma

2) Papillomas

Almost 25% of patients with renal pelvic papillomas ultimately develop a TCCA.

Of those with multiple papillomas, 50% develop TCCAs.

2. Mesodermal Tumors: Extremely rare

1) From Smooth Muscle

(1) Leimyoma

In renal pelvis: Can achieve fairly large proportions

Usually in women: Colicky flank pain

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KUB: Mass may be appreciated

IVU, RGP: Sizable filling defect(DDx with blood clot or TCCA)

Angio: Moderate to extensive neovascularity(a few: hypovascular)

US: Homogeneous pelvic mass(Some may show low echogenecity with limited through transmission & no far wall enhancement)

2) From Fibrous Tissue

(1) Fibroepithelial Polyp

Predilection for UPJ; Rare fibrous polyps arising in a calyx

(2) Renal Medullary Interstitial Cell Tumors("Medullary Fibromas")

Usually quite small, occasionally large; Women with flank pain & hematuria

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IVU: Large renal pelvic mass indistinguishable from other filling defects. Peripelvic fibroma compressing renal pelvis & splaying calyces

3) Vascular Tumors

(1) Hemangioma

Important, but rare, benign lesion in renal pelvis

Vary in size from microscopic to 10 cm or more

Capillary to cavernous, arterial, cirsoid(resembling a varix), or mixed

Usually in patients in twenties to forties, but in any age(esp. childhood)

Often Hx of intermittent gross or microscopic hematuria

Rare renal hemangiomas associated with Klippel-Trenaunay & Sturge-Weber synd.

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IVU, RGU: Usually normal or presence of calyceal blood clot(provide clue to diagnosis); Possible renal papillary necrosis.

Angio: May be diagnostic; Group of fine, coiled, vascular loops or clusters of opacified vessels; Focal puddling of contrast throughout the arterial & venous phase; Larger cavernous hemangioma --- displacement by hypovascular, poorly marginated mass (extremely poor blood flow in cavernous spaces)

US: Stanley et al. reported highly echogenic hemangioma

(2) Lymphangioma

4) Neural Tumors(Neurilemmoma, Neurofibroma), Mixed Tumors, etc

MALIGNANT NEOPLASMS OF RENAL COLLECTING SYSTEM & PELVIS

1. Transitional Cell Carcinoma(TCCA)

Primary neoplasms of the renal pelvis constitute less than 10% of renal tumors; 75% to 80% are

malignant, and most are transitional cell carcinomas.

TCCA : renal cell ca. = 1 : 5, TCCA : ureteric neoplasms = 2∼3 : 1, renal pelvis TCCA : bladder ca. = 1 : 50

Frequent multiplicity, often involving any one or all of the collecting systems's transitional mucosa. Frequent association of papillomas in patients with TCCA(Almost 25% of patients with renal pelvic papillomas ultimately develop a TCCA. Of those with multiple papillomas, 50% develop transitional cell carcinomas.)

Frequent multicentricity of TCCA in renal pelvis or ureter.

Papillary(80%; about half of these are infiltrative) and nonpapillary(20%; considered malignant by most pathologists)

Frequent in adults(usually in sixties or older). M : F = 2-3 : 1

Less common hematogeneous metastases(lung, liver, bone) than hypernephroma; early lymphogeneous involvement, direct extension to retroperitoneum.

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KUB: Occasional renal mass; Rare renal calculi; Extremely rare disseminated calcification in tumor (irregular, mottled)

IVU: 1) Discrete single or multiple filling defect (most common finding) --- usually irregular, stippled, serrated, and frondlike surface(or may be smooth); Flat, sessile(nonpapillary types) or pediculate masses); "Stipple sign"(trapping of contrast media within the intersticies of the tumor)

2) Filling defects within distended calyces; Ballooned tumor filled calyx("oncocalyx")

3) Calyceal obliteration(phantom calyx; infundibular stenosis)

4) Reduced function without renal enlargement (global nonfunction in case of UPJ obstruction)

5) Hydronephrosis with renal enlargement(focal hydrocalycosis and/or hydronephrosis with focal intensifying nephrogram

RGP: Optimal projections and pelvic filling with fluoroscopic control most readily demonstrate the extent of the tumor; Especially valuable in nonfunctioning kidney; Irregular or smooth filling defect, irregular mucosal surface, hydronephrosis, and/or stricture; Possible pyelocancerous backflow(insinuation of contrast medium into the interstices of the tumor)

Brush biopsy: Ca. 80% accuracy; Either thru retrograde or antegrade catheters

AGP: Decompressive and diagnostic in hydronephrotic nonfunctioning kidney; Delineates upper margin of the tumor; Samples urine for cytology

CT: Renal TCCA larger than 1 cm can be seen with IV bolus of 50 ml contrast media & thin(5 mm) contiguous section; May enhance minimally A solid, round, or flat mass in the renal pelvis; A ballooned tumor filled calyx or calyceal group ("oncocalyx"), and compression or invasion or renal sinus fat; Trapped contrast media in curvilinear calyceal spaces around tumor or in adjacent compressed collecting ducts; Striated nephrogram in case of incomplete obstruction of collecting ducts; Delayed CT may occasionally be valuable in showing a delayed or intensifying nephrogram.

Preservation of renal parencyme around the tumor and the reniform outline of the kidney without focal bulging, the tendency to spread medially through the renal hilus, focal dilation of calices or hydronephrosis, (diffuse enlargement of the kidney, disturbed renal function, etc).

US: Separation of CEC by an area of the hypoechoic tumor(isoechoic to renal parenchyme and hypoechoic than renal sinus fat); Less common amputation of CEC and loss of normal parenchymal architecture due to tumor infiltration; Widened

hypoechoic renal parenchyme in case of diffuse tumor infiltration

Angio: Hypovascular to avascular; Occasional fine tortuous neovascularity(56% to 82%) with an occasional tumor blush(15% to 82%); May be some encasement of arteries and veins(26% to 73%); Often enlarged renal pelvic artery; Possible pronounced ureteral circulations or lumbar arterial collaterals; No tumoral AV shunting; May involve IVC(5%) & renal vein

MRI: Little value; But very sensitive to vascular extension of the tumor

2. Squamous Cell Carcinoma

0.5% of all renal tumors and 6.2% of renal pelvic tumors; Nonpapillary and malignant; Usually obvious invasion of underlying structures with accompanying fibrosis & inflammation; Highly associated with pelvic calculi(40% to 80%); Aggressive with poor prognosis

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KUB: Usually urinary stone can be seen

IVU: Usually enlarged kidney with maintenance of reniform outline; Often nonfunctioning kidney(late period); Mimic XGP

RGP: The involved mucosa may have a cobble-stone appearance.

US, CT: Indistinguishable from XGP; At the time of diagnosis, the perinephric space is usually affected.

Angio: Avascular or hypovascular; Mimic inflammatory process

3. Adenocarcinoma of the Renal Pelvis

A calculus, usually staghorn, is present in two-thirds of cases; Almost all patients have urinary tract infection.

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IVU: Renal mass with an associated stone; Hydronephrosis, usually without function due to a combination of the stone and advanced tumor; May obscure the tumor by the stone & inflammatory and/or obstructive changes; Possible calcification; Common local spread at surgery

4. Carcinosarcoma

Only in adults over 60 years of age; Quite large and palpable mass; Uniformly fatal.

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IVU: A filling defect or occasional nonfunction

US: Evidence of renal vein & IVC invasion

5. Undifferentiated Carcinoma

Anaplastic. Nonspecific radiological findings.

6. Malignant Mesodermal Tumors

Sarcoma involving the renal pelvis; Usually aggressive and quite large when first appreciated; Poor prognosis.

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Angio: Variable vasculature

US, CT: Huge retroperitoneal mass

7. Secondary Tumors Involving the Renal Pelvis

Local extension of a hypernephroma, lymphoma, or a variety of retroperitoneal tumors; Lymphohematogeneous metastases(melanoma)

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