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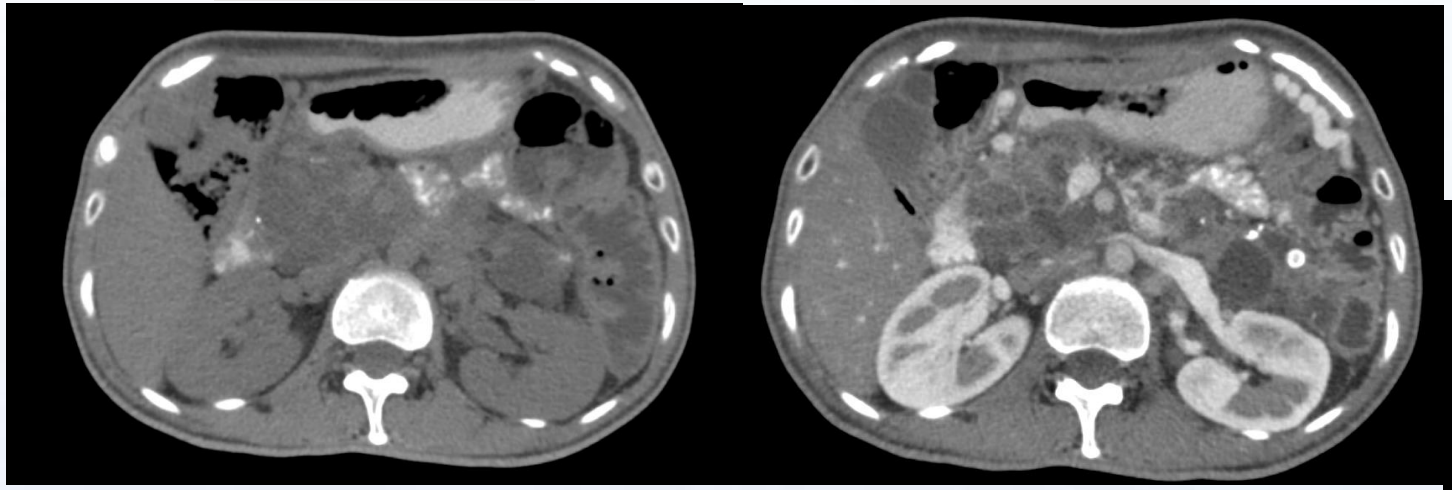
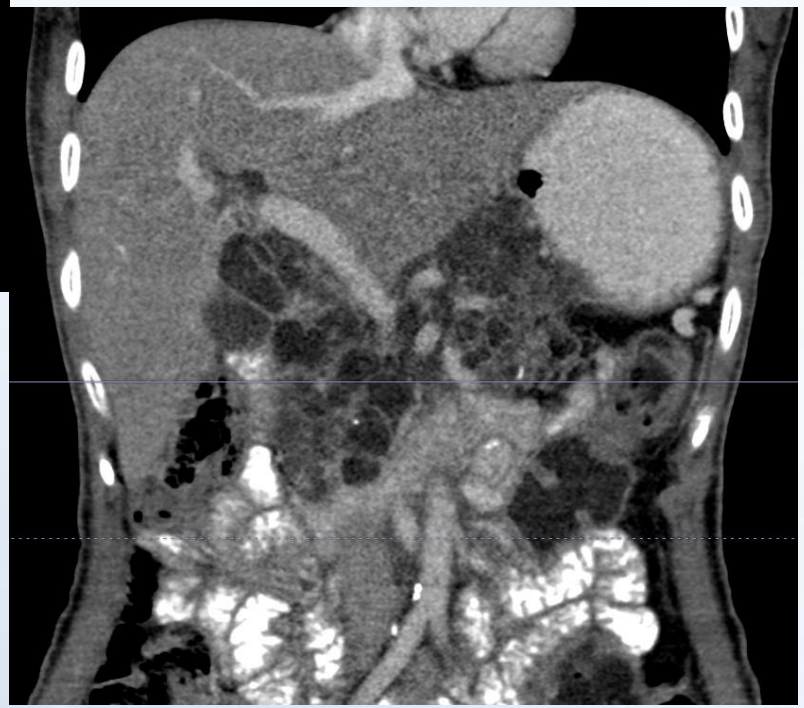
CT whole abdomen

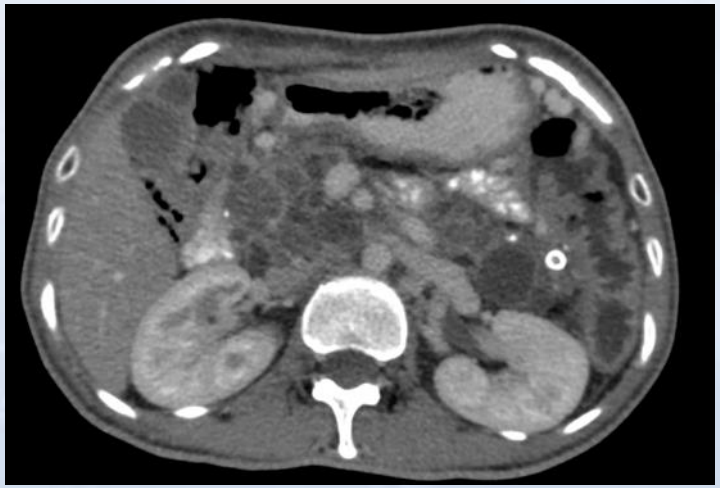
Non contrast

Arterial phase





Venous phase



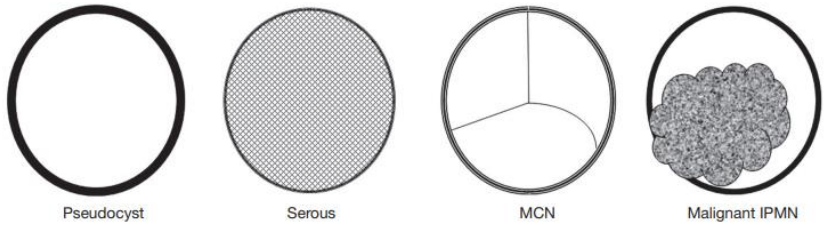
CT upper abdomen

Lower thorax: Suspected a small cavitary lesion at lateral basal segment of the RLL.
Liver and hepatic vasculature: Fatty change of the liver. No focal lesions. Patent portal veins, hepatic veins and intrahepatic IVC.
Gallbladder and bile ducts: CBD dilatation, about 1.6 cm, and mild dilatation of IHD. No calcified gallstone, gallbladder wall thickening or mass.
Pancreas: **Multiple cystic/multiloculated cystic lesion replacing the entire pancreas with some of them contain turbid content and calcification. Note, there are some enhancing solid portion at the head and tail of pancreas.**
Spleen: No splenomegaly.
Adrenals: No nodules.
Kidneys, ureters and bladder: Normal.
Reproductive organs: Normal.
Bowel and mesentery: No distension or wall thickening.
Lymph nodes: No enlargement.
Peritoneum, retroperitoneum and abdominal wall: No free fluid or free air.
Vessels: Small size splenic vein could be due to pressure effect from pancreatic lesion with evidence of perisplenic collaterals from SMV.
Bony structures: No suspicious lytic or blastic lesion.

Diagnosis

Classification of Pancreatic cyst

- Pancreatic cyst
  - No lining
    - Pseudocyst
  - True lining (Cystic neoplasm)
    - Cystic neoplasm
      - Non mucinous (Serous)
      - Mucinous
      - Cystic Degeneration in a solid neoplasm



Simeone DM. J Gastrointest Surg 2008;12:1475–7
William R. et al. J Gastrointest Oncol 2015;6(4):375-388

Classification of Pancreatic cystic Neoplasm (PCN)

PCN

- **Non mucinous (Serous)**
  - **Benign**
    - Serous cystadenoma (SCA) 90%
- **Mucinous**
  - **Premalignant**
    - Mucinous cystadenoma (MCA)
    - IPMN (Main duct, side br, mixed)
  - **Malignant**
    - Mucinous cystadenocarcinoma (MCAC)
    - Malignant IPMN
- **Cystic degeneration in a solid neoplasm**
  - Solid pseudopapillary tumor (SPT)
  - Cystic pancreatic neuroendocrine
  - Neoplasm (CPEN)

Simeone DM. J Gastrointest Surg 2008;12:1475–7

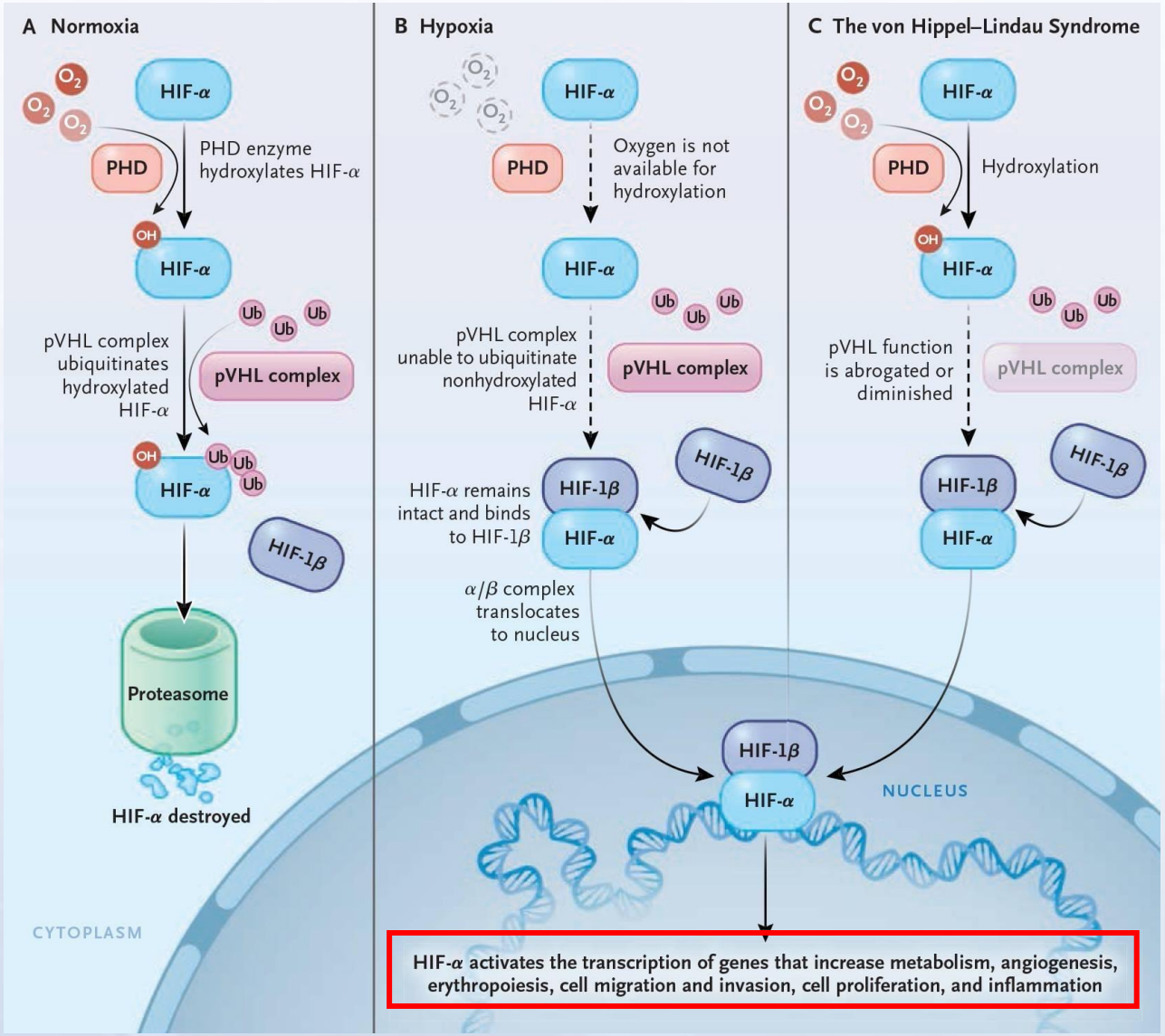
Type of PCN	Age at diagnosis (years)	Gender distribution	Connection to main duct	Characteristics on imaging	Fluid CEA	Fluid amylase	Solitary or multifocal	Malignancy rate
Pseudocyst	Any	Equal	Some	Well-circumscribed, oval, or round, anechoic on EUS, low attenuation on CT	Low	High	Either	None
Serous cystic neoplasm	40s–60s	75% female	No	Microcystic/honeycomb, 30% have central scar	Low	Low	Solitary	None
Solid-pseudopapillary neoplasms	20s	90% female	No	Well-demarcated mixed solid-cystic tumors. Occur anywhere in pancreas	Low	Low	Solitary	High
Cystic pancreatic neuroendocrine tumor	30s–50s	Equal	No	Well-circumscribed cystic lesion with peripheral rim enhancement	Low	Low	Typically solitary	<2 cm in size: Low >2 cm in size: Moderate
Mucinous cystic neoplasm	40s–60s	Almost exclusively females	No	May be unilocular or septated, some have peripheral calcifications, most located in tail of pancreas	High	Low	Solitary	<3 cm in size: <5% >3 cm in size: high
Main duct IPMN	40s–60s	Equal	Yes	Dilation of PD	High	High	Either	Very high
Branch duct IPMN	40s–60s	Equal	Yes	Dilation of side branches of PD; grape-like cystic lesion	High	High	Either	Variable (depending on high-risk features)[a]

CEA, carcinoembryonic antigen; CT, computerized tomography; EUS, endoscopic ultrasound; IPMN, intraductal papillary mucinous neoplasm; PCN, pancreatic cystic neoplasm; PD, main pancreatic duct.
[a]Refer to Tables 4 and 5 for high-risk features of branch duct IPMNs.

RCD Buerlein.Ther Adv Gastrointest Endosc 2021;14: 1–21

Von Hippel-Lindau

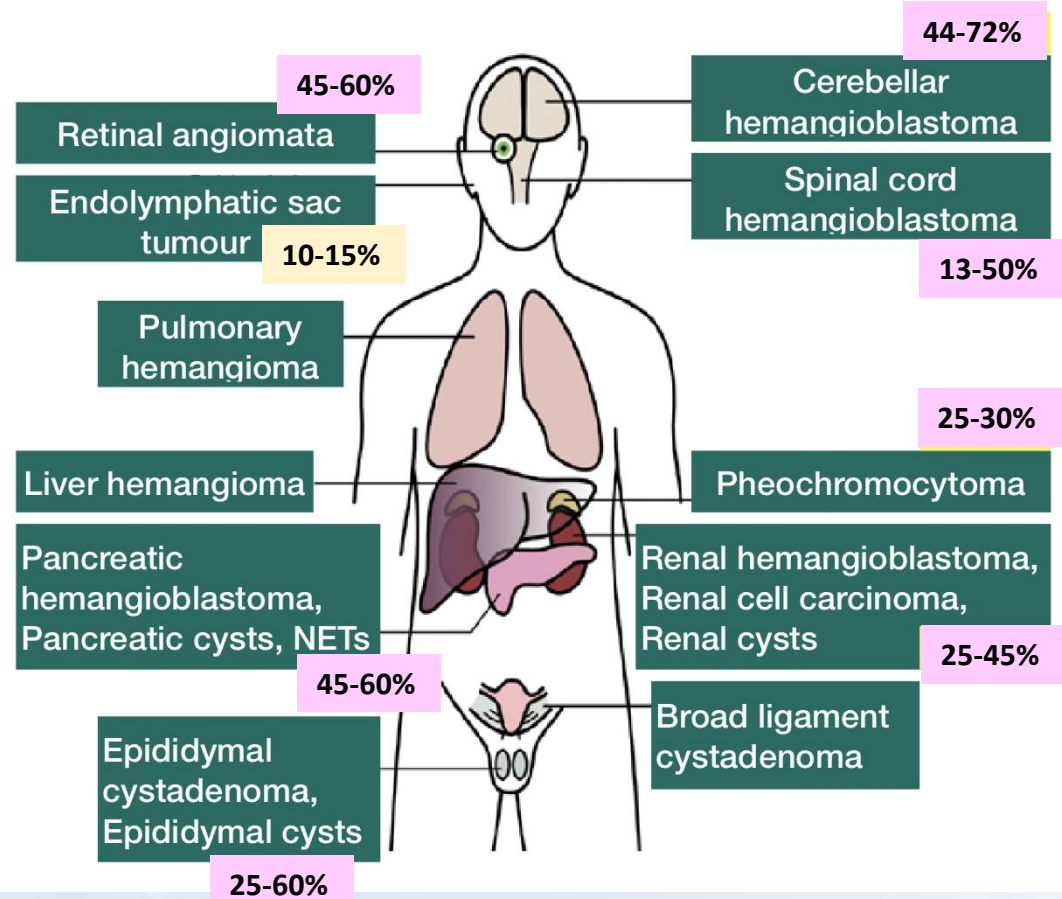
Von Hippel-Lindau



Von Hippel-Lindau

VHL-disease subtype	Genotype	Phenotype
I	*VHL* exon deletion or truncation usually present	Increased risk of all tumour types; low risk of pheochromocytoma
IIA	*VHL* exon missense mutation usually present (codon 98)	Associated with a high risk of pheochromocytoma, and retinal and CNS haemangioblastomas
IIB	*VHL* exon missense mutation usually present	High risk of pheochromocytoma, and retinal and CNS haemangioblastomas, as well as RCC, pNET, and pancreatic cysts
IIC	*VHL* exon missense mutation usually present (codon 168)	Characterized by increased susceptibility to pheochromocytoma only

CNS, central nervous system; pNET, pancreatic neuroendocrine tumour; RCC, renal-cell carcinoma; VHL, von Hippel–Lindau.



Natures review. Clinical oncology.2016,Vol.38,537-549
Radiographics.rsna.org.2018,Vol.38,No.3
Human Molecular Genetic,2001,Vol.10,No.7

Von Hippel-Lindau

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Clinical criteria for Diagnosis of VHL

Patients with a family of VHL
Develop

- Hemangioblastoma in the CNS or retinal hemangioblastoma
- RCC
- Pheochromocytoma
- Pancreatic tumor or cyst
- Epididymal cystadenoma/Broad ligament cystadenoma

Patients without a family history of VHL
But develop

- Hemangioblastoma in the CNS or retinal hemangioblastoma

Combination with other tumor

- RCC
- Pheochromocytoma
- Pancreatic tumor or cyst
- Epididymal cystadenoma/Broad ligament cystadenoma

80% Autosomal dominant , 20% De novo

Clin Cancer Res; 23(12) June 15, 2017
Jpn J Clin Oncol 2006;36(6)337-343

Pancreatic manifestation in VHL

- 7.6% of patients with VHL disease present with pancreatic manifestations alone
  - **Pancreatic cyst**
    - Multiple cyst 60% and along pancreas
    - simple cysts
  - **Serous cystadenomas : most common**
  - **Solid lesion** neuroendocrine tumor (often islet cell origin)

- **Benign**
- **Ddx:**
  - **premalignant cystic lesions ; IPMN**
  - **RCC metastatic**

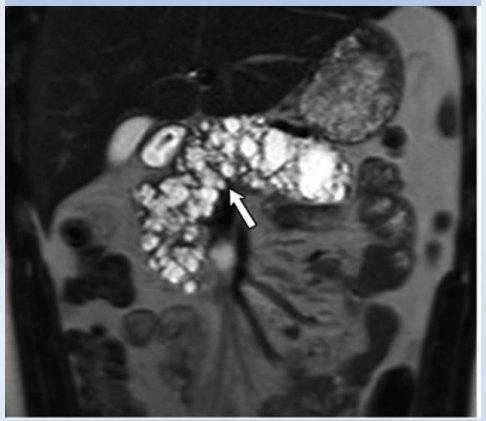
- **Symptoms**
  - Asymptomatic
  - Vague symptoms of epigastric pain, diarrhea, dyspepsia, and obstructive jaundice
  - Diabetic Mellitus : structural and functional pancreatic dysfunction

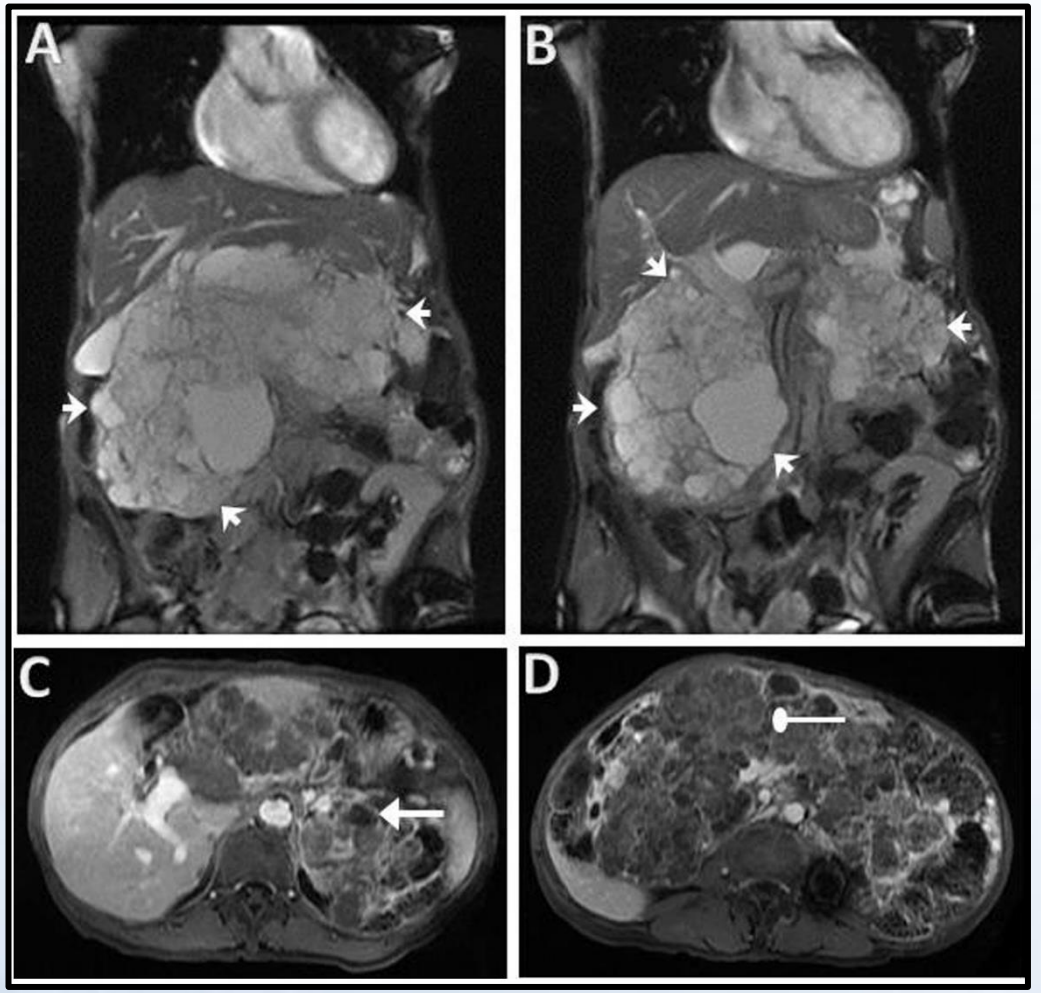
Int J Sur Case rep.2016; 21: 70-72

Pancreatic cysts in Patient with VHL

- Typical: multiple and asymptomatic.
- Surgical intervention : Symptoms associated with local obstruction of the bile duct or pancreatic duct, or adjacent structures.

Coronal T2- MR





Radiographics.rsna.org.2018,Vol.38,No.3

S. Ayloo, M. Molinari / International Journal of Surgery Case Reports 21 (2016) 70–72

Pancreatic cysts

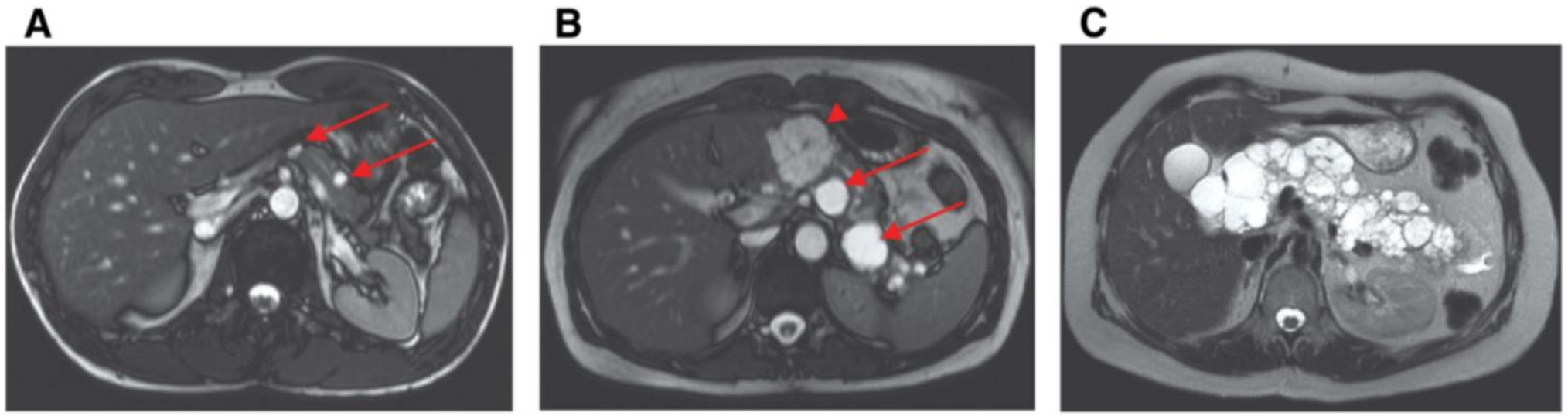
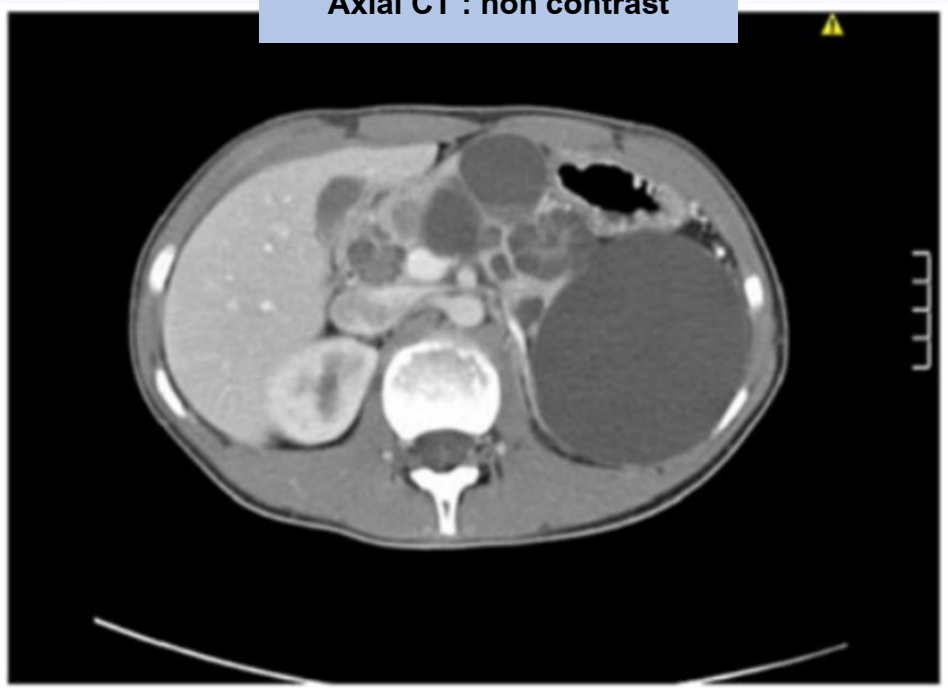


Figure 2 Axial MRI images of pancreatic involvement in three VHL patients. None of these patients had pancreas-related symptoms or exocrine/endocrine insufficiency. (**A**) Simple cysts (arrows) with size <1 cm in a 32 year old man; (**B**) A 4 cm sized serous microcystic cystadenoma (arrowhead) is present next to multiple simple cysts (arrows) in a 39 year old woman; (**C**) Shows replacement of almost the entire pancreas by multiple cysts in a 47 year old woman.

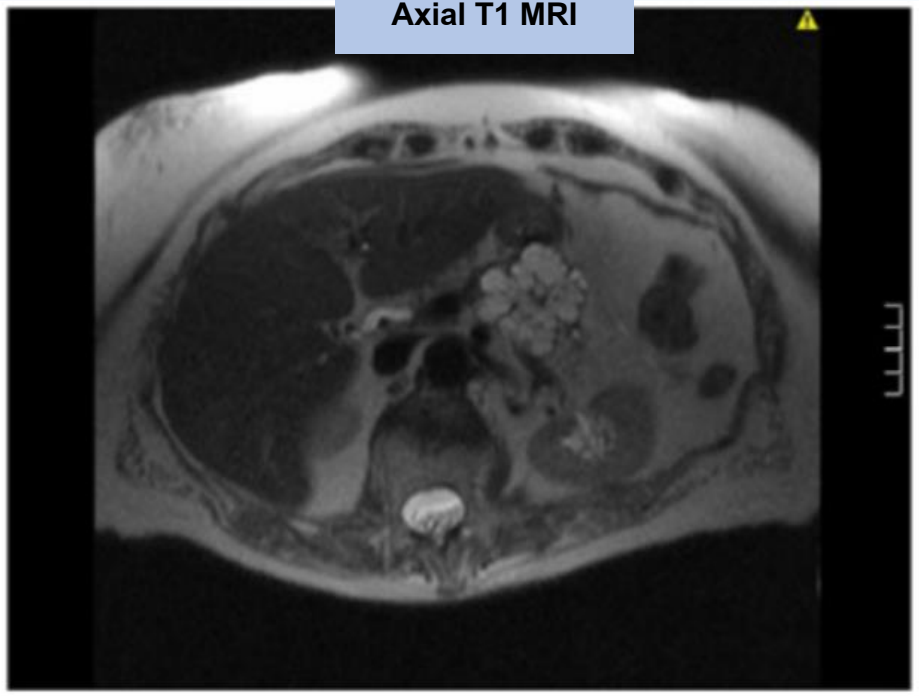
Van Asselt et al. Cilia 2013, 2:3

Serous cystadenoma

Axial CT : non contrast



Axial T1 MRI



- Serous cystadenomas “cluster of cysts.” : 9–17% in VHL.
- Histopathology : serous cystadenomas demonstrate well demarcated multilocular clusters of small cysts, separated by thin fibrous septa.
- Non communicate with pancreatic duct, which helps differentiate from intraductal papillary mucinous neoplasms.

J Gastrointest Surg (2012) 16:1422–1428
Radiographics.rsna.org.2018,Vol.38,No.3

Pancreatic neuroendocrine tumor

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- Pancreatic NETs : 15% of VHL.
- The incidence of malignancy in VHL-associated pancreatic NETs varies 8 -13%, with tumors demonstrating local invasion and regional or distant metastases.
- CT with contrast : lesions that enhance on the arterial phase are pathognomonic for pancreatic NETs.
- 68Ga-DOTATATE or 18F-FDG PET CT :
  - Detected metastatic disease or distinguish pancreatic NETs
  - Differentiating solid microcystic serous adenomas from pancreatic NETs.

Radiographics.rsna.org.2018,Vol.38,No.3
Natures review. Clinical oncology.2016,Vol.38,537-549

Pancreatic neuroendocrine tumor

- **Non contrast CT or T1-MRI : hypointense relative to the unaffected pancreatic parenchyma, and sometimes hemorrhagic or contain necrotic and/or calcified areas.**
- **T2-MRI images : higher signal intensity than that of the normal pancreatic parenchyma, but not as high as that of their cystic counterparts.**
- **After injected contrast agents both CT and MRI scans : hypervascularity and brightly enhancing lesions.**

Radiographics.rsna.org.2018,Vol.38,No.3
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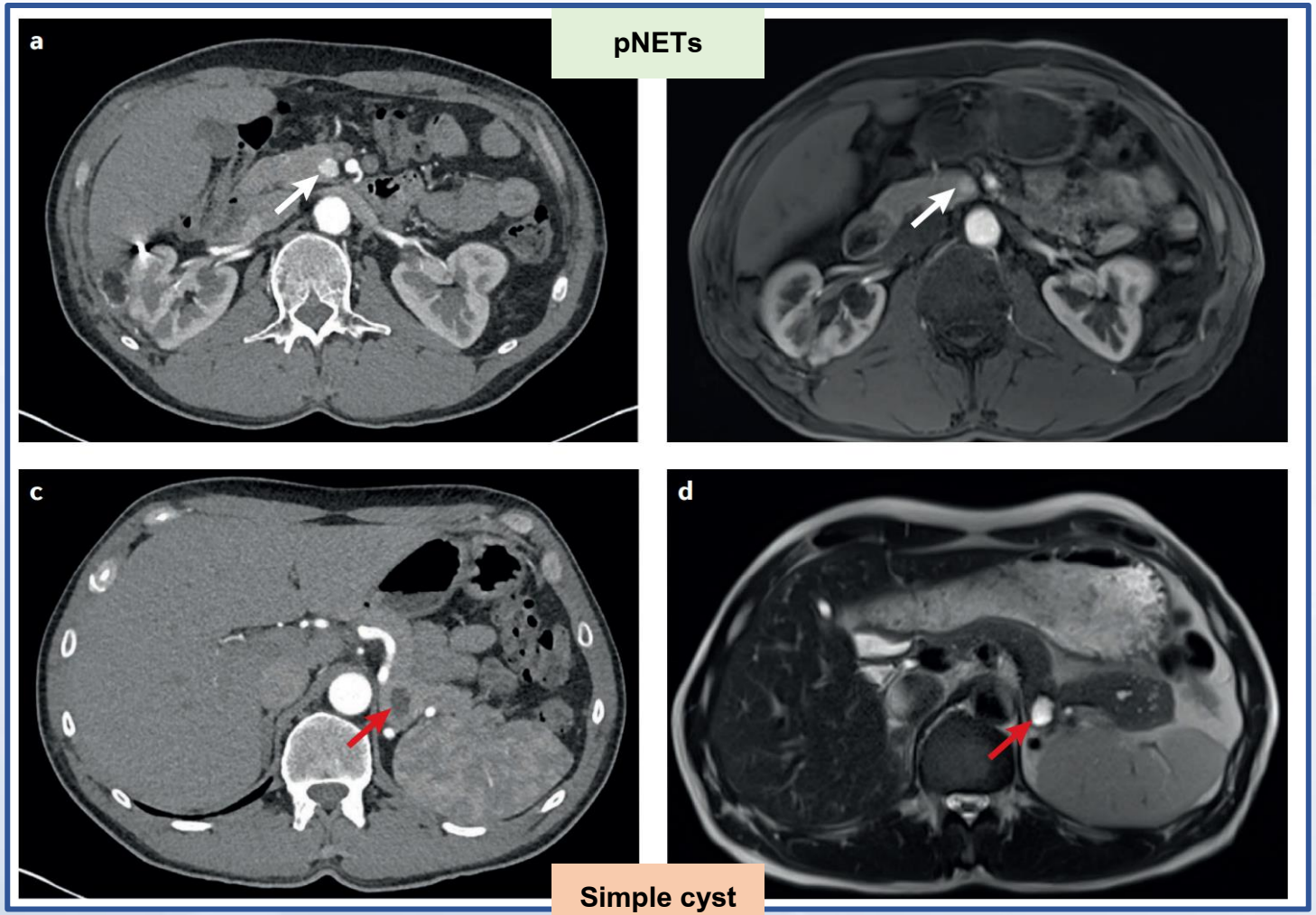
Pancreatic neuroendocrine tumor

CT c contrast A-phase:

Highly vascularized pNET

CT c contrast :

Non enhanced cyst



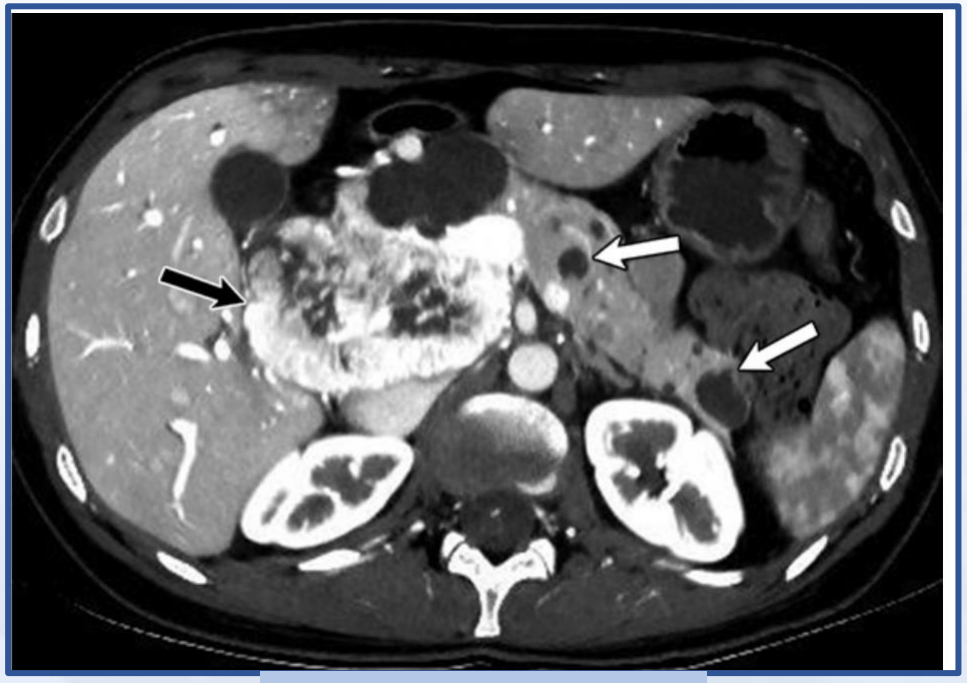
T1 MRI:

Contrast enhanced

T2 MRI: clear cyst

Natures review. Clinical oncology.2016,Vol.38,537-549

Pancreatic neuroendocrine tumor

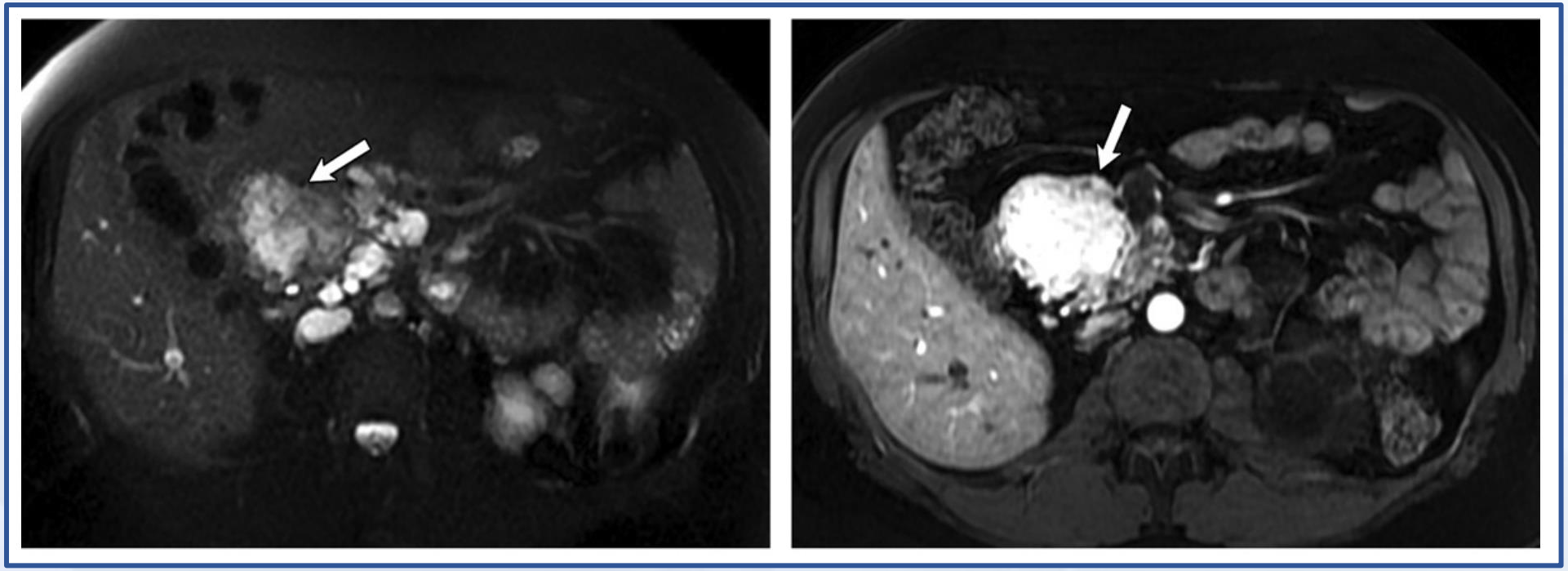


Axial MRI abdomen

- **Contrast enhance hypervascular heterogeneous mass, consistent with an NET. (black arrow)**
- **Numerous scattered nonenhancing cysts (white arrow)**

Radiographics.rsna.org.2018,Vol.38,No.3

Pancreatic neuroendocrine tumor



Axial T2-MRI: heterogenous hyperintense tumor

Axial A-phase GD MRI : avid enhancement

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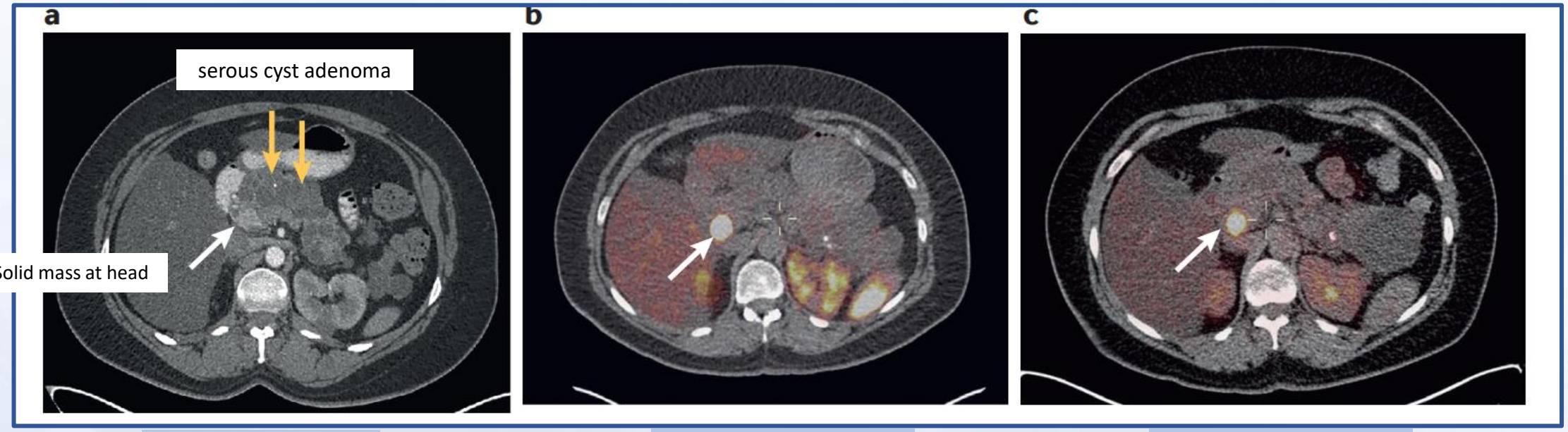
Pancreatic neuroendocrine tumor



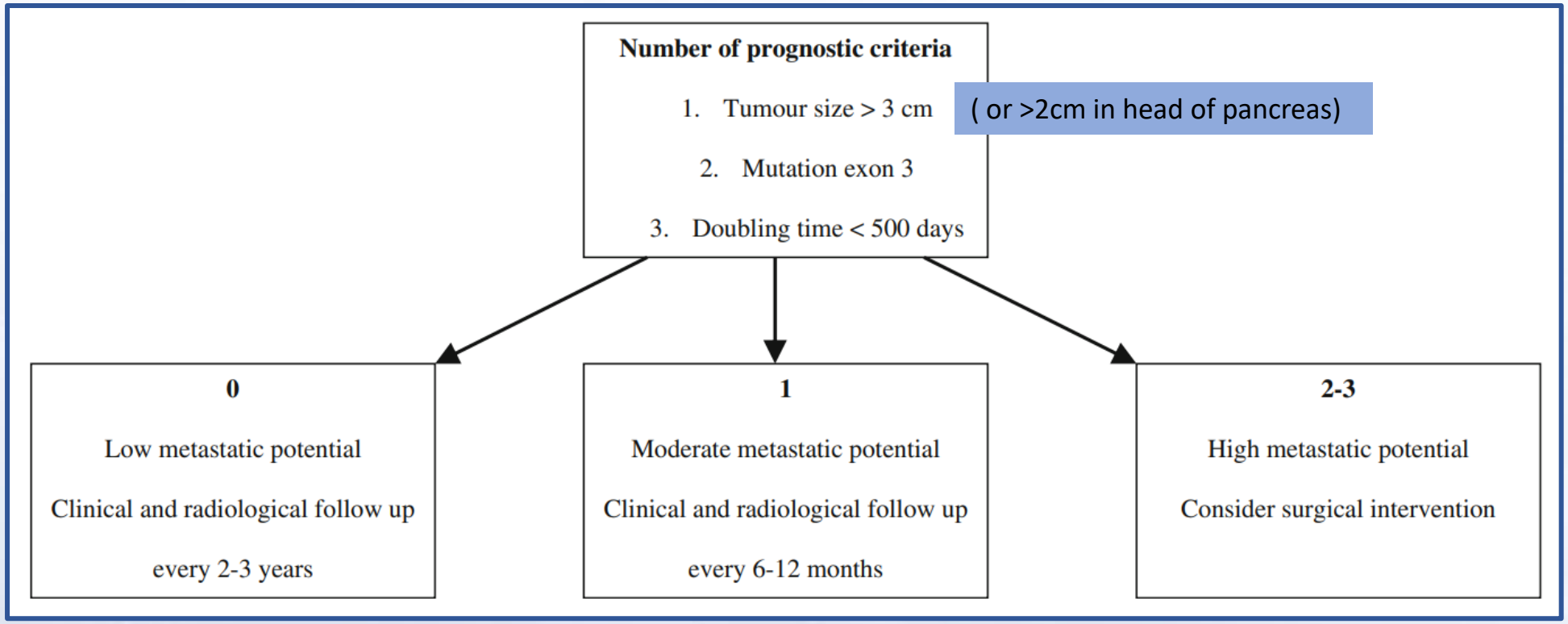
CT scan NC

68Ga-Dotatate PET CT

18F-FDG PET–CT

Natures review. Clinical oncology.2016,Vol.38,537-549

pNETs in VHL:



Modification to the 1998 recommendations by Libutti et al.20, s set out by Blansfield et al.26 With permission from S.K. Libutti

J Gastrointest Surg (2012) 16:1422–1428
Natures review. Clinical oncology(2016)38:537-549

VHL surveillance

Age	Surveillance Recommendations
At birth	Clinical evaluation for neurologic disturbance, ophthalmic examination, and newborn hearing tests
1–4 years of age	Annual comprehensive ophthalmic examination Annual clinical evaluation for neurologic disturbances and abnormalities in blood pressure, vision, and hearing
5–15 years of age	All of the surveillance recommendations at birth and at ages 1–4 Annual biochemical tests, including plasma metanephrine or 24-hour urinary metanephrine levels Annual abdominal US from 8 years of age or earlier if indicated; MR imaging of the abdomen or functional imaging with MIBG scintigraphy to be performed only if biochemical abnormalities are found Audiology assessment every 2–3 years (annually if any audiovestibular symptoms) MR imaging with contrast enhancement of the internal auditory canal every 2–3 years
≥16 years of age	Annual comprehensive ophthalmic examination Annual clinical evaluation for neurologic disturbances and abnormalities in blood pressure, vision, and hearing Annual biochemical tests, including plasma metanephrine or 24-hour urinary metanephrine levels Annual abdominal US and abdominal MR imaging with and without contrast enhancement every 1–2 years Annual MR imaging with and without contrast enhancement of the brain, petrous temporal bone, and whole spine every 2–3 years
Pregnancy	Regular eye examination (risk of rapid progression of retinal HB) MR imaging of the brain and whole spine without contrast enhancement (to ensure that there is no rapid progression or complications such as hydrocephalus) Plasma metanephrine levels in early, mid-, and late pregnancy to test for active pheochromocytoma Consider cesarean delivery if patient has known retinal or CNS tumors

Radiographics.rsna.org.2018,Vol.38,No.3

Proposed diagnostic criteria pancreatic (Type 3c) diabetes

Major criteria (must be present)

- Presence of exocrine pancreatic insufficiency (monoclonal fecal elastase-1 test or direct function tests)
- Pathological pancreatic imaging (endoscopic ultrasound, MRI, CT)
- Absence of type 1 diabetes mellitus associated autoimmune markers

Minor criteria

- Absent pancreatic polypeptide secretion
- Impaired incretin secretion (*e.g.*, GLP-1)
- No excessive insulin resistance (*e.g.*, HOMA-IR)
- Impaired beta cell function (*e.g.*, HOMA-B, C-Peptide/glucose-ratio)
- Low serum levels of lipid soluble vitamins (A, D, E and K)

Ewald N,wt al. World J Gastroterol 2013

Take home message

- Pancreatic imaging should be considered in patients with poorly controlled DM and unexplained cause
- Pancreatic manifestation alone is uncommon in VHL
- Diabetes is a manifestation in patients with VHL who have extensive pancreatic involvement