

2021 NET Lecture

神經內分泌腫瘤的內視鏡 診斷與治療

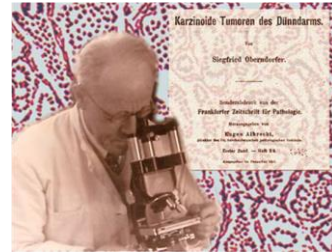
鄭祖耀醫師

臺大醫院癌醫中心分院

2021/11/13

 NTU CANCER CENTER
台大癌醫中心

類癌



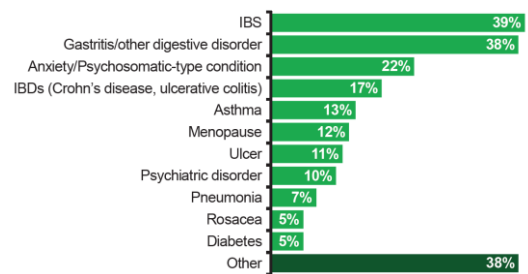
- In 1907, Siegfried Oberndorfer described 6 autopsy cases with multiple small ileal tumors that grew extremely slowly and did not appear to metastasize. He ascribed a new name, **karzinoide** (carcinoma-like), to describe the nature of these tumors.

~Modlin IM, et al. Arch Surg. 2007;142:187-97

有症狀/功能性神經內分泌腫瘤

- Well-differentiated NETs arising in the GI system have traditionally been referred to as **carcinoid tumors** or **pancreatic NETs**
 - Carcinoid tumors may arise from **GI tracts** and **lungs**
 - Pancreatic NETs arise from the **pancreas** and rarely within the **duodenal wall**
- Symptomatic/ functional GEP-NETs, associated with a hormonal syndrome
 - GI NETs (carcinoid tumors)**
 - carcinoid syndrome** rarely developed without **liver metastases** (due to liver clearance effects)
 - Pancreatic NETs**
 - About 25-50% of are functional
- Symptoms of NETs are **nonspecific** and may resemble other conditions

神經內分泌腫瘤正式診斷前的臆斷



~Pavel M, et al. Neuroendocrinology 2015;102:160

神經內分泌腫瘤有症狀到診斷的時間差

Diagnosed with NET in the following time period	Don't know/ NA	<6 months	6 months - 2 years	2 - 5 years	>5 years	Mean (months)
Total sample (N = 1929)	9%	20%	18%	19%	29%	52.0
Diagnosed <5 years ago (n = 1154)	9%	23%	18%	18%	26%	48.2
Diagnosed ≥5 years ago (n = 775)	7%	16%	18%	21%	33%	67.5
GI NET	8%	17%	18%	21%	31%	54.4
pNET	9%	27%	16%	18%	24%	47.5
Lung NET	8%	21%	15%	21%	29%	56.9

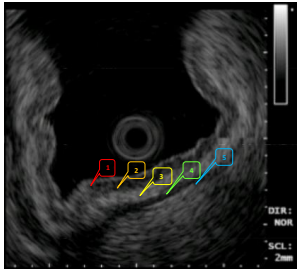
~Pavel M, et al. Neuroendocrinology 2015;102:160

腸胃道神經內分泌腫瘤的評估

- Colonoscopy as appropriate for colonic NETs
- Small bowel imaging with CT enterography or capsule endoscopy as appropriate for jejunal and ileal NETs
- EUS** and/or EGD as appropriate for **duodenal** and **gastric** NETs
- Proctoscopic examination for rectal NETs


 NCCN
National
Comprehensive
Cancer
Network

內視鏡超音波(EUS)評估腸胃道壁的分層



- **Layer 1** : interface of luminal fluid and mucosa
- **Layer 2** : deep mucosa
- **Layer 3** : submucosa + interface
- **Layer 4** : the muscularis propria - interface
- **Layer 5** : adventitia or serosa + adjacent fatty or fibrous tissue

~Hwang JH, et al. Gastroenterology. 2006;130:2217-28

胃黏膜下腫瘤的EUS特徵

Subepithelial lesion	EUS layer*	Echogenicity
Benign		
Leiomyoma	2, 3 or 4	Hypoechoic
Neural origin tumors		
Schwannoma	3 or 4	Hypoechoic
Neuroma		
Neurofibroma		
Lipoma	3	Intensely hyperechoic
Duplication cyst	Any or extramural	Anechoic
Pancreatic nest	2 or 3	Hypoechoic
Inflammatory	3 or 4	Hyperechoic
fibroid polyp		
Granular cell tumor	2 or 3	Hypoechoic
Varices	2 or 3	Anechoic
Malignant or with malignant potential		
GIST	4 (rarely 2 or 3)	Hypoechoic
Neuroendocrine carcinoma	Any	Hypoechoic
Glomus tumor	3 or 4	Hypoechoic

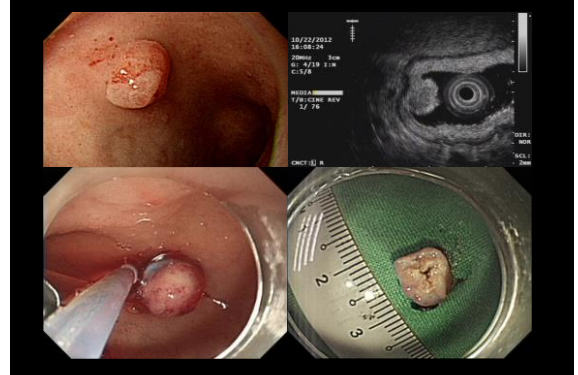
胃神經內分泌腫瘤 2 or 3 低回音性

~Hwang JH, et al. Gastroenterology. 2006;130:2217-28

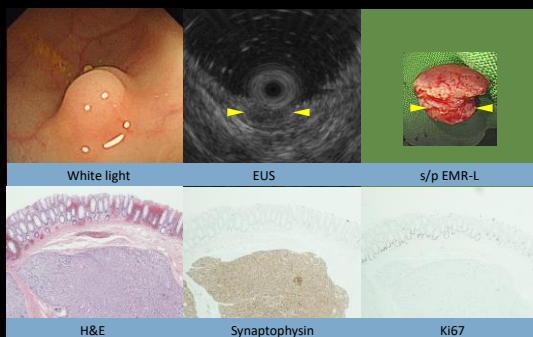
胃神經內分泌腫瘤的EUS影像

	Type I	Type II	Type III
Proportion of gastric carcinoids	70%–80%—most common	Less than 5%	15%–20%
Associations	Chronic atrophic gastritis, pernicious anemia	MEN-1, Zollinger-Ellison syndrome	Sporadic carcinoid syndrome
Epidemiology			
Plasma gastrin levels	High	High	High
Gastric acid output	High	High	High
Number of tumours	Multiple	Multiple	Multiple
Size of tumours	Small	Small	Small
Site of tumours	Body	Body	Body
Metastasis	10%	10%	10%
Mean age at diagnosis	60 years	60 years	60 years
Prognosis	Usually good—a minority of tumours are more aggressive	Usually good—a minority of tumours are more aggressive	Usually good—a minority of tumours are more aggressive

十二指腸神經內分泌腫瘤的EUS影像



直腸神經內分泌腫瘤的EUS影像



胰神經內分泌腫瘤的診斷

- Diagnosing a functioning pancreatic NET is based on the presence or absence of **clinical syndromes** resulting from **inappropriate hormone secretion**
- A pancreatic NET should not be considered as functioning if the characteristic clinical syndrome is absent
- Confirmation of a functioning pancreatic NET requires the **corresponding hormone test**

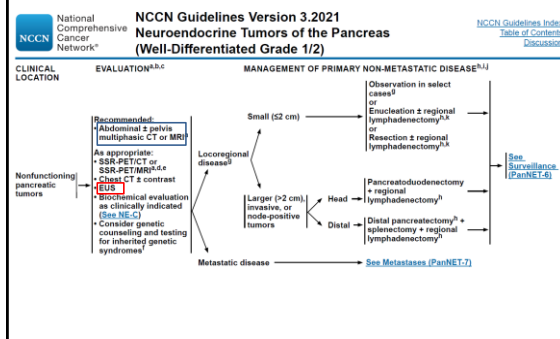
胰神經內分泌腫瘤的診斷

- Cross-sectional imaging via **contrast-enhanced CT** and/or **MRI** is necessary to detect and establish the extent of the primary tumor and/or metastatic disease.
- SRS/ octreoscan is suggested at the time of diagnostic workup and/or preoperatively if available

胰神經內分泌腫瘤的診斷

- EUS is effective in detecting sub-centimeter pancreatic NETs and should be performed for diagnostic purposes even if no primary tumor identified on cross-sectional imaging.
- **EUS with FNA** is a preferred route for a diagnostic biopsy of a pancreatic NET.
- **Peri-pancreatic lymphadenopathy** may be sampled at the same time on pancreatic EUS-FNA for preoperative evaluation.

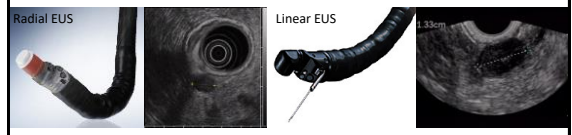
胰神經內分泌腫瘤的診療指引



以EUS評估胰神經內分泌腫瘤

- ◆ EUS as an evaluation tool "as appropriate"

NCCN Guideline 1.2013	NCCN Guideline 3.2021
Non-functioning pNET	Non-functioning pNET
Gastrinoma	Gastrinoma
Insulinoma	Insulinoma
	Glucagonoma
	VIPoma

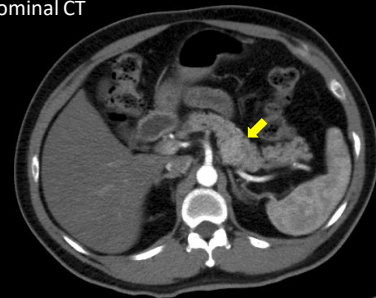


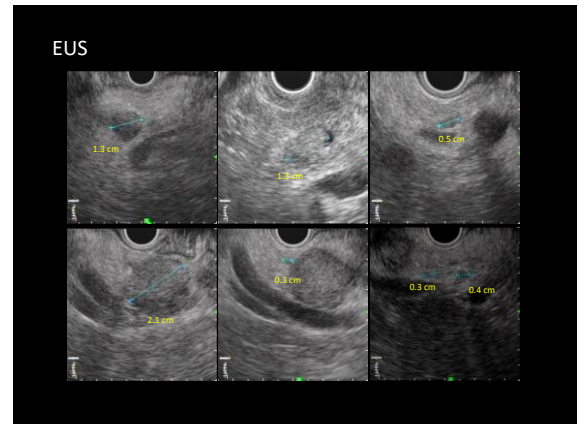
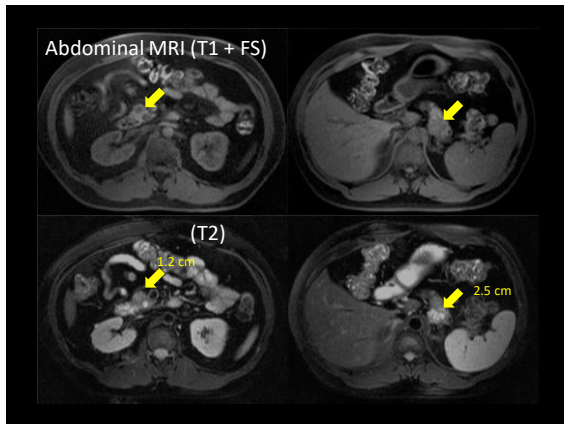
胰神經內分泌腫瘤的診斷工具

Author	Publication year	n	Insulinoma (%)	NP-NET (%)	Mean Size (mm)	Size < 20 mm (%)	CT (%)	EUS (%)	MRI (%)	SRS (%)
Roch, et al	1992	37	80	0	14	95	(all CT-negative)	82	-	-
Palazzo, et al	1993	13	100	0	-	-	14	79	-	-
Zimmer, et al	1996	20	50	0	18	82	25	86	18	50
Ueno, et al	1996	7	71	29	-	86	57	100	-	-
de Angelis, et al	1999	23	52	9	7-35	83	30	87	25	15
Anderson, et al	2000	54	61	0	15	71	-	93	-	-
Gines, et al	2002	10	40	0	12	90	30	100	-	66
Gouya, et al	2003	30	100	0	20	-	72	94	-	-
			* IDPCT: Dual Phase helical CT with thin section				(IDPCT: 84%)			
Ardengh, et al	2004	23	52	30	20	83	61	100	24	-
Alsaibani, et al	2008	14	-	-	4-25	93	77	100	67	50
Khashab, et al	2011	60	32	58	-	68	63	92	-	-

~Khashab MA et al. Gastrointest Endosc 2011;73:691-6

45M, parathyroid tumor + pancreatic tumor
Abdominal CT





胰神經內分泌腫瘤的EUS特徵

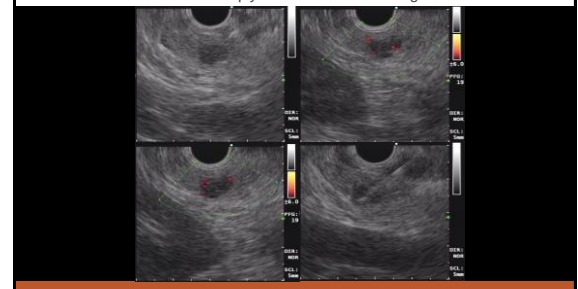
	Adeno-carcinoma	Neuroendocrine tumors	Pseudotumoral pancreatitis	Lymphoma
EUS findings	- Hypoechoic - Poorly vascularized - Lobulated margin - Dilated MPD - Vascular infiltration	- Hypoechoic - Highly vascularized - Sharply delineated round margin	- Hypoechoic - Hypo-vascularized - Lobulated margin - Calcifications - Necrotic areas	- Hypoechoic - Differently vascularized - Sharply delineated round margin
Cytology features	- Disorderly groups of ductal cells - Pleomorphism - Increased N/C - Nuclear atypia (enlargement, irregular nuclear membranes)	- Singly, clustered, or rosettes - Monotonous - Plasmacytoid appearance - Salt-and-pepper chromatin pattern	- Ductal hypertrophy - Inflammatory background (lymphocytes, plasma cells)	- Singly - Monotonous - Increased N/C - Nuclear indentation - Lymphoglandular bodies in the background

—鄭祖耀，台灣消化系醫學會第39屆教育研討會講義，2015

胰神經內分泌腫瘤的EUS特徵

Key features:

- hypoechoic
- highly vascularized
- sharply delineated round margin

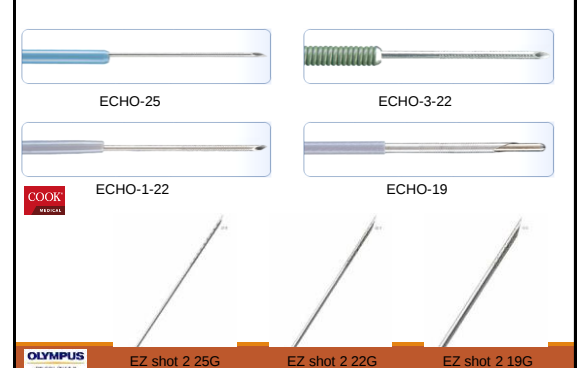


胰神經內分泌腫瘤經EUS導引細針穿刺

Author	Publication year	n	Non-functional NET (%)	Mean size (mm)	Accuracy (%)
Gouya, et al	2003	30	0	20	90
Ardengh, et al	2004	23	30	20	83
Alsohaibani, et al	2008	14	-	4-25	90
Atiq, et al	2012	81	91	27.5	90



EUS導引細針穿刺術(FNA)的特殊針



EUS導引細針穿刺術(FNA)的特殊針



ProCore needle 19-25G



EZ shot 2 22G with side port



Expect 19 Flex Needle

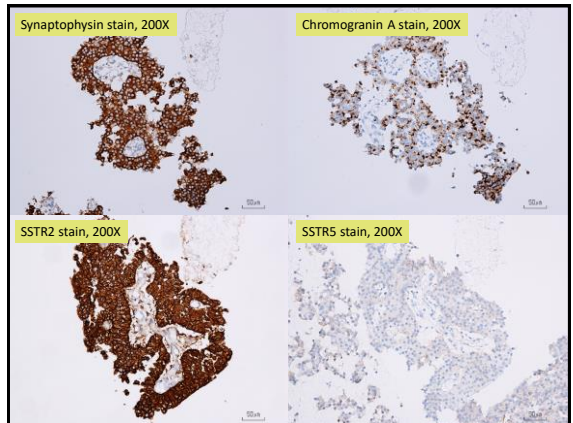
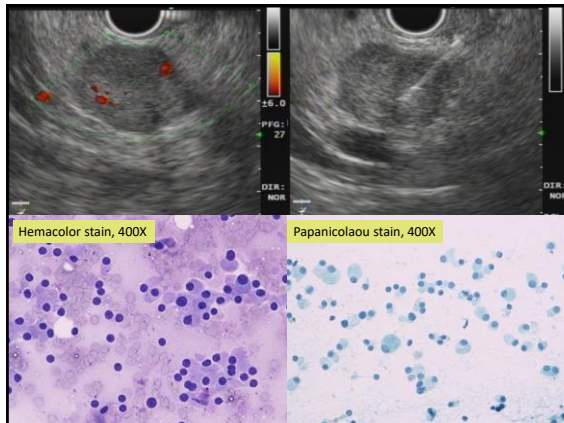
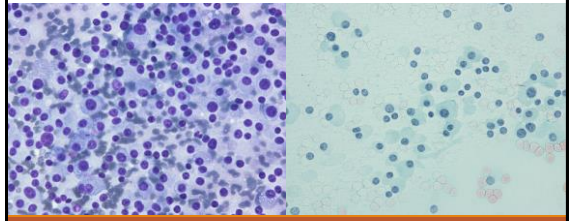
胰神經內分泌腫瘤的細胞學特徵

Key features:

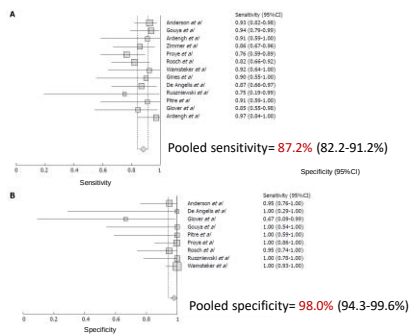
- Singly, clustered, or rosettes
- Monotonous
- Plasmacytoid appearance
- Salt-and-pepper chromatin pattern

Hemacolor stain, 400X

Papanicolaou stain, 400X



以EUS診斷胰神經內分泌腫瘤



~Puli SR, et al. World J Gastroenterol. 2013;19:3678-84

SCANDINAVIAN JOURNAL OF GASTROENTEROLOGY, 2016
VOL. 51, NO. 2, 245-252
<http://dx.doi.org/10.3109/0036521.2015.1083050>



ORIGINAL ARTICLE

Efficacy of endoscopic ultrasonography and endoscopic ultrasonography-guided fine-needle aspiration for the diagnosis and grading of pancreatic neuroendocrine tumors

NAO FUJIMORI^{1,2}, TAKASHI OSOEGAWA¹, LINGAKU LEE¹, YUICHI TACHIBANA¹, AKIRA ASO¹, HIROAKI KUBO¹, KEN KAWABE^{1,2}, HISATO IGARASHI¹, KAZUHIKO NAKAMURA¹, YOSHINAO ODA¹ & TETSUhide ITO³

¹Department of Medicine and Bioregulatory Science, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan,

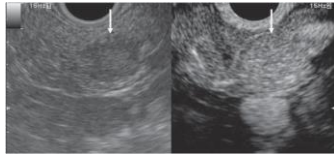
²Department of Gastroenterology, Clinical Research Institute, National Hospital Organization Kyushu Medical Center, Fukuoka, Japan, and

³Department of Anatomic Pathology, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

- Retrospective, single center
- EUS-FNA, surgical results, 51 patients
- Concordance rate of tumor grades based on Ki-67 index
 - **69.2%** between EUS-FNA and surgical specimens
 - relatively high (**87.5%**, 5/6) in tumors < 20 mm; lower (57.1%, 4/7) in tumors ≥ 20 mm

~Fujimori N, et al. Scandinavian Journal of Gastroenterology 2016; 51: 245-52

對比劑增強EUS (CEH-EUS)



- NETs are hypervascular with **strong arterial hyperenhancement** under CEH-EUS
- CEH-EUS-depicted hypervascular enhancement diagnosed neuroendocrine tumors with a sensitivity of **78.9%** (95% CI, 61.4%-89.7%) and specificity of **98.7%** (95% CI, 96.7%-98.8%),
- CEH-EUS + EUS-FNA, sensitivity of EUS-FNA increased from 92.2% to **100%**

~ Kitano M, et al. Am J Gastroenterol. 2012;107:303-10

胰神經內分泌腫瘤與多發性內分泌腫瘤第一型(MEN-1)

- A clinical diagnosis for MEN1 includes two or more MEN1-associated tumors
 - Parathyroid** hyperplasia
 - Pancreatic** NETs
 - Pituitary** tumors
- Patients with MEN1 are more likely to have **multiple** pancreatic NETs than those with sporadic tumors
 - 44% of the sporadic pancreatic NETs had somatic inactivating mutations in *MEN1* gene
 - 25~30% MEN1 patients have ZES (Zollinger-Ellison syndrome)

32

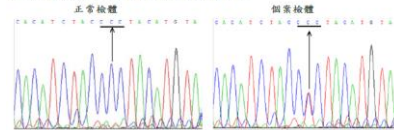
胰神經內分泌腫瘤與多發性內分泌腫瘤第一型(MEN-1)

- Genetic testing for MEN-1 is recommended in **all young patients with gastrinoma or insulinoma**, any patient with a **family or personal history of other endocrinopathies** (esp. hyperparathyroidism) or **multiple pancreatic NETs** on EUS studies
- Plasma calcium, iPTH, prolactin, IGF-1 and pituitary gland MRI should be examined in patients with MEN-1.

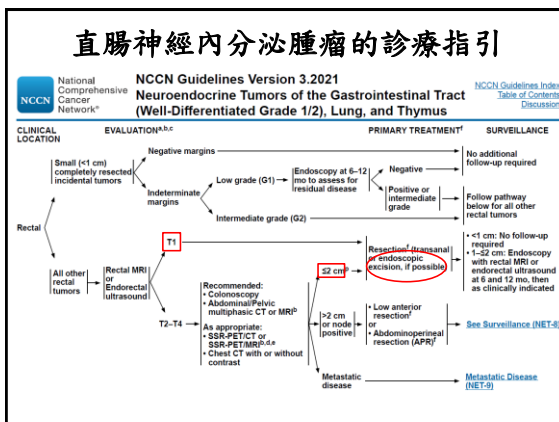
MEN1 Gene Analysis

臺大醫院基因醫學部報告

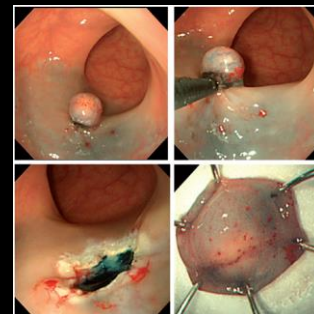
檢體種類：血液
 檢體狀況：正常
 檢驗項目：MEN1 基因
 檢驗結果：MEN1 基因序列第 959 個核苷酸由 C 變成 T (向染色體中僅一條發現變異)
 判斷：「確定」帶有會影響基因功能的基因變異點。



直腸神經內分泌腫瘤的診療指引

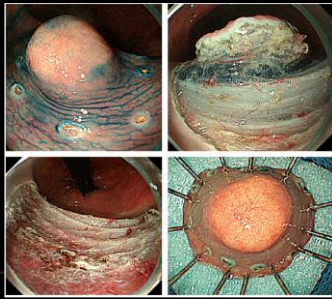


綁紮式內視鏡黏膜切除術 (EMR-L)



~Kaneko H, et al. Scand J Gastroenterol. 2016;51:1489-1494

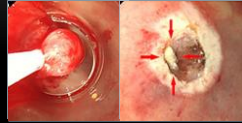
內視鏡黏膜下剝離術 (ESD)



-Kaneko H, et al. Scand J Gastroenterol. 2016;51:1489-1494

各式內視鏡切除術

Polypectomy



Conventional EMR



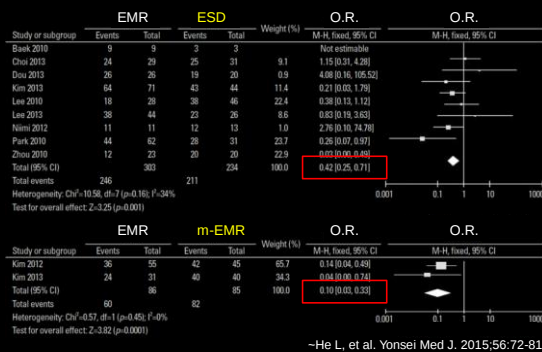
Modified EMR (EMR-B(L), EMR-C, CIEMR)



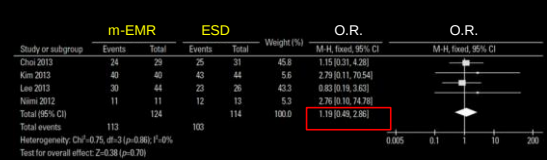
Under water EMR/ESD



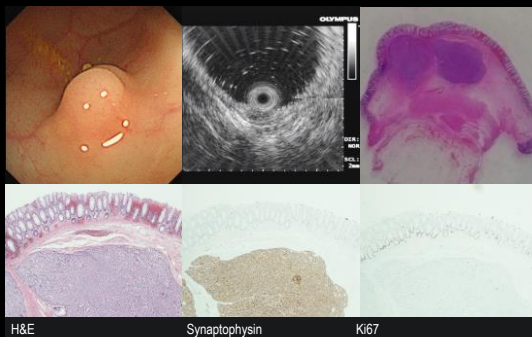
META-ANALYSIS FOR ENDOSCOPIC RESECTION THERAPIES IN RECTAL NETS



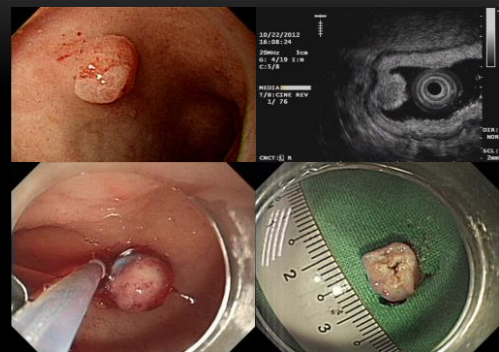
META-ANALYSIS FOR ENDOSCOPIC RESECTION THERAPIES IN RECTAL NETS



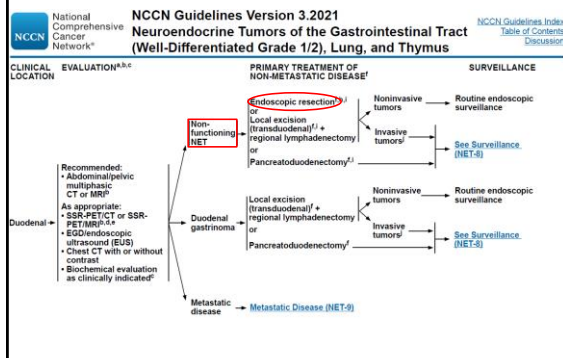
以EUS評估直腸神經內分泌腫瘤



以EUS評估十二指腸神經內分泌腫瘤



十二指腸神經內分泌腫瘤的診療指引



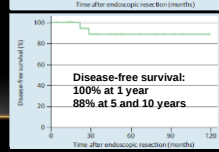
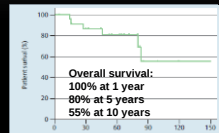
以EMR治療小型十二指腸神經內分泌腫瘤

* ASSOCIATED WITH SIGNIFICANT MORBIDITY, DIFFICULT IN R0 RESECTION AND RISK OF LAPS

29 patients with 32 duodenal NETs

Tumor size, mean(range),mm	8.9 (3-17)
Tumor location, n(%)	
1 st portion duodenum	18 (56)
2 nd portion duodenum	7 (22)
Major papilla	7 (22)
Resection, n(%) (19 EMR, 13 EMR-C)	
En-bloc	30 (94)
Piecemeal	2 (6)
WHO 2010, n(%)	
G1	27 (84)
G2	5 (16)
Microscopic margin, n(%)	
R0	16 (50)
R1	14 (44)
Rx	2 (6)

• Mortality: 3%
 • Morbidity: 38% (28% bleeding)



~Gincul R et al. Endoscopy 2016; 48: 979-986

以EMR治療小型十二指腸神經內分泌腫瘤

* CAN BE A SAFE AND EFFECTIVE ALTERNATIVE TO SURGERY IN CAREFULLY SELECTED PATIENTS

- Retrospective cohort, USA (20 m-EMR, 10 surgery)

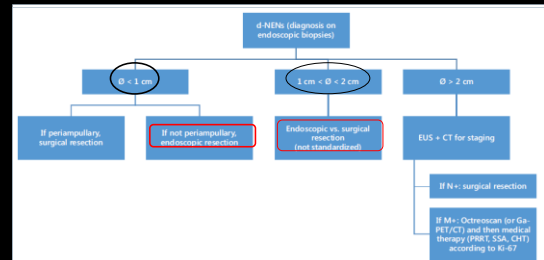
	Endoscopic Mucosal Resection	Surgery	P
Average size (mm)	7.7 ± 3.8	11.4 ± 3.9	< 0.05
Location (%)			0.76
Duodenal bulb	15 (75)	8 (80)	
Second portion	5 (25)	2 (20)	
Morphology (%)			0.45
Sessile	18 (90)	8 (80)	
Pedunculated	2 (10)	2 (20)	
Perineural invasion (%)	0 (0)	0 (0)	—
Lymphovascular invasion (%)	0 (0)	1 (10)	0.15
Depth of invasion by histology (%)			0.15
Limited to the submucosa	20 (100)	9 (90)	
Extension into the muscularis propria	0 (0)	1 (10)	

* No local or distant recurrence at 26-mo follow-up in patients who underwent complete resection by m-EMR.

~Shroff FR et al. Surg Laparosc Endosc Percutan Tech 2015;25:e134-39

十二指腸神經內分泌腫瘤的診療指引 (ENET 2016)

Endoscopic management for lesions **≤ 10 mm** in size, **not periampullary**, confined to the **M/SM** layer, without lymph node or distant metastasis



以EUS評估胃神經內分泌腫瘤

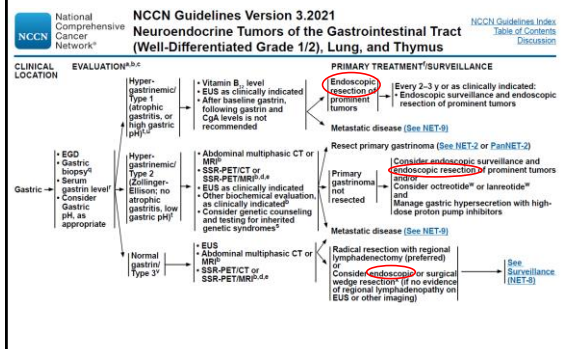


胃神經內分泌腫瘤的特徵

Characteristic	Type I GNETs	Type II GNETs	Type III GNETs
Proportion	70-80%	5-10%	10-15%
Associated dx	CAG	MEN 1(3%) ZES	None
Gender	F>M	F=M	F<M
Tumor No.	>1	>1	1
Tumor size	<10-20mm	<10-20mm	>20mm
Location	Fundus/corpus	Fundus/corpus	Any region
Histology	WD (G1-2)	WD (G1-2)	WD to PD (G1-3)
Invasion depth	M/SM	M/SM	Any depth
Serum gastrin	High	High	Normal
Gastric pH	High	Low	Normal
Metastasis	2-5%	10-30%	>50%
Tumor related death	0%	<10%	25-30%

~Dig Surg 2012; 29:331, ~World J Gastrointest Endosc 2015 Apr 16; 7(4): 346-353;
 ~Neuroendocrinology 2016;103:119-124

胃神經內分泌腫瘤的診療指引



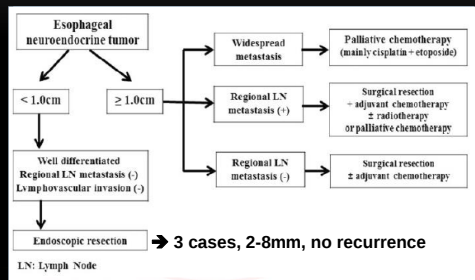
ESD VS. EMR

- 13 type I G1 <1cm gastric NET (6 EMR, 7 ESD)
- Vertical margin free: 100% ESD vs. 33.3% EMR, $p=0.02$
 ~Hepatogastroenterology, 2013;60:1524-7
- 87 type I <1cm gastric NET (48 EMR, 39 ESD)
- CR rate: 94.9% ESD vs. 83.3% EMR, $p=0.17$
- Vertical margin free: 97.4% ESD vs. 83.3% EMR, $p=0.04$
 ~Gastroenterol Res Pract. 2014; 253860



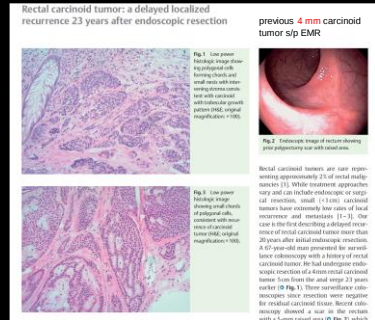
以內視鏡切除小型食道神經內分泌腫瘤

Retrospective multicenter study in Korea, 26 esophageal NETs



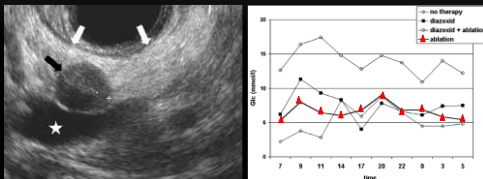
~BMC Cancer 2014;14:569

直腸神經內分泌腫瘤經EMR後的局部延遲性復發



~Judd S, et al. Endoscopy, 2014;46 Suppl 1 UCTN:E555-6

胰神經內分泌腫瘤經EUS導引酒精注射



Case report: 78F, repeated hypoglycemic attack with conscious change a 1.3 cm pancreatic body tumor proved to be NET by EUS-FNA; declined to have operation treated successfully by EUS-guided ethanol injection

~Jürgensen C, et al. Gastrointest Endosc. 2006;63:1059-62

以酒精注射進行腫瘤消融

- Safe and effective
- Renal/ hepatic cysts
- Solid tumors
- Advantages
 - Low cost
 - Wide availability
 - Rapid in action

~ Yang D, et al. Gastrointest Endosc. 2015;82:1127

胰神經內分泌腫瘤經EUS導引酒精注射

Ref.	n	Max. diameter (mm)	Ethanol (%)	Volume (mL)	Complications
Jurgensen et al.	1	13	95	8.0	Localized pain in the upper abdomen; a mild increase of serum lipase
Muscattello et al.	1	11 & 7 (*MEN-1 with VIPoma)	40	2.0	A small pancreatic necrotic lesion treated with laparoscopic necrosectomy
Deprez et al.	1		98	3.5	A mild /asymptomatic elevation of pancreatic enzymes; hematoma and ulceration of the duodenal wall
Viegeaar et al.	1	9.5	96	0.3	None
Levy et al.	5	18	95	0.12, 0.38, 0.12	None
		20	98	0.12, 0.25	None
		21	98	0.95, 0.28	None
		8	98	3.0, 1.5	None
		16	99	0.7, 1.0	None

~ Zhang WY et al. World J Gastroenterol 2013; 19: 3397-3403

胰島素瘤經EUS導引酒精注射

Ref.	n	Max. diameter (mm)	Ethanol (%)	Volume (mL)	Complications
Qin et al.	4	10	95	0.5	None
		5.4	95	0.25	None
		11.8	95	0.5	None
		10.0	95	0.3	None
Yang et al.	4	22	98	1.8	None
		26 (MEN-1)	98	3.8	None
		15	98	2.5, 7.0	None
		11	98	0.5	None

~ Qin SY, et al. Medicine. 2014;93:e85

~ Yang D, et al. Gastrointest Endosc. 2015;82:1127

胰神經內分泌腫瘤經EUS導引酒精注射

43F, p-head insulinoma

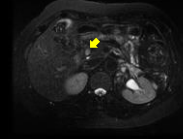
Declined to have Whipple's operation in fear of surgical risk



2014/06: s/p alcohol injection

Complications: recurrent pancreatitis

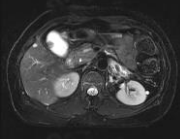
2014/03



2014/09



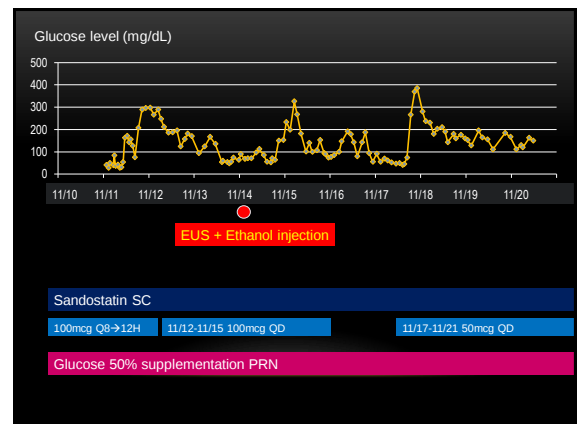
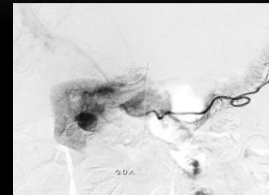
2014/12



胰神經內分泌腫瘤經EUS導引酒精注射

72F, frequent fasting hypoglycemia complicated with dizziness, sweating

Angiography: Hypervascular tumors (n=5) at the pancreatic head and neck, up to 2.1cm



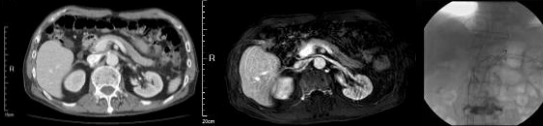
EUS導引細針穿刺診斷術合併酒精注射

80M, Hyperinsulinemic hypoglycemia

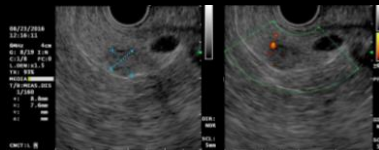
Abdominal CT: negative

Abdominal MRI: negative

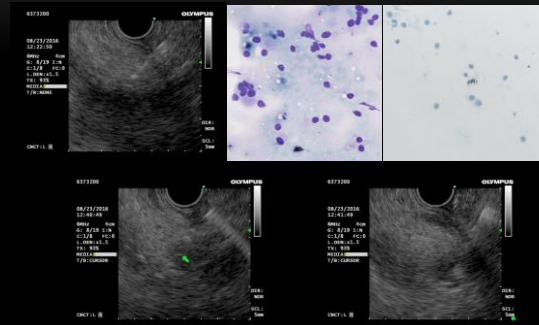
SACST: negative



EUS:
Multiple pNETs



EUS導引細針穿刺診斷術合併酒精注射



小型胰神經內分泌腫瘤經EUS導引酒精注射待解決的問題

- optimal type of injection needle with spray side holes?
- optimal size of injection needle 22G alone?
- safe target area within tumor mass regarding alcohol spreading feeding artery ablation?
- adequate amount of alcohol to achieve successful ablation without causing significant pancreatitis

~Seo DW. Gut Liver. 2010;4 Suppl 1:S76-81

胰神經內分泌腫瘤經EUS導引RFA消融術

ORIGINAL ARTICLE

Clinical Trials Study

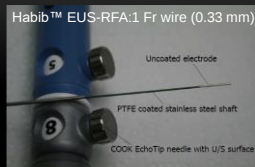
Endoscopic ultrasound guided radiofrequency ablation, for pancreatic cystic neoplasms and neuroendocrine tumors

Madhava Pai, Nagy Habib, Hakan Senturk, Sundee Lakhtakia, Nageshwar Reddy, Vito R Ciccinnati, Iyad Kaba, Susanne Beckebaum, Panagiotis Drymoussis, Michel Kahaleh, William Brugge

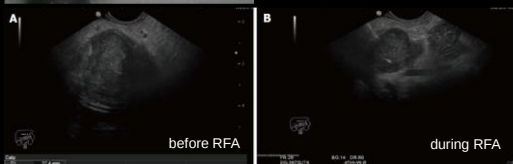
- Prospective, multi-center, pilot safety feasibility study
- EUS-RFA, 2 pancreatic head NETs (6 cystic tumors)
- Post-RFA evaluation with cross sectional images
 - a change in vascularity (15 mm tumor), and central necrosis about 15 mm (40 mm tumor)
- complications: mild abdominal pain resolved in 3 days

~Pai M, et al. World J Gastrointest Surg. 2015;7:52-9

胰神經內分泌腫瘤經EUS導引RFA消融術



- EUS-RFA with a 19 gauge biopsy needle
- Remove stylet and replace with the RFA catheter
- Withdraw FNA needle by 3 cm to disengage contact between the active part of the RF catheter at the tip and the metallic FNA needle
- Apply RF energy for 90-120s at the set wattage



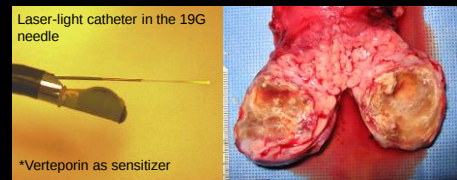
~Pai M, et al. World J Gastrointest Surg. 2015;7:52-9

經EUS導引光動力治療(PDT)

NEW METHODS: Experimental Endoscopy

EUS-guided photodynamic therapy with verteporfin for ablation of normal pancreatic tissue: a pilot study in a porcine model (with video)

Tony E. Yusuf, MD, Kai Mathies, MD, William R. Brugge, MD
Division, Gastroenterology, USA



*Verteporfin as sensitizer

~Yusuf TE, et al. Gastrointest Endosc. 2008;67:957-61

總結

- **EUS** as a good and accurate tool for diagnosing NETs
- EUS along with **EUS-FNA/B** helpful for diagnosing pancreatic NETs, even for the small ones (≤ 2 cm)
- Development of adjunctive techniques with EUS, such as CEH-EUS, can further increase potential detection of small lesions
- Tumor grade may be evaluated with EUS-FNA/B for those **smaller NETs** (< 2 cm)
 - the tumor response to biological therapy based on FNA/B specimen is to be evaluated

總結

- Endoscopic resection of rectal NETs with ESD or modified EMR is superior to EMR
 - the efficacy of **modified EMR** is equivalent to ESD
- EUS-guided **ethanol injection** with 40-99% ethanol for small pancreatic neuroendocrine tumors has been attempted with good resolution and few complications
- EUS-guided tumor ablation strategies for small pancreatic tumors offers a minimally invasive access for local treatment, and may become an alternative choice of surgical resection

謝謝聆聽！

