



Current Status of Nuclear Medicine in China and it's Application in Oncology

Rui An, MD

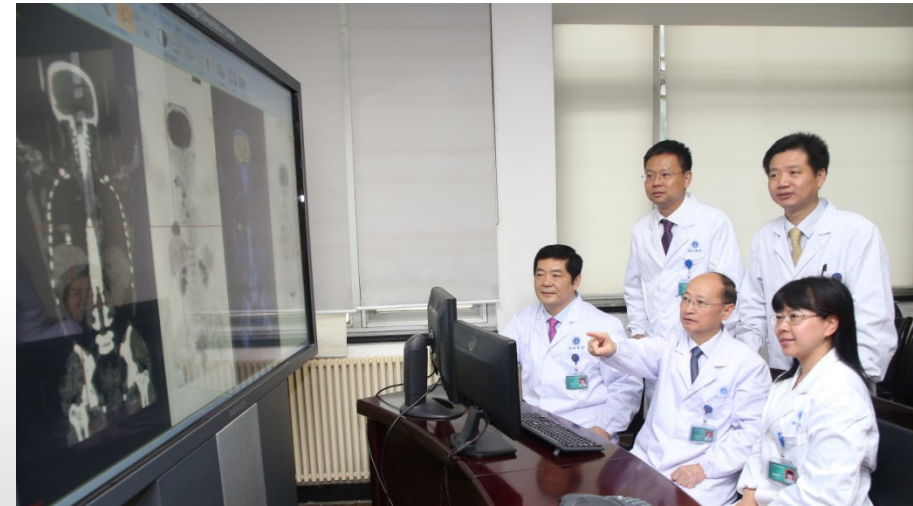
Vice-president of Chinese-Germany Medical Association

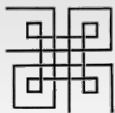
President-elect of Chinese Nuclear Medical Doctor Association



Long History of China

Young Chinese Nuclear Medicine





Milestones of Chinese Nuclear Medicine



1956



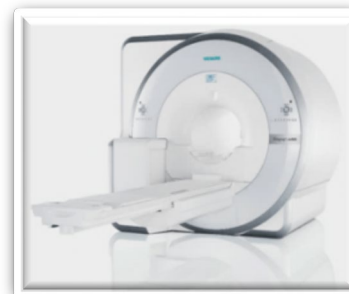
1980 CSNM



1983 SPECT



2000 Micro-PET

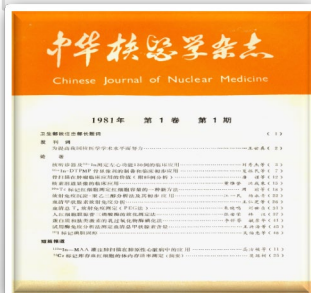


2012 PET/MR

1958



1981 CJNM

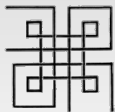


1995 PET



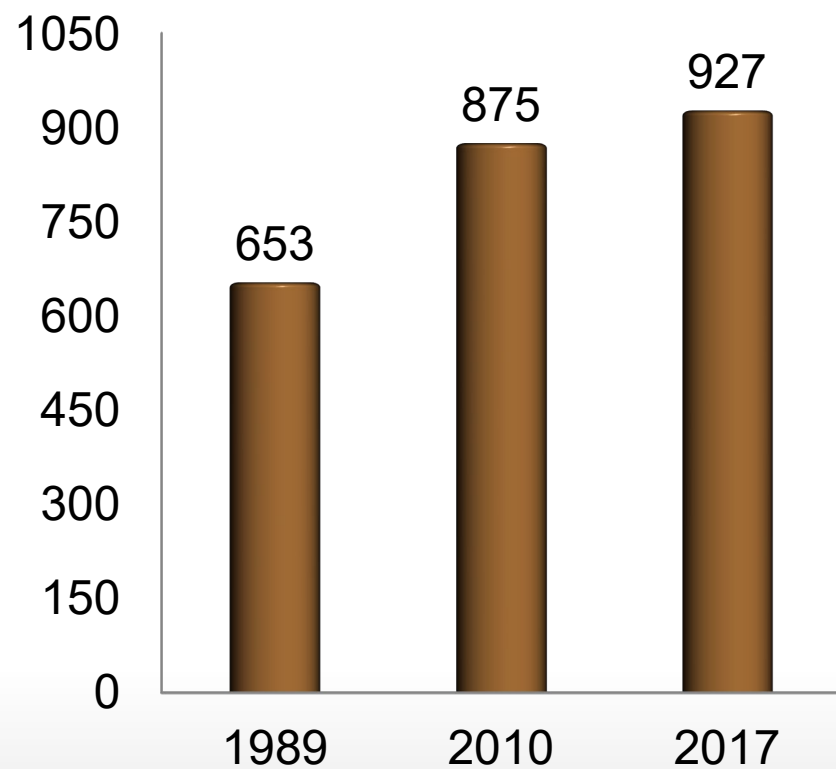
2002 PET/CT



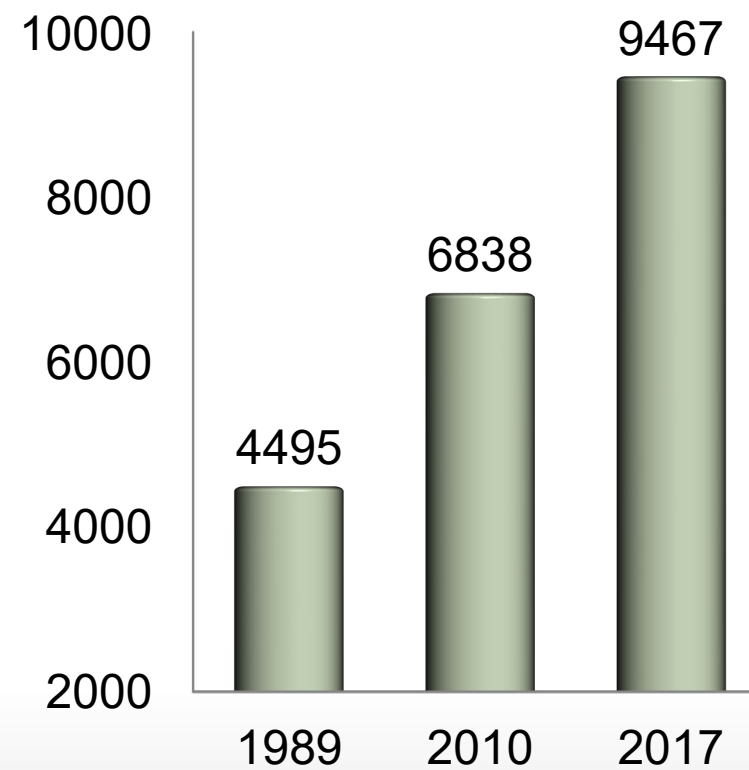


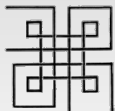
Status of Chinese Nuclear Medicine

Dept. of Nucl Med



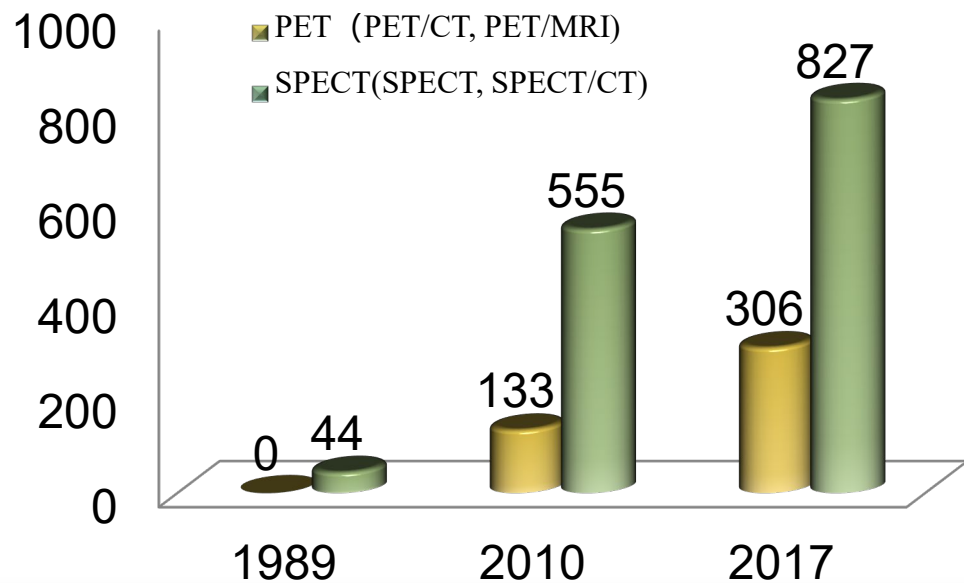
Staff



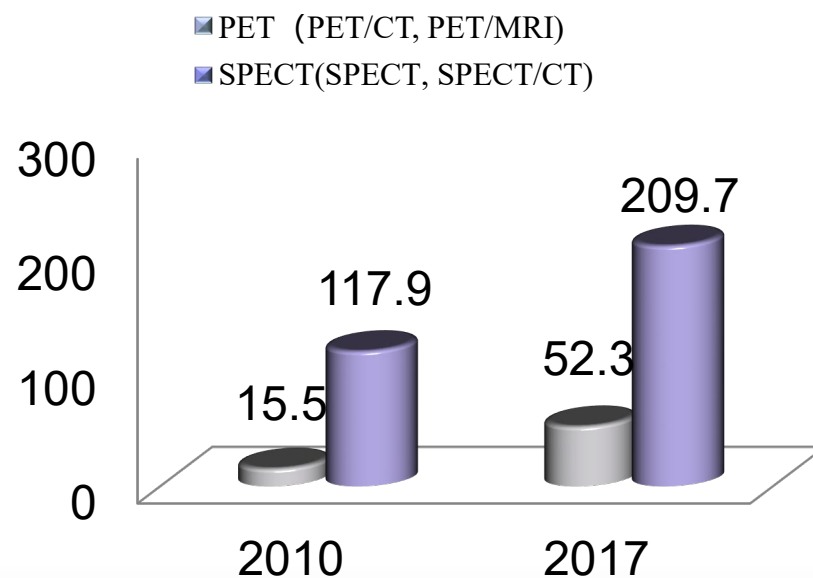


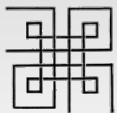
Status of Chinese Nuclear Medicine

Equipment



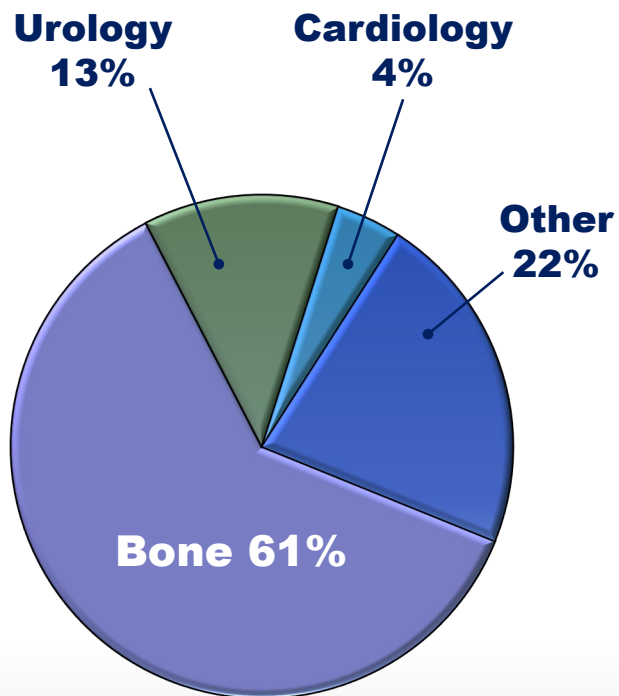
Workloads ($\times 10^4$)



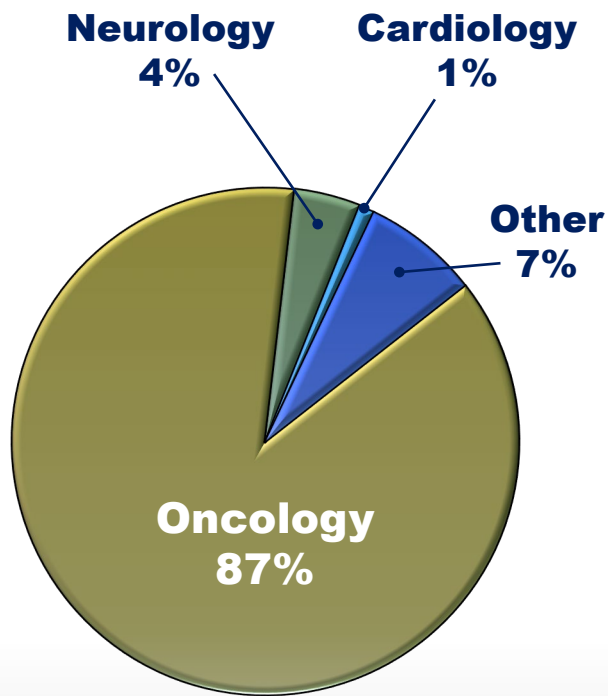


Status of Chinese Nuclear Medicine

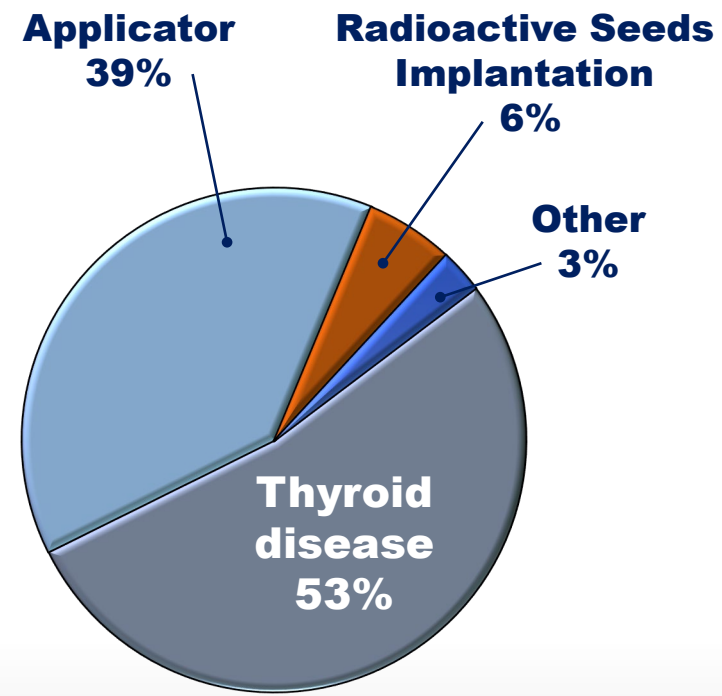
SPECT Scans

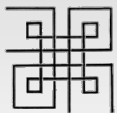


PET Scans



Radionuclides Therapy



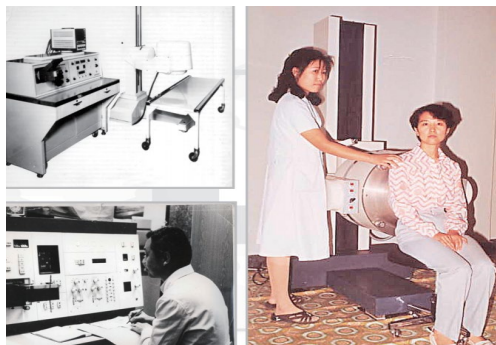


Status of Chinese Nuclear Medicine

Equipment Made in China



60s scanner



70s Gamma camera



2013 PET/CT



2017 SPECT/CT

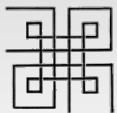


2018 PET/MRI



Micro-PET/CT

- United Imaging
- MinFound Medical
- Arrays Medical
- Pingseng
- Novel Medical
- Sino Vision
- Madic Tech.
- Neusoft



Status of Chinese Nuclear Medicine

Radiopharmaceuticals

Production and Supply

12 PET Radiopharmaceuticals

15 SPECT Radiopharmaceuticals

12 Therapeutic Radiopharmaceuticals

^{18}F -FDG ^{18}F -NaF

^{13}N - NH_4 ^{15}O - H_2O

^{11}C -AcOH ^{11}C -CO

^{11}C -MET ^{11}C -Choline

^{11}C -FMZ ^{11}C -Raclopride

^{11}C - β -CFT ^{11}C -NMSP

$^{99\text{m}}\text{Tc}$ - NaTcO_4 $^{99\text{m}}\text{Tc}$ -MDP

$^{99\text{m}}\text{Tc}$ -MIBI $^{99\text{m}}\text{Tc}$ -DTPA

• • • • •

^{131}I -NaI ^{32}P - NaPO_4

^{89}Sr - SrCl_2 ^{125}I -Seeds

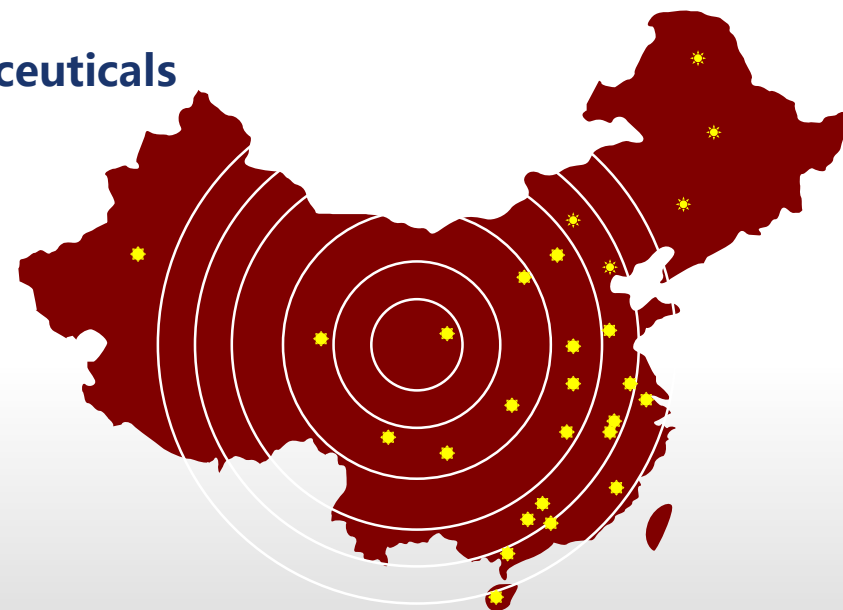
^{177}Lu

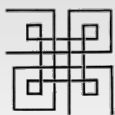
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40 GMP Qualified Centers



30 Radiopharmaceuticals
Delivery Centers





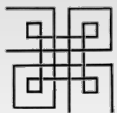
Status of Chinese Nuclear Medicine

Guidelines of Nuclear Medicine

- Criteria for diagnosis and treatment of primary lung cancer in China (2015)
- Chinese expert consensus on the non-invasive imaging examination pathway for stable coronary heart disease (2017)

指南规范 (Guidelines)

时 间	名 称
1997年6月	《核医学诊断与治疗规范》(第1版) 出版
2004年1月	《临床技术操作规范(核医学分册)》出版
2010年10月	《 ¹³¹ I治疗Graves甲亢专家共识(2010年)》发表
2012年8月	核医学诊疗标准操作规程(SOP)编写启动
2012年8月	《甲状腺结节和分化型甲状腺癌诊治指南》发表
2013年4月	《 ¹³¹ I治疗格雷夫斯甲亢指南(2013版)》发表
2013年8月	PET/CT肿瘤临床应用指南编写启动
2014年8月	《 ¹³¹ I治疗分化型甲状腺癌指南(2014版)》发表
2014年10月	《核医学与分子影像临床操作规范》(新版) 出版
2015年8月	制定《中华医学会核医学分会关于核医学科开展放射性粒子治疗工作的指导意见》
2015年8月	制定《PET/CT设备使用评价指标》
2015年8月	制定《中华医学会核医学分会PET/CT验收指导意见》
2015年8月	《核医学体外分析实验室管理规范》发表
2015年9月	制定《核医学图像质量评价标准总则》
2015年10月	《SPECT和SPECT/CT仪临床使用评价指标(2015版)》发表
2016年1月	《PET/CT引导下微创经皮生物靶区活检术操作规范(2016版)》定稿
2016年2月	《PET和PET/CT临床使用评价指标(2015版)》发表
2016年2月	《 ¹⁸ F-NaF PET/CT骨显像操作指南》发表
2016年3月	《临床核医学辐射安全指南》编委会议在太原召开,首次由行业发布临床核医学辐射安全指南



Status of Chinese Nuclear Medicine

Training System for Nuclear Physicians





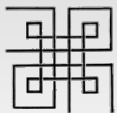
Status of Chinese Nuclear Medicine

Domestic Academic Exchange



**2017 Annual Conference of National Nucl Med
Taiyuan Shanxi, China**

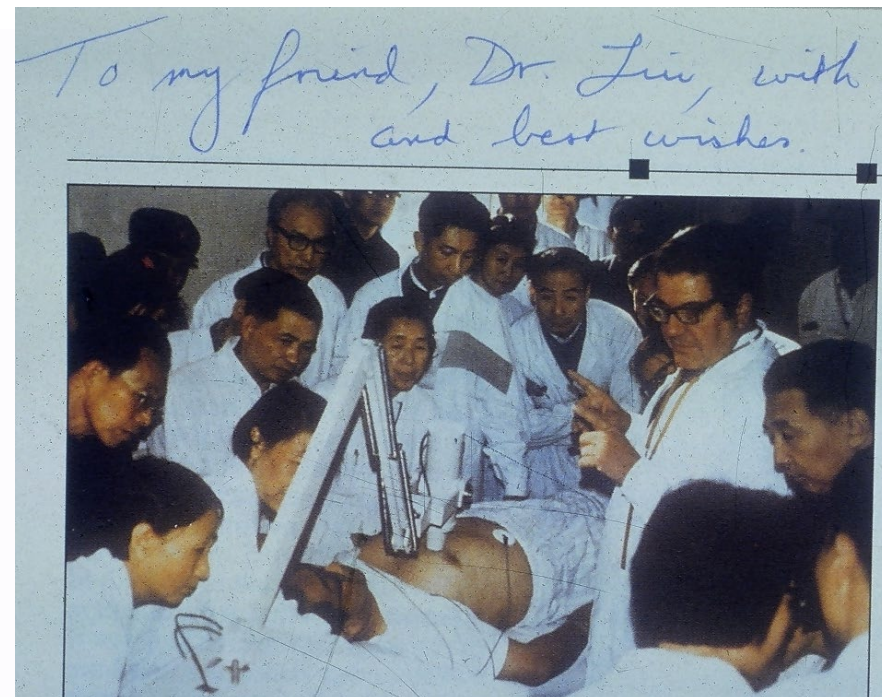
- Annual Conference of National Nucl Med
- Annual Conference of National Physicians of Nucl Med
- Annual Conference of Nucl Cardiol
- Annual Meeting of Quality Control of Nucl Med
- Annual Meeting of National Radionuclide Therapy
- Annual Meeting of National Radiopharmaceuticals



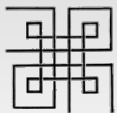
Status of Chinese Nuclear Medicine

International Academic Activities

- 1986 1st Sino-USA Nucl Med Academic Conference (Wuxi)
- 1993 1st Global Chinese Nucl Med Conference (Wuxi)
- 1995 1st China-Japan Nucl Med Academic Conference (Beijing)
- 1996 1st Cross-strait Nucl Med Academic Conference (Taipei)
- 1998 1st China-Korea Nucl Med Academic Conference (Beijing)
- 2002 1st China-Japan-Korea (CJK) Nucl Med Academic Conference (Dalian)
- 2004 8th Asia Oceania Congress of Nuclear Medicine and Biology (Beijing)
-
- Regular meetings were held with the leaders of SNMMI and EANM in the past 10 years



In 1979, Wagner instructs Chinese physicians on the use of the “nuclear stethoscope”

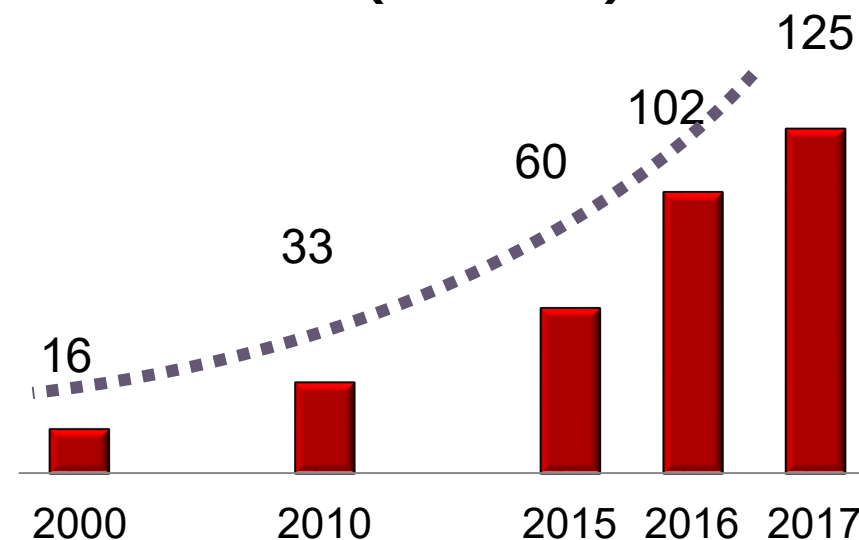


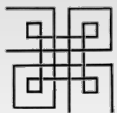
Status of Chinese Nuclear Medicine

Financial Supports by Government

- National Natural Science Foundation of China (NSFC)
- National Basic Research Priorities Program
- National Key Technologies R & D Program
- Science Foundation of Ministry of Education of China
- China Postdoctoral Science Foundation
- Projects of International Cooperation and Exchanges NSFC

Funds from Governments (Millions)





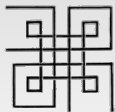
Status of Chinese Nuclear Medicine

Strategy for Development of Nuclear Medicine

- **2900 county hospitals in China, only less than 5% have nuclear medicine department**
- **CSNM proposed the strategy of county-level nuclear medicine development**



**Shuyang county hospital,
Jiangsu Province, China**



Application of Nuclear Medicine in Oncology

IMAGING

PET/CT

PET/MR

SPECT/CT

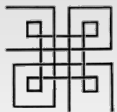
THERAPY

^{131}I – thyroid cancer

^{89}Sr – bone pain of metastasis

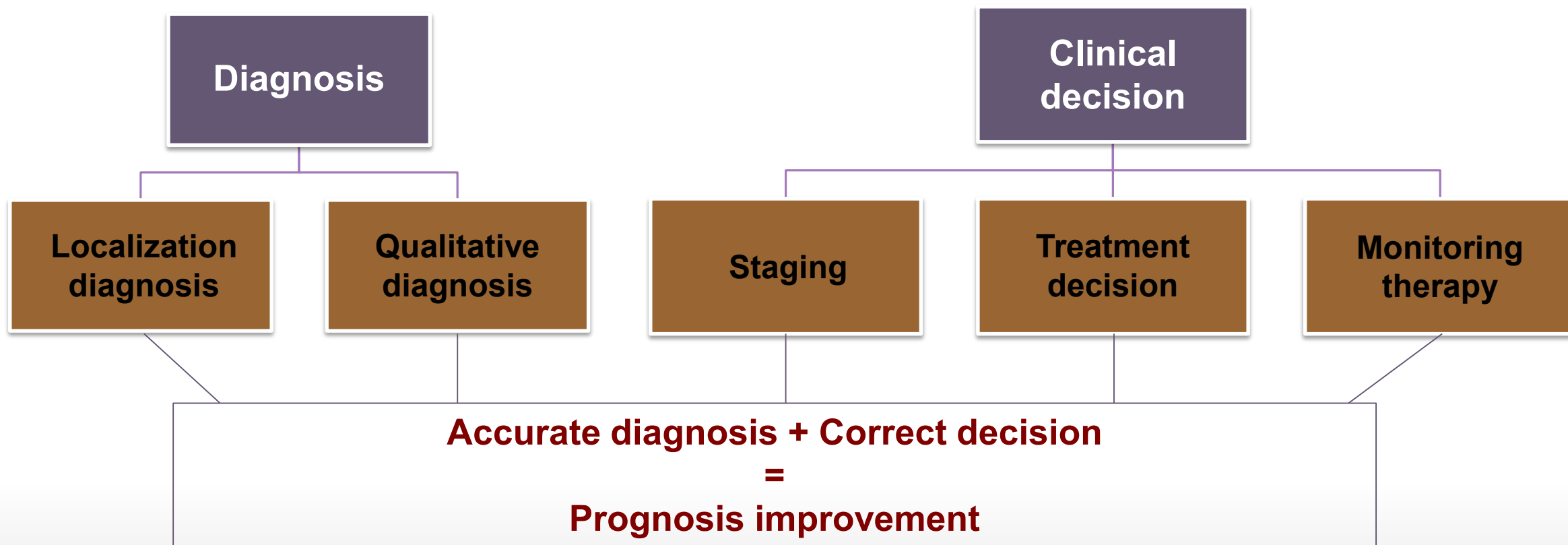
^{177}Lu -PSMA – prostate cancer

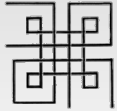
**^{177}Lu -DOTA-TATE - neuroendocrine
tumor**



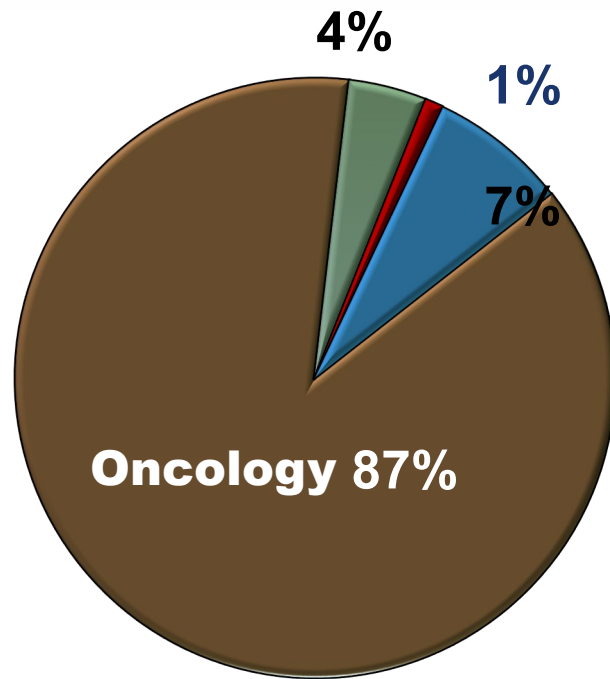
Application of Nuclear Medicine in Oncology

IMAGING





Application of Nuclear Medicine in Oncology



PET Scans

More than 457,500 scans/per year in oncology

IMAGING

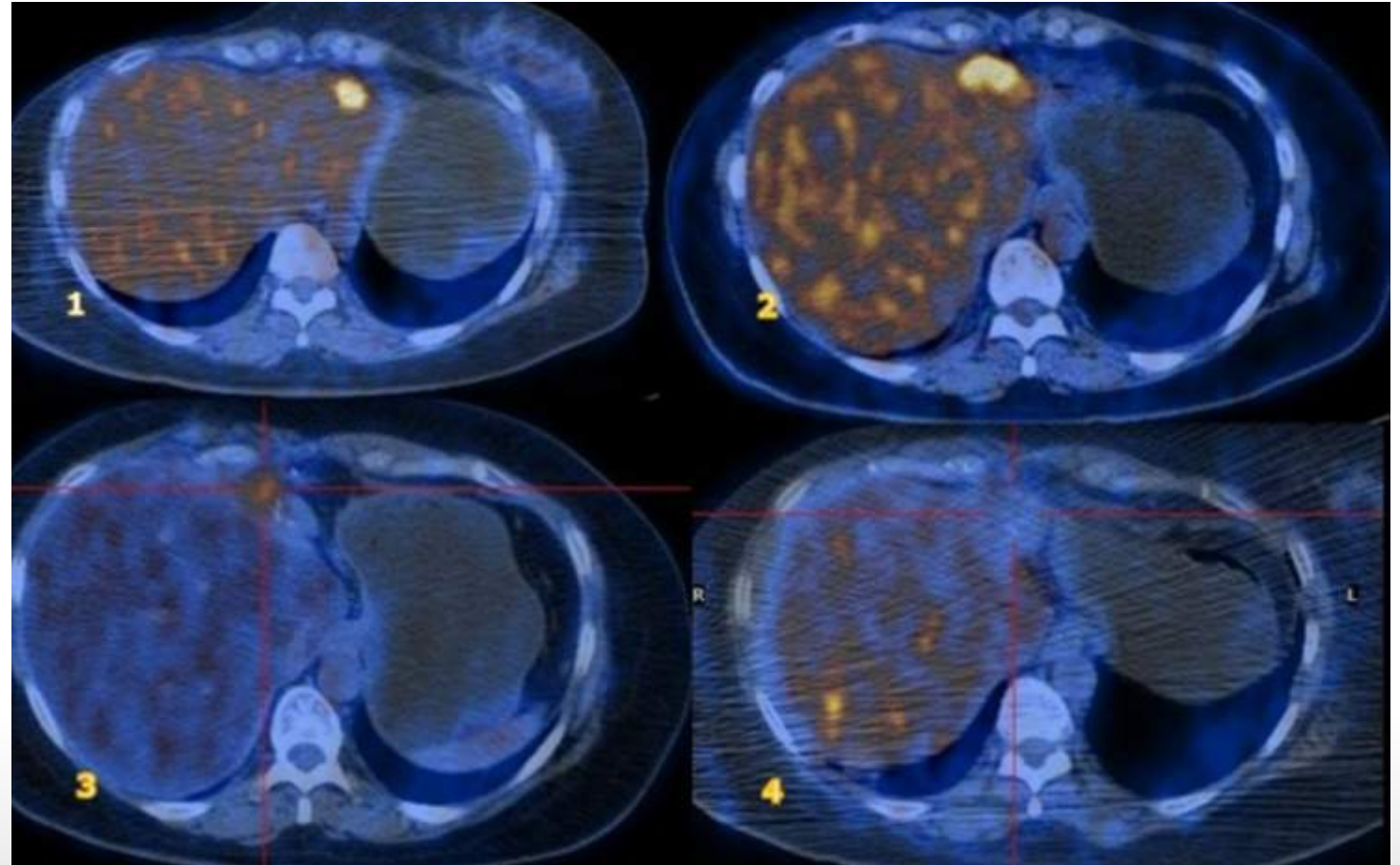
^{18}F -FDG:	broad spectrum tumor tracer
^{11}C -Choline:	prostate cancer, liver cancer
^{11}C -methionine:	glioma
^{11}C -Acetate:	liver cancer; prostate cancer
^{68}Ga -DOTA-TATE:	neuroendocrine tumor
^{68}Ga -PSMA:	prostate cancer



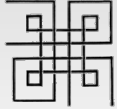
Application of Nuclear Medicine in Oncology

^{18}F -FDG PET/CT in the assessment of breast carcinoma

A 42-year-old woman with right breast infiltrating ductal carcinoma, 2 years after radical mastectomy; no recurrence or metastasis on chest X-ray or abdominal ultrasonography.



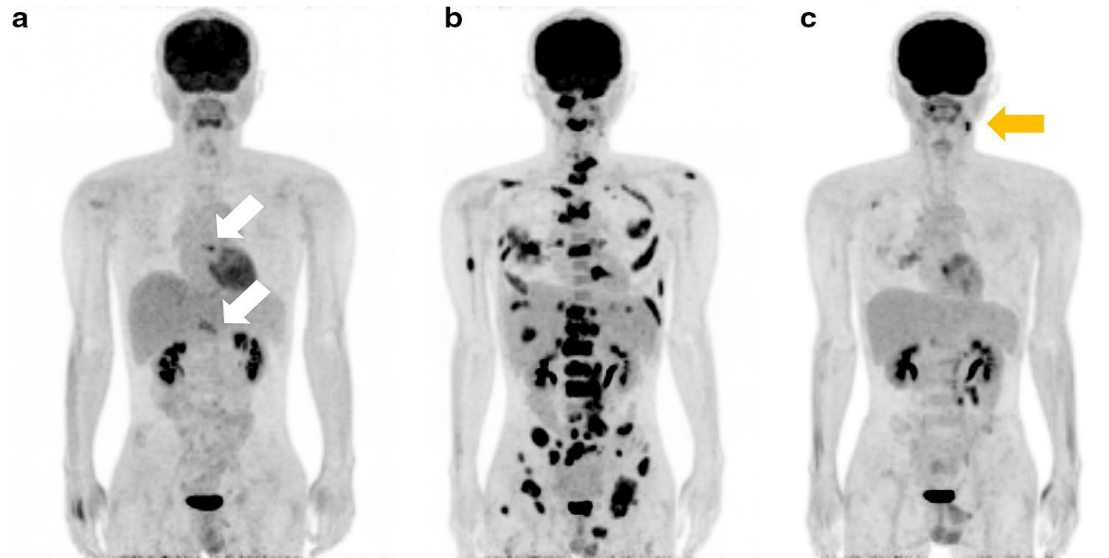
Data from Wuhan Union Hospital



Application of Nuclear Medicine in Oncology

FDG PET/CT in the Assessment of Refractory Hodgkin Lymphoma

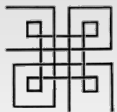
A 25-year-old man with refractory HL, Serial PET MIP images show metabolically active lesions after ASCT and Nivolumab immunotherapy accurately.



a: 30 days after ASCT, PET shows residual lesions in mediastinal and retroperitoneal lymph nodes.

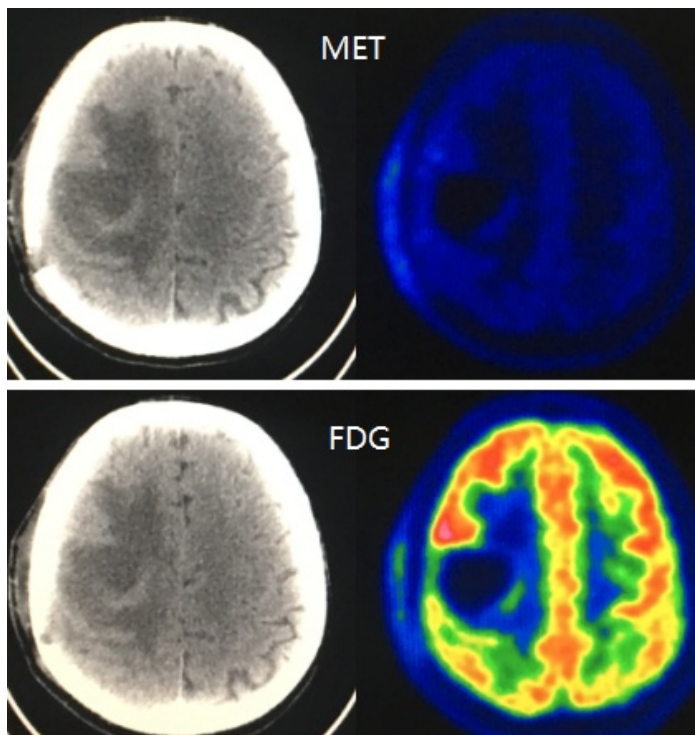
b: 403 days after ASCT, PET shows multiple lesions in bones and lymph nodes, suggesting lymphoma progress.

c: 4 cycles of Nivolumab immunotherapy, PET shows residual lesion only in cervical lymph node, suggesting partial remission.

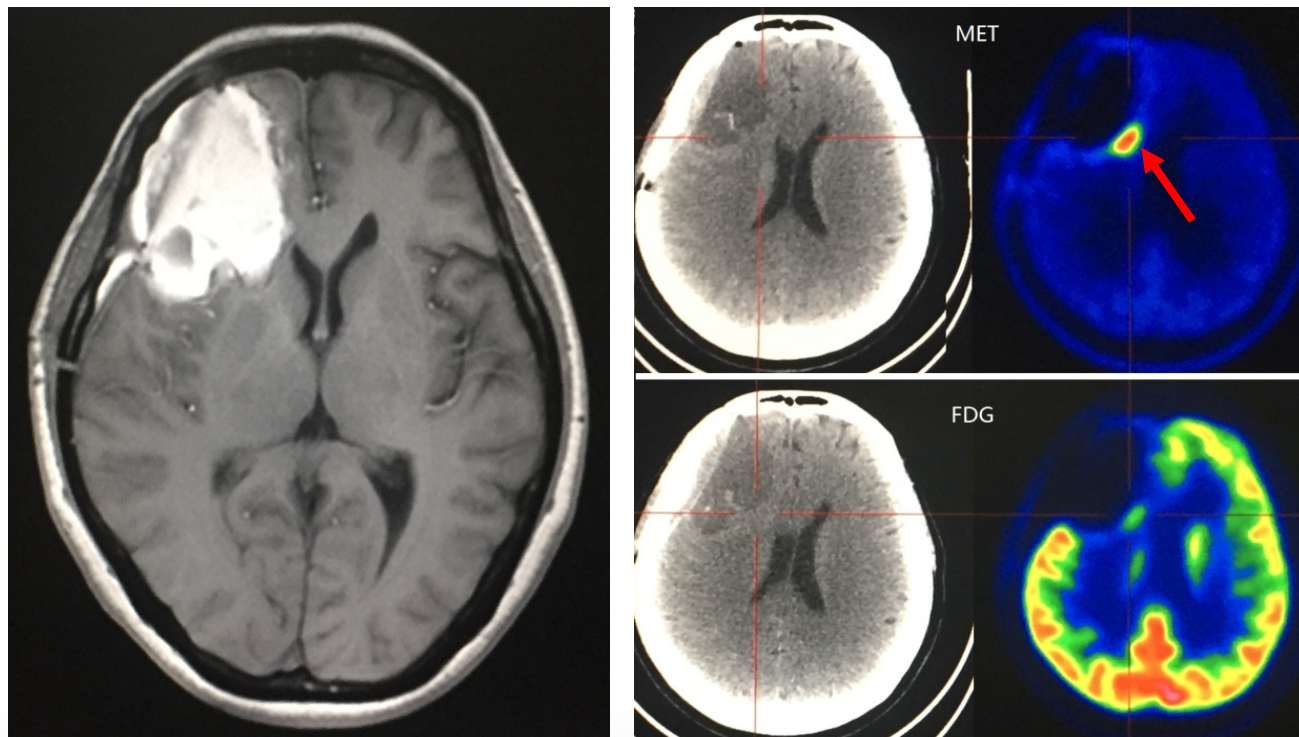


Application of Nuclear Medicine in Oncology

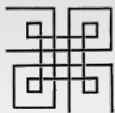
Accurate diagnosis with ^{18}F -FDG PET/CT and ^{11}C -MET PET/CT in glioma



Male, 36y, The right parietal lobe glioblastoma (grade IV) , half a month after surgery.

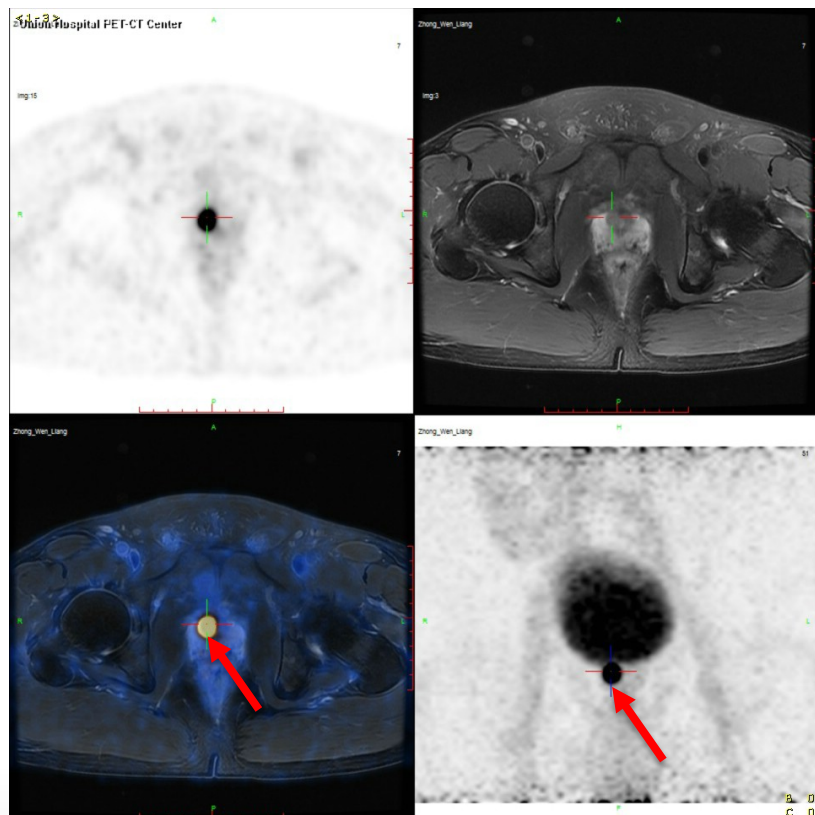


Female, 56y, In right frontal lobe glioblastoma (grade IV), one month after surgery, MRI showed postoperative edema.

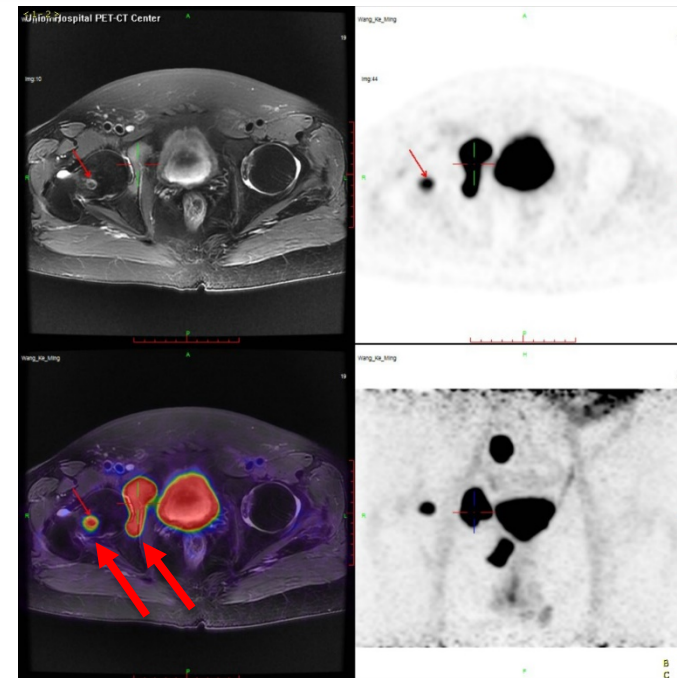
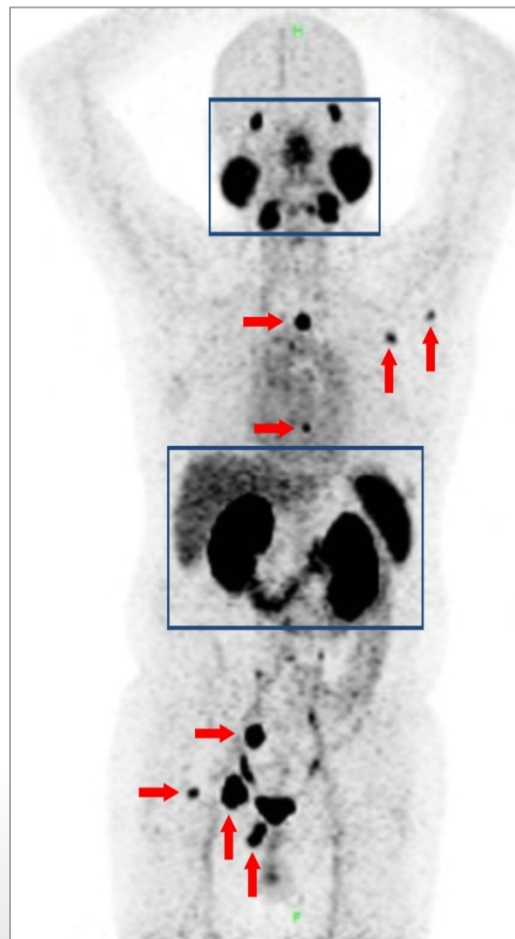


Application of Nuclear Medicine in Oncology

^{68}Ga -PSMA PET/MR in prostate cancer



Male, 53y, physical examination,
tPSA 5.62 ng/ml (normal 0-4)



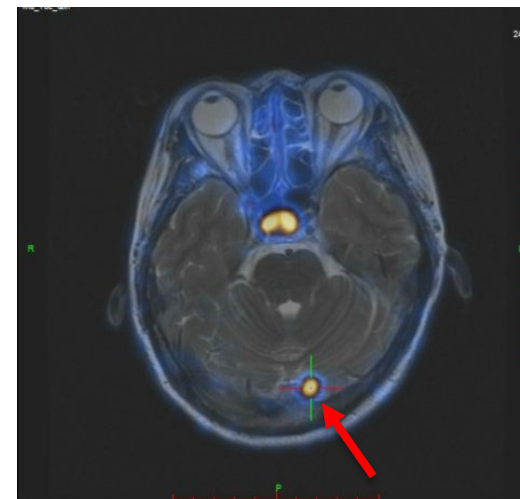
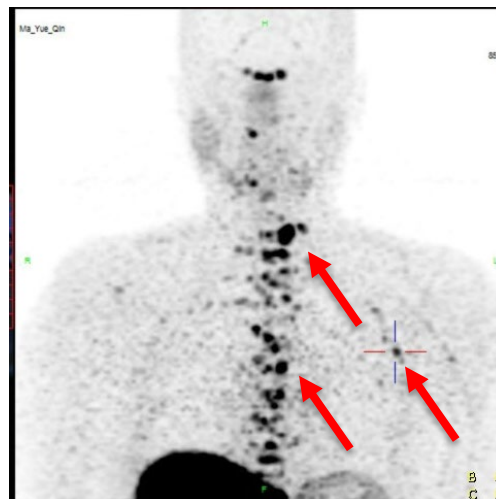
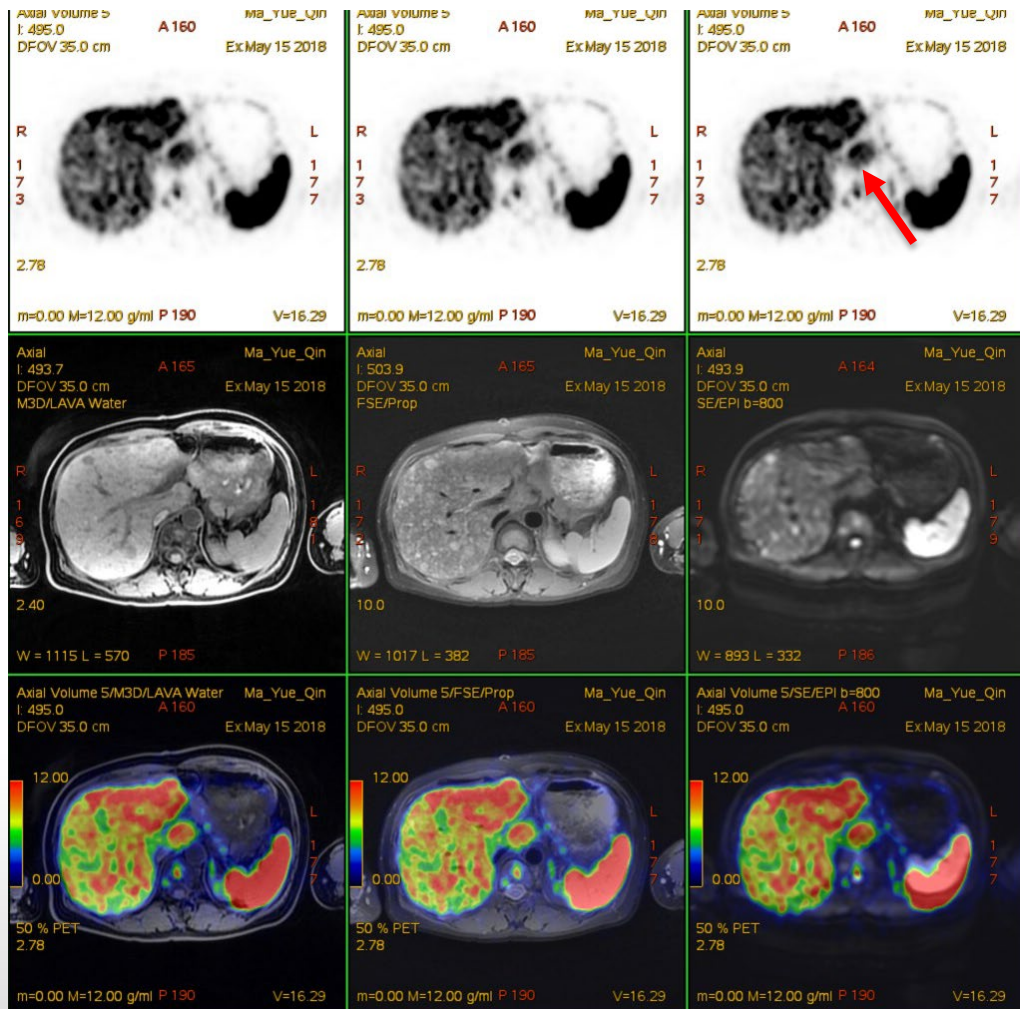
Male, 66y, Prostate cancer,
prostatectomy, tPSA 6.66,
fPSA 1.74

Data from Wuhan Union Hospital



Application of Nuclear Medicine in Oncology

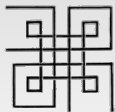
^{68}Ga -DOTA-TATE PET/MR in neuroendocrine tumor



Female, 53y, liver neuroendocrine tumor

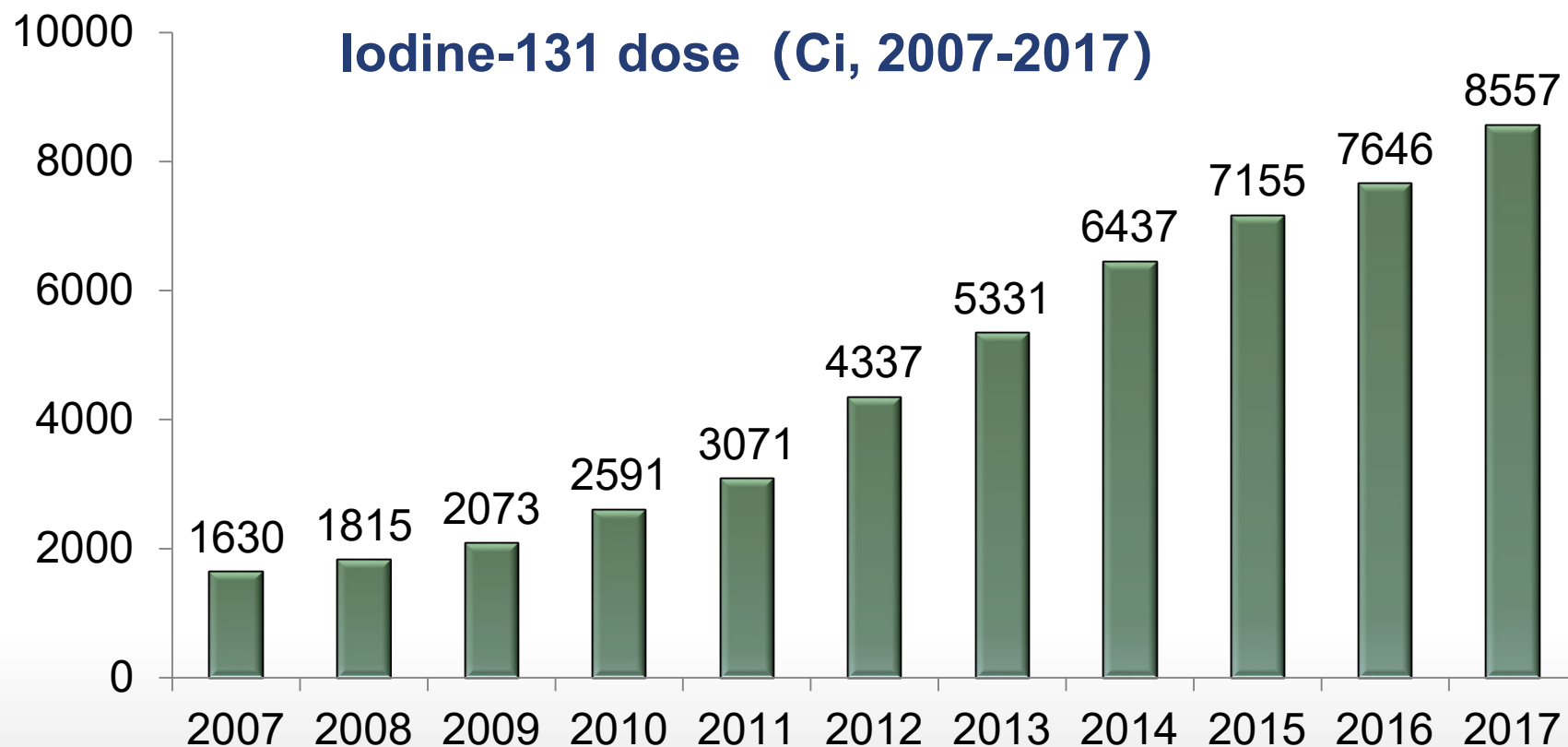
Multiple metastasis lesions in liver, lymph nodes, brain and bone

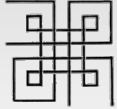
Data from Wuhan Union Hospital



Application of Nuclear Medicine in Oncology

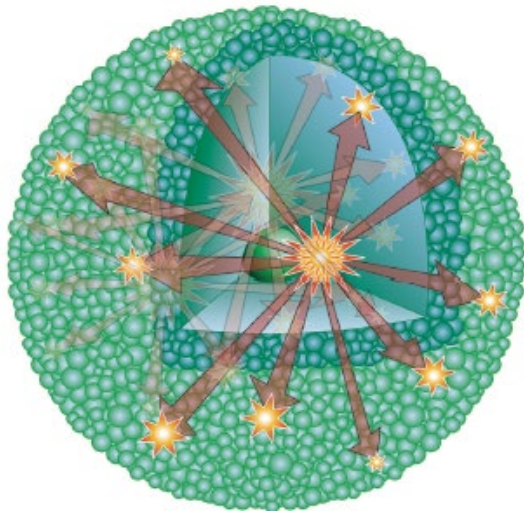
THERAPY





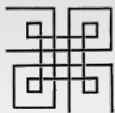
THERAPY

^{131}I treatment thyroid diseases



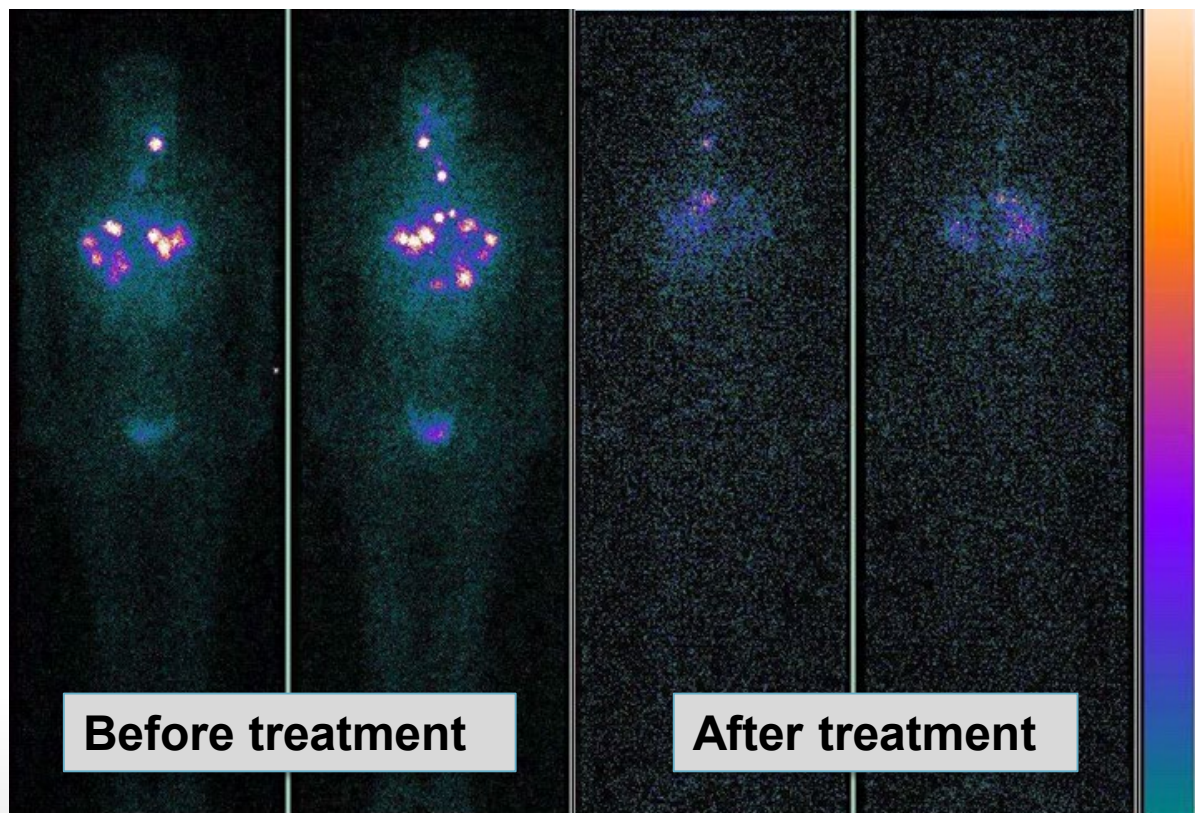
- 1,785 special beds for radionuclide therapy
- 70,135 cases of differentiated thyroid cancer treated with ^{131}I
- 145,114 patients with Graves's hyperthyroidism treated with ^{131}I
- 3,933 patients with autonomic functional thyroid nodules treated with ^{131}I
- 1,441 patients with nontoxic goiter treated with ^{131}I

Data: Jan 01,2017- Dec 31, 2017



Application of Nuclear Medicine in Oncology

^{131}I treatment thyroid cancer



Data from Wuhan Union Hospital

· 264 ·

中华核医学与分子影像杂志 2014 年 8 月第 34 卷第 4 期 Chin J Nucl Med Mol Imaging, Aug. 2014, Vol. 34, No. 4

· 指南与共识 ·

^{131}I 治疗分化型甲状腺癌指南 (2014 版)

中华医学会核医学分会

Guideline

编写委员会

· 416 ·

中华核医学与分子影像杂志 2018 年 6 月第 38 卷第 6 期 Chin J Nucl Med Mol Imaging, Jun. 2018, Vol. 38, No. 6

· 指南与共识 ·

分化型甲状腺癌术后 ^{131}I 治疗临床路径 专家共识 (2017 版)

Clinical pathway

中华医学会核医学分会

通信作者: 李亚明, Email: ymli2001@163.com

DOI: 10.3760/cma.j.issn.2095-2848.2018.06.009

2017 expert consensus for clinical pathways on postoperative ^{131}I treatment of differentiated thyroid carcinoma Chinese Society of Nuclear Medicine

Corresponding author: Li Yaming, Email: ymli2001@163.com

一、分化型甲状腺癌 (differentiated thyroid carcinoma, DTC) 术后 ^{131}I 治疗临床路径标准住院流程

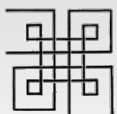
(一) 适用对象

第一诊断 (指出院诊断) 为肿瘤术后核素治疗 [国际疾病分类 (International Classification of Diseases, ICD)-10: Z51.806], 第二诊断为甲状腺恶性肿瘤 (ICD-10: C73.X00), 已行甲状腺全切或近全切除术, 且符合以下条件之一者: (1) DTC 初始术后伴有

4. 甲状腺癌为侵袭型的组织学类型, 或伴有血管侵犯。

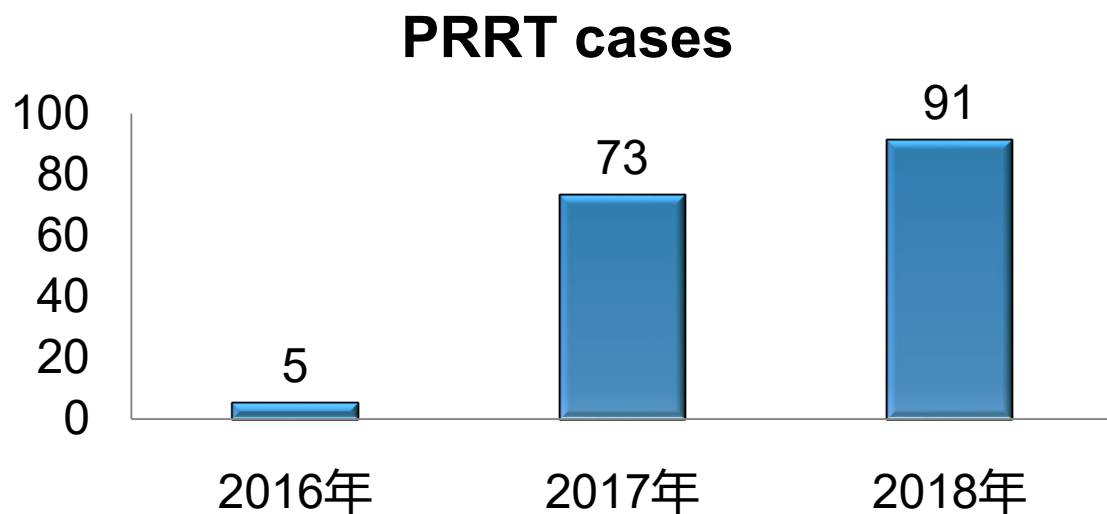
(三) 选择治疗方案的依据

参照《甲状腺结节和分化型甲状腺癌诊治指南》^[1], 《 ^{131}I 治疗分化型甲状腺癌指南 (2014 版)》^[2], 《临床诊疗指南: 核医学分册》^[3], 《临床技术操作规范: 核医学分册》^[4], 《甲状腺结节和分化型甲状腺癌诊治指南 (ATA 2015 版)》^[5] 制定。且患者的全身



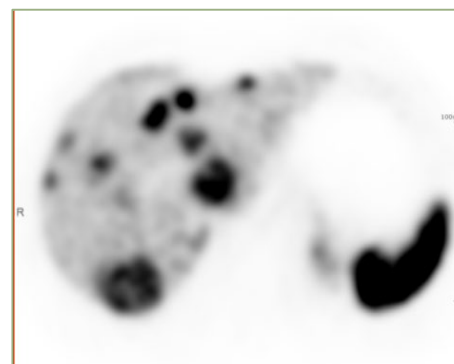
Application of Nuclear Medicine in Oncology

Molecular targeting therapy with Lu-177



Peptide radioreceptor therapy (PRRT) with Lu-177 labeled DOTA-TATE to neuroendocrine tumor

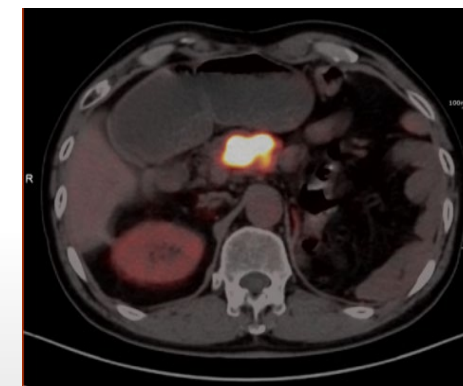
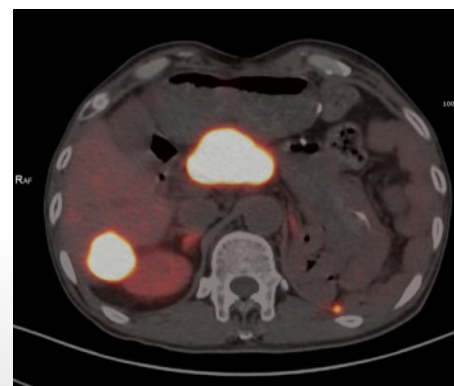
Data from Nanjing First Hospital

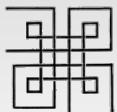


Before therapy



After therapy

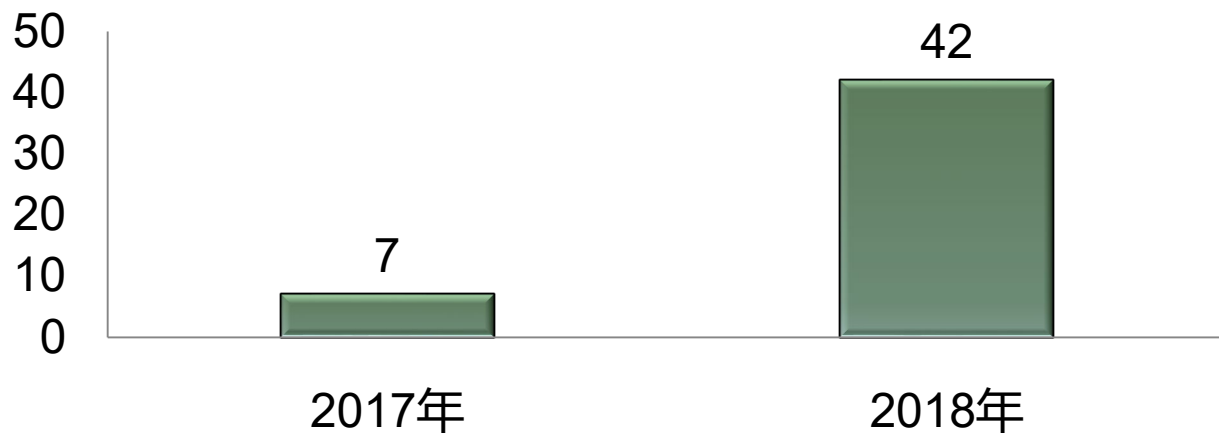




Application of Nuclear Medicine in Oncology

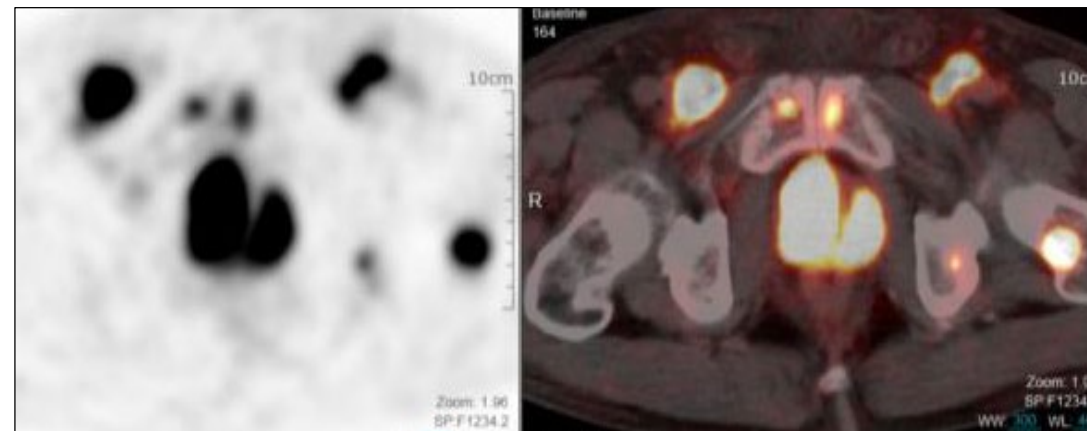
Molecular targeting therapy with Lu-177

PRLT cases

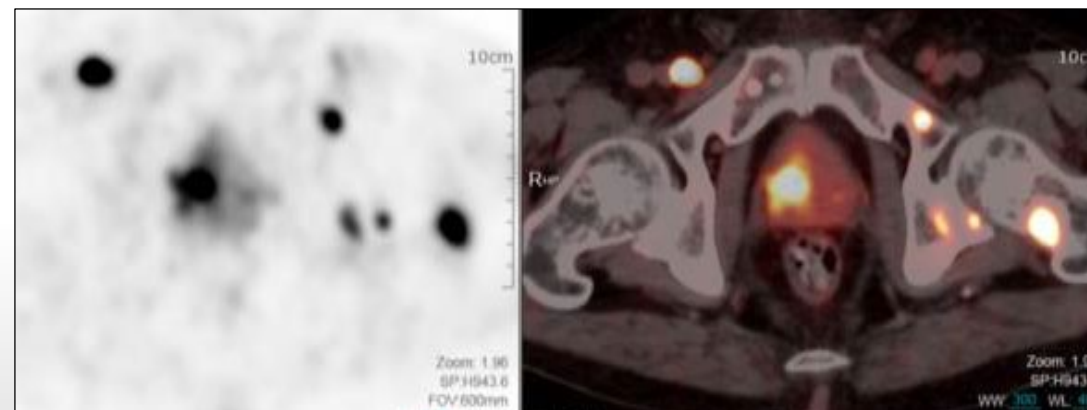


Peptide radioligand therapy (PRLT) with Lu-177 labeled PSMA to prostate cancer

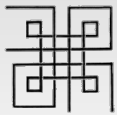
Data from Nanjing First Hospital



Before therapy



After therapy



Application of Nuclear Medicine in Oncology

Summary

■ In radionuclide imaging:

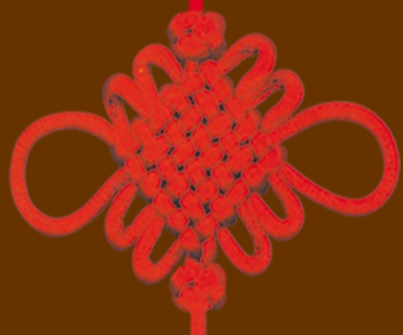
- Nuclear medicine imaging is widely used in the diagnosis, staging, therapy evaluation and monitoring tumors, and is basically in keeping up with the world.
- Further efforts should be made in the development and translation of new imaging tracers.

■ In radionuclide therapy:

- ¹³¹Iodine treatment of thyroid cancer has matured. At present, special patients' beds are not enough, and demand exceeds supply.
- Targeted therapy of ¹⁷⁷Lu is still in its infancy in China, and needs to be standardized.



2004.10.WUHAN



THANKS

WELCOME TO CHINA

