

山东省放疗现状与展望

山东肿瘤医院

李宝生

17地市放疗设备分布

- 济南: 31
- 潍坊: 23
- 淄博: 17
- 烟台: 13
- 泰安: 12
- 青岛: 12
- 聊城: 12
- 济宁: 12
- 滨州: 12
- 德州: 10
- 临沂: 10
- 东营: 8
- 日照: 7
- 威海: 6
- 枣庄: 5
- 菏泽: 4 (800万)
- 莱芜: 4 (127万)

合计: 197台(1/47.7), 人员: 3800余人

开展的放疗技术

- 立体定向手术(SRS)
- 立体定向体部放射治疗(SBRT)
- 3-D适形放射治疗 (3DCRT)
- 调强放射治疗(IMRT)
- 自适应放射治疗 (ART)
- 图像引导放疗 (IGRT)
- 近距离照射

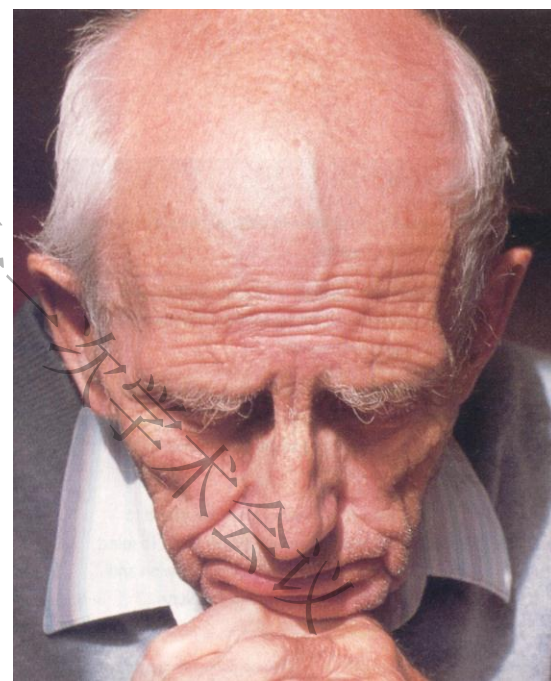
近年来的标志性成果

- 国家科技进步二等奖
- 山东省科技进步一等奖

肿瘤治疗形势严峻

□ 我国癌症5年生存率为 25% (2006年第4届全国肿瘤大会);而美国为68%(Cancer Facts & Figures 2012)

- 中国人对肿瘤的认识
- 早发现、早诊断与早治疗
- 综合治疗以及个体化治疗

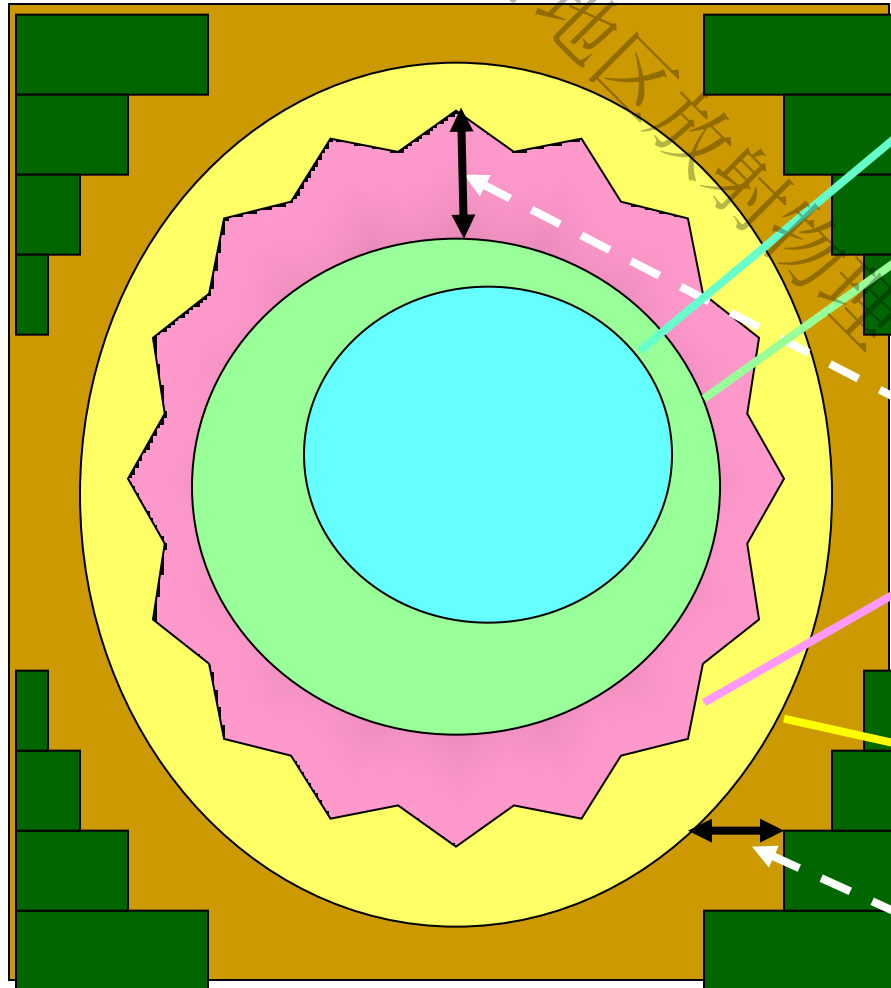


主要研究方向

- 看的清？
- 打的准？
- 多学科？

看的清--靶区

ICRU report 62



■ GTV=tumor

CTV=tumor + subclinical lesion

IM (Internal Margin)

ITV=CTV+IM

PTV=ITV + SM (5mm)

Leaf Margin(5mm)

GTV

- CT
- CT-MR
- CT-PET

基于CT靶区勾画的挑战

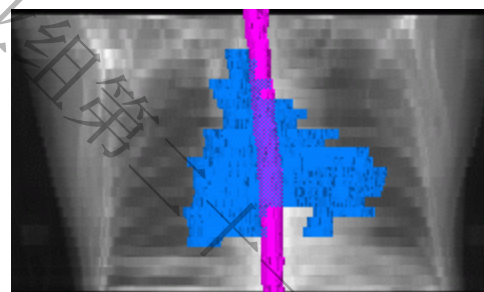
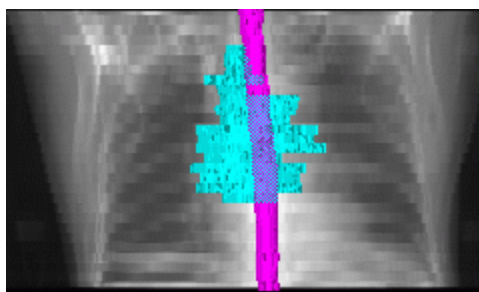
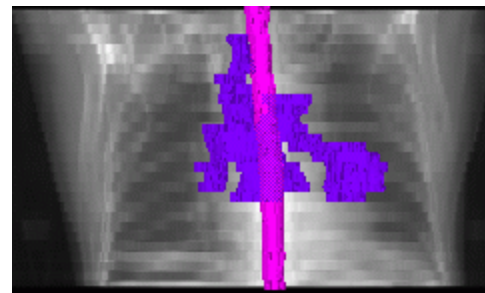
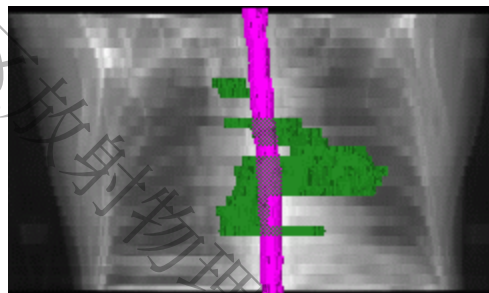
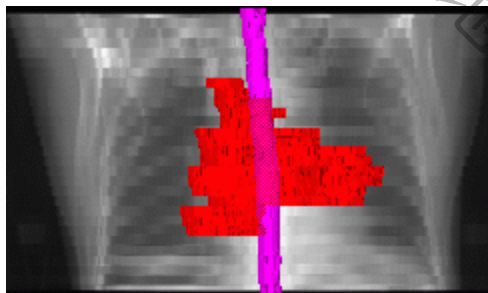
■ GTV: GTVp/GTVn

窗宽/窗位

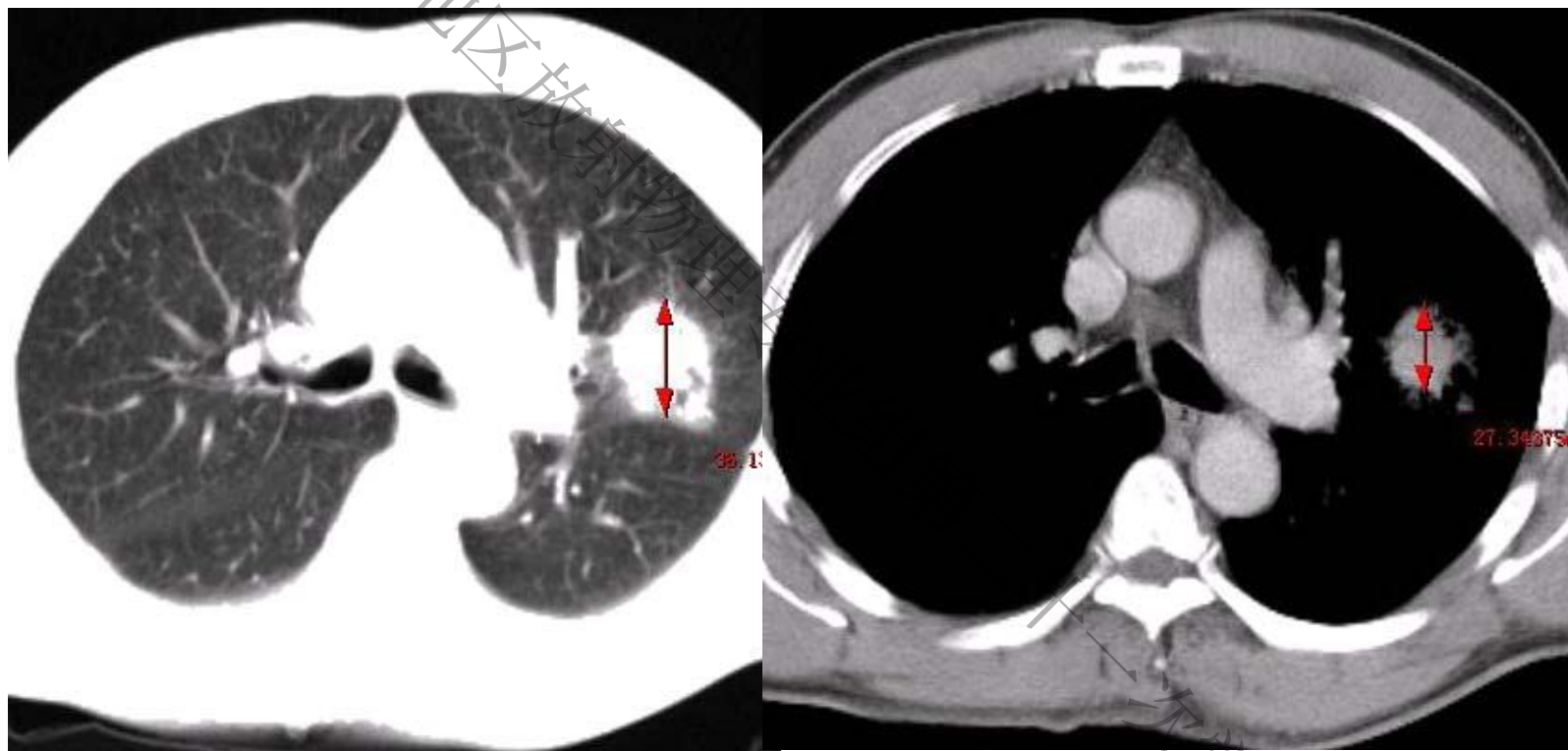
强化

病理性改变：如肺不张等

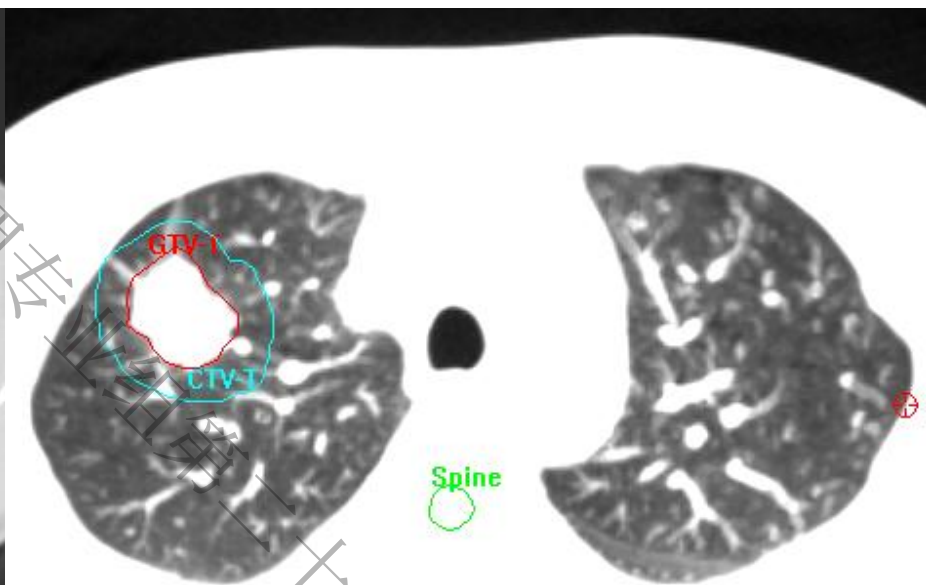
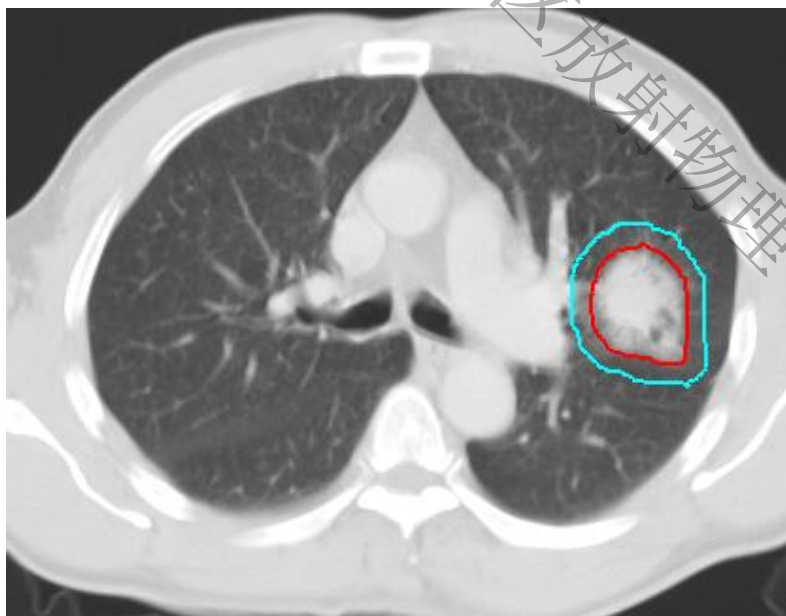
不同医生勾画的GTV



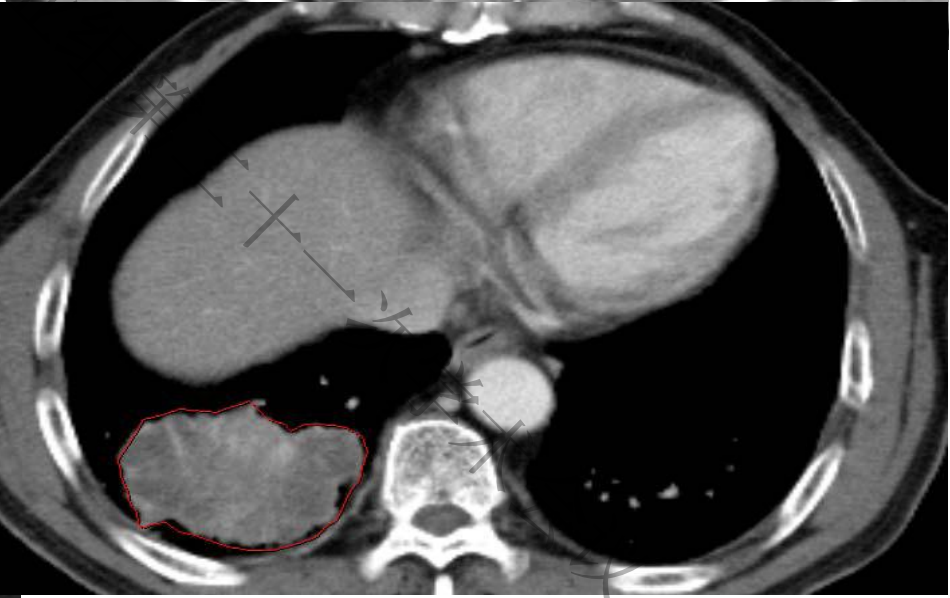
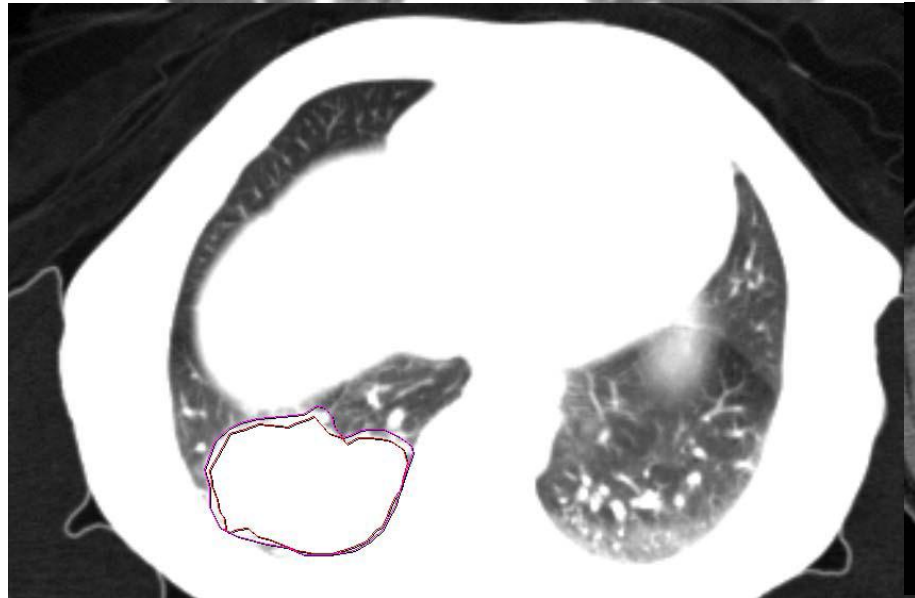
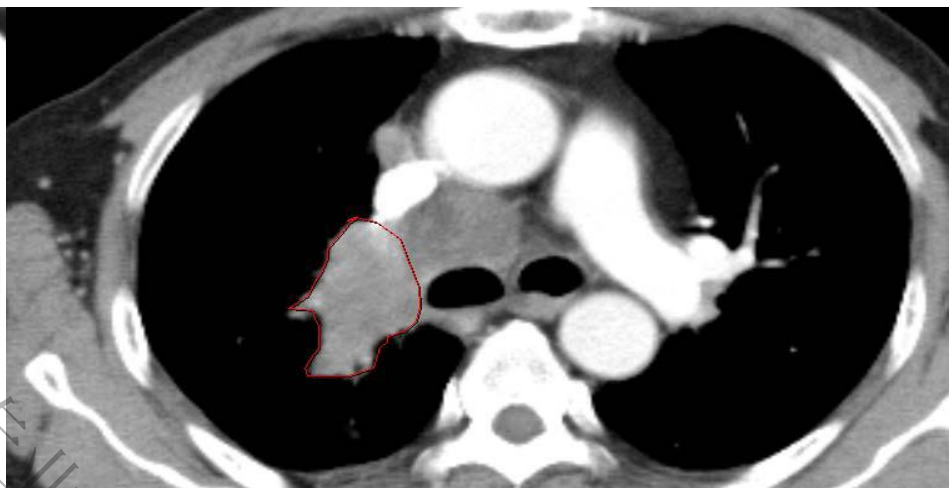
GTV-T – 窗宽窗位



GTV-T - 毛刺

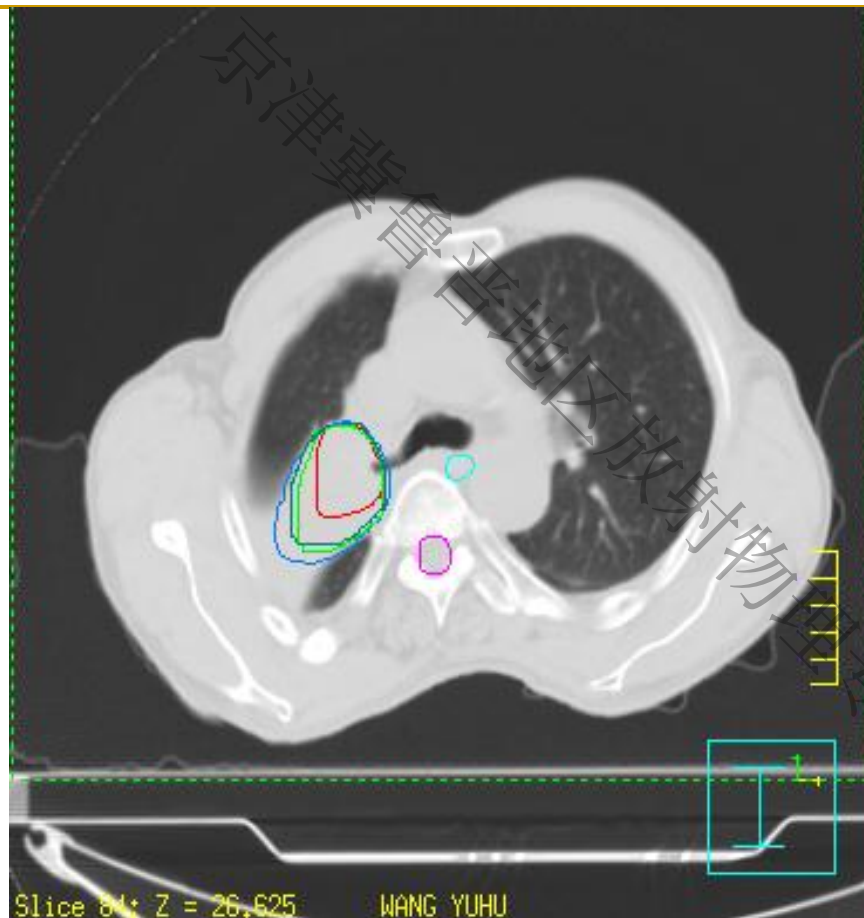


纵隔、胸壁

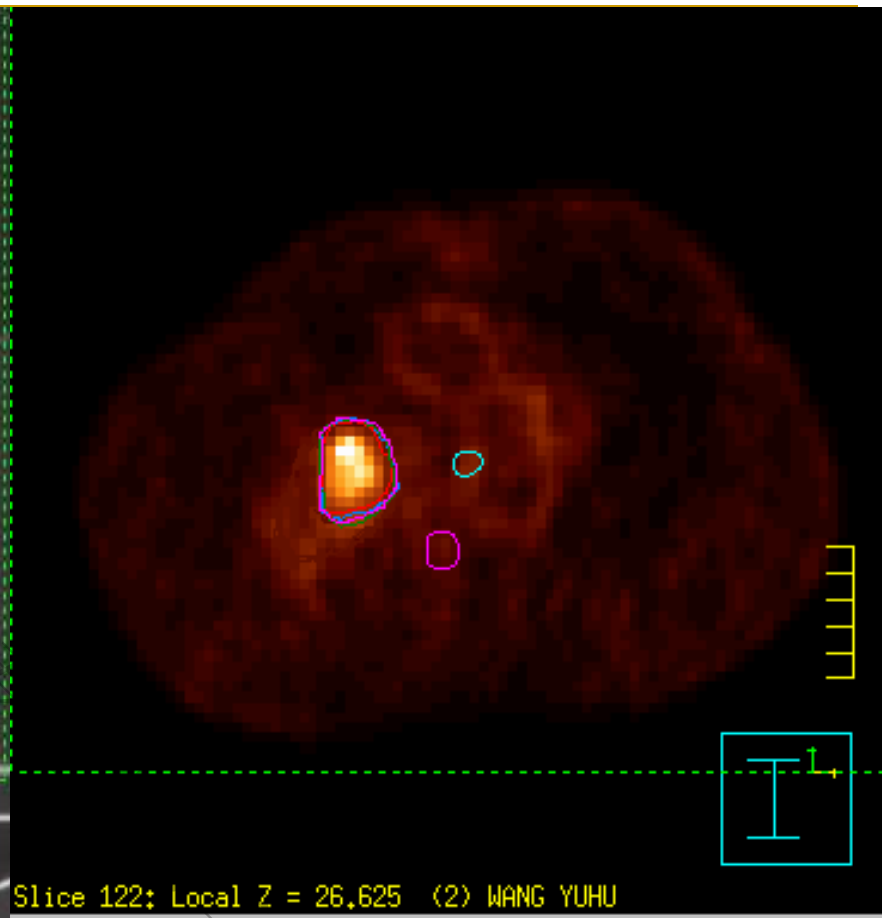


反映肿瘤生物学特征的分子 显像技术

- **FDG PET:** 葡萄糖代谢
- **FETNIM... PET:** 乏氧
- **FLT PET:** 增殖
- **PD153035: EGFR**
- ...



4位医生勾画的GTV-CT

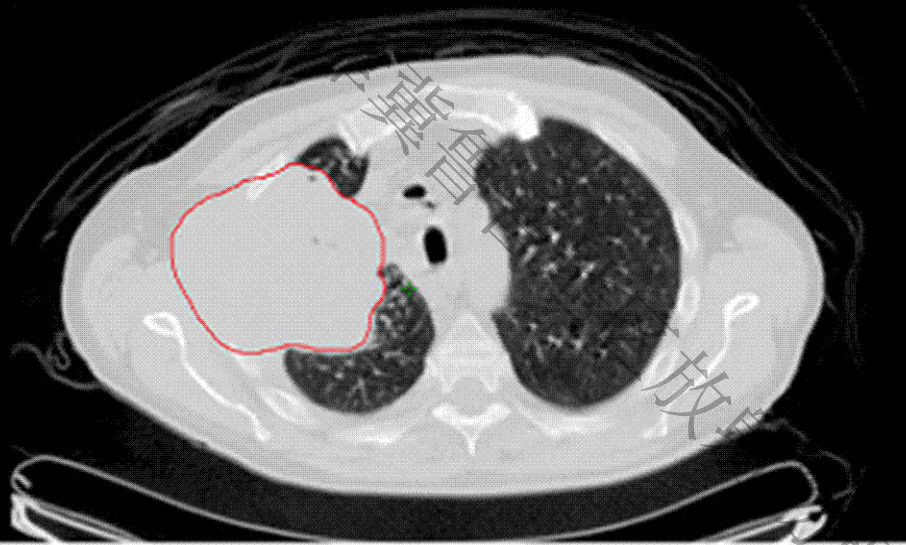


4位医生勾画的GTV-PET

NSCLC伴有肺不张时4位医生勾画GTV的差异

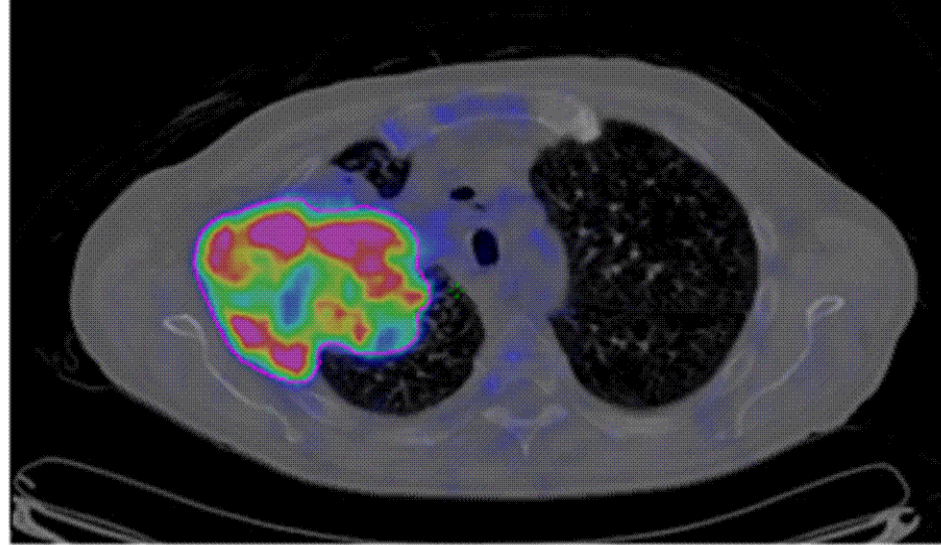
GTV_CT

a)



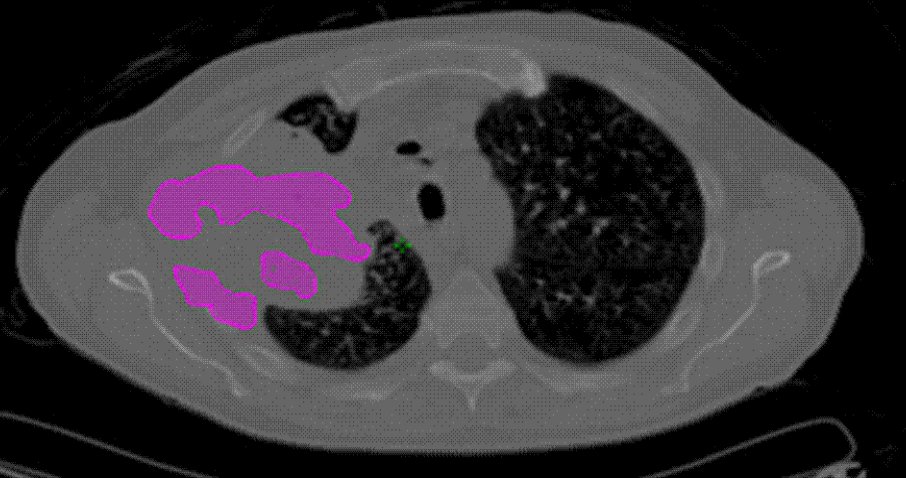
GTV_PET_QVM

b)



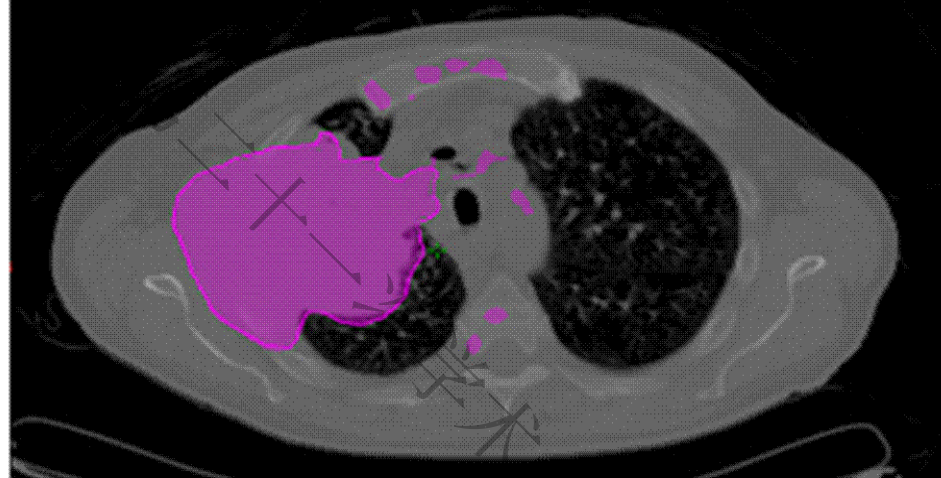
GTV_PET_40%_max

c)



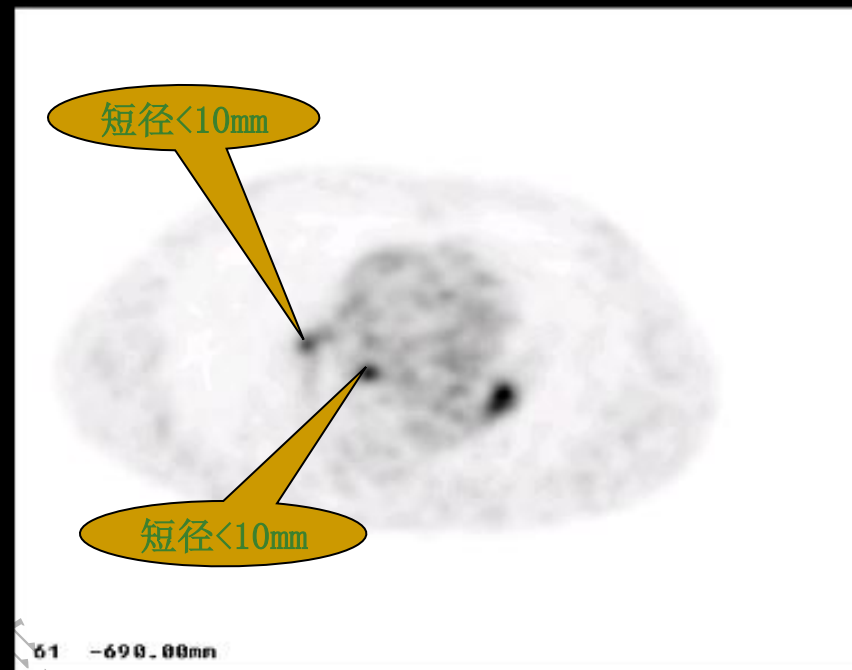
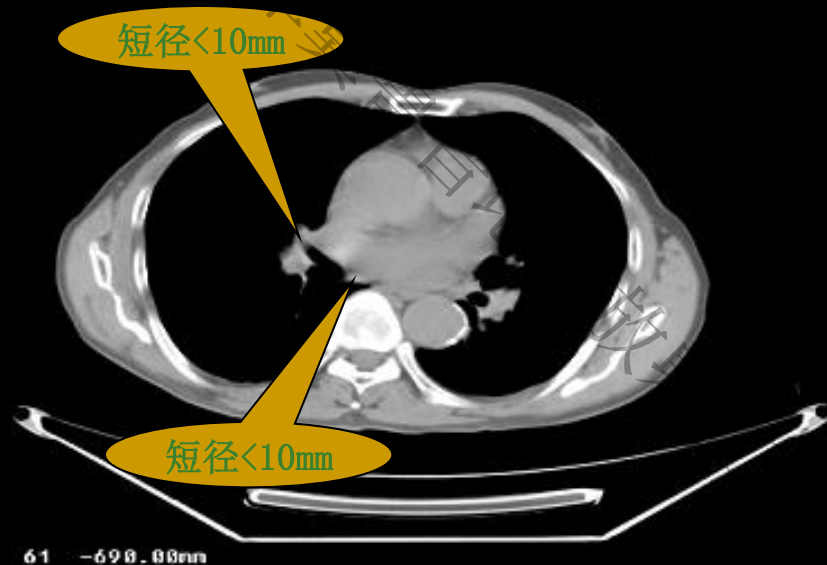
GTV_PET_15%_max

d)



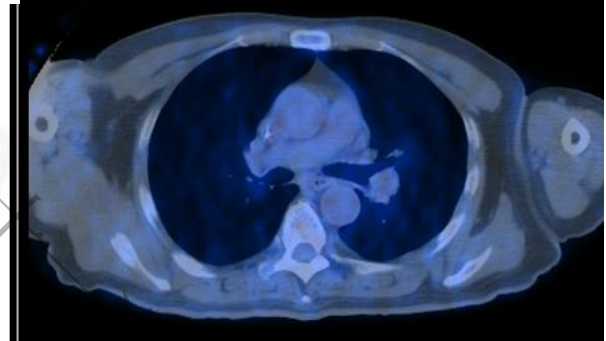
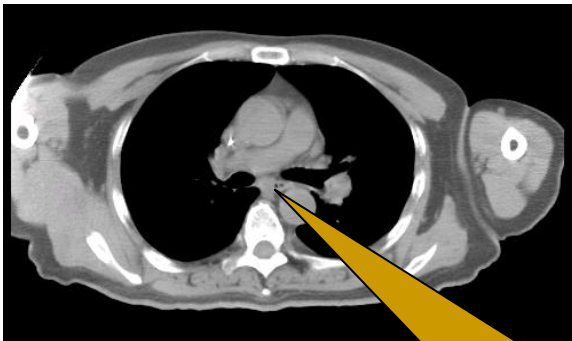
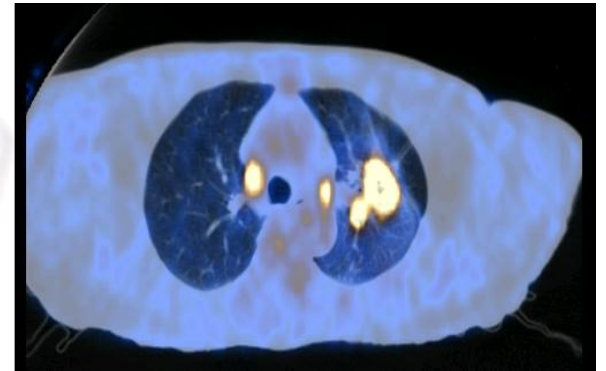
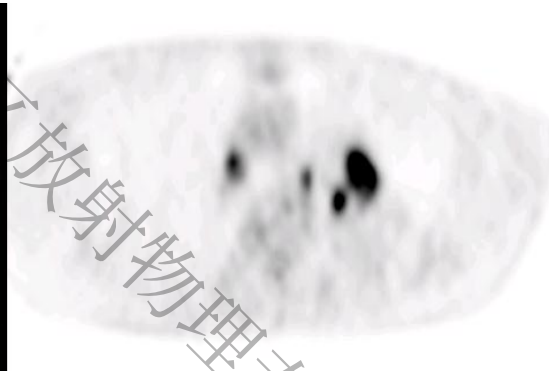
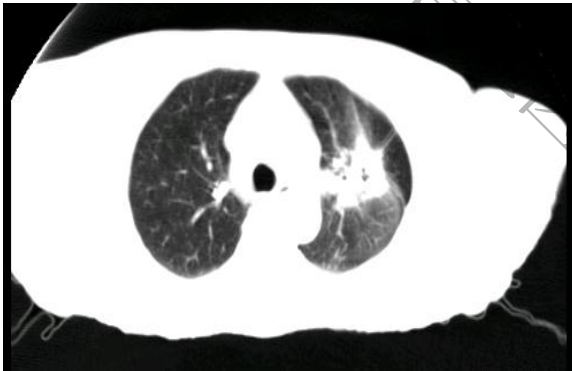
PET-CT LN 临床研究

- PET-CT对短径小于10mm可见76个淋巴结的敏感性为83.3%; 其特异性为90.5%
- 准确性为91.7%;
- 阳性预测值为62.5%; 阴性预测 93.6%
- 判断纵隔淋巴结微小转移的有效手段



PET示右肺门和隆突下淋巴结, 短径均小于**10mm**
CT诊断标准为阴性, 病理证实为淋巴结转移

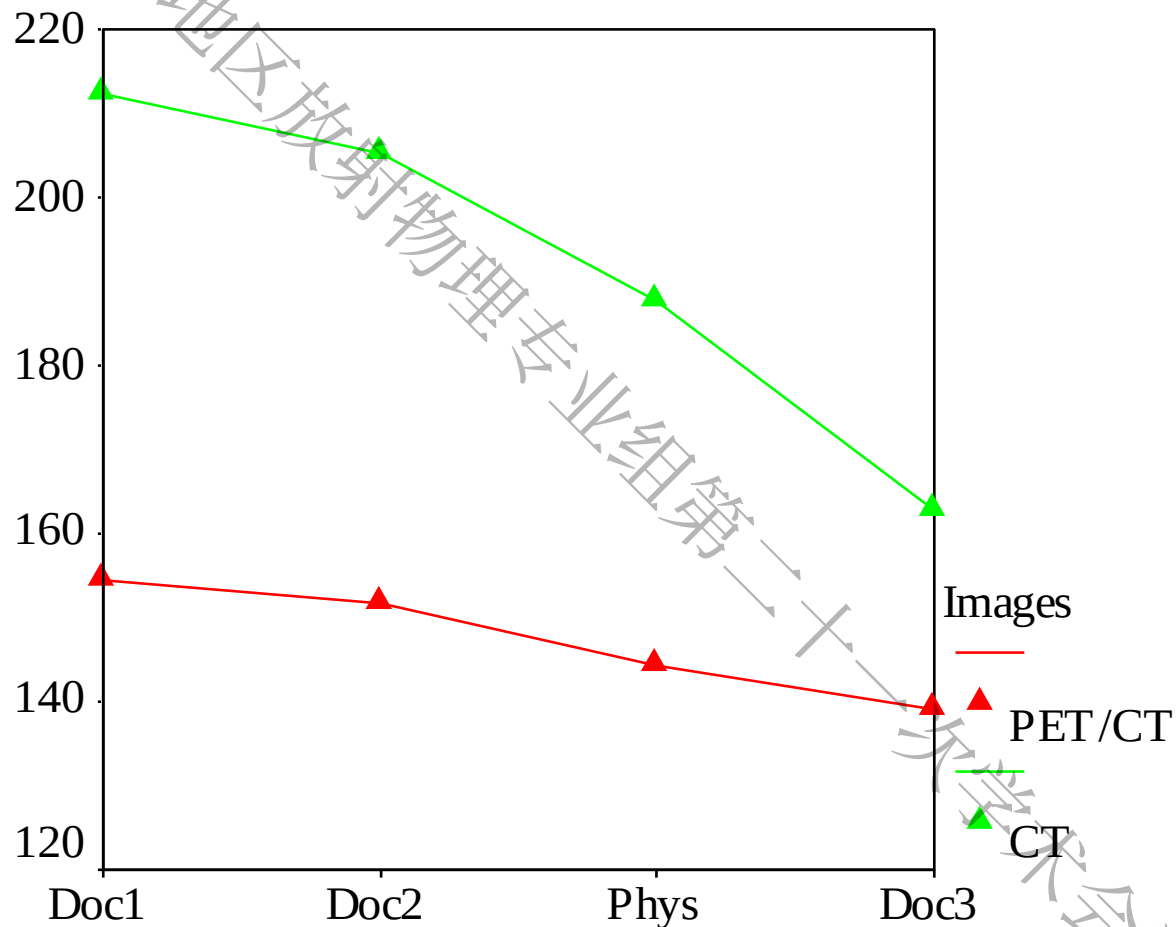
病理示左肺腺癌并肺门淋巴结转移



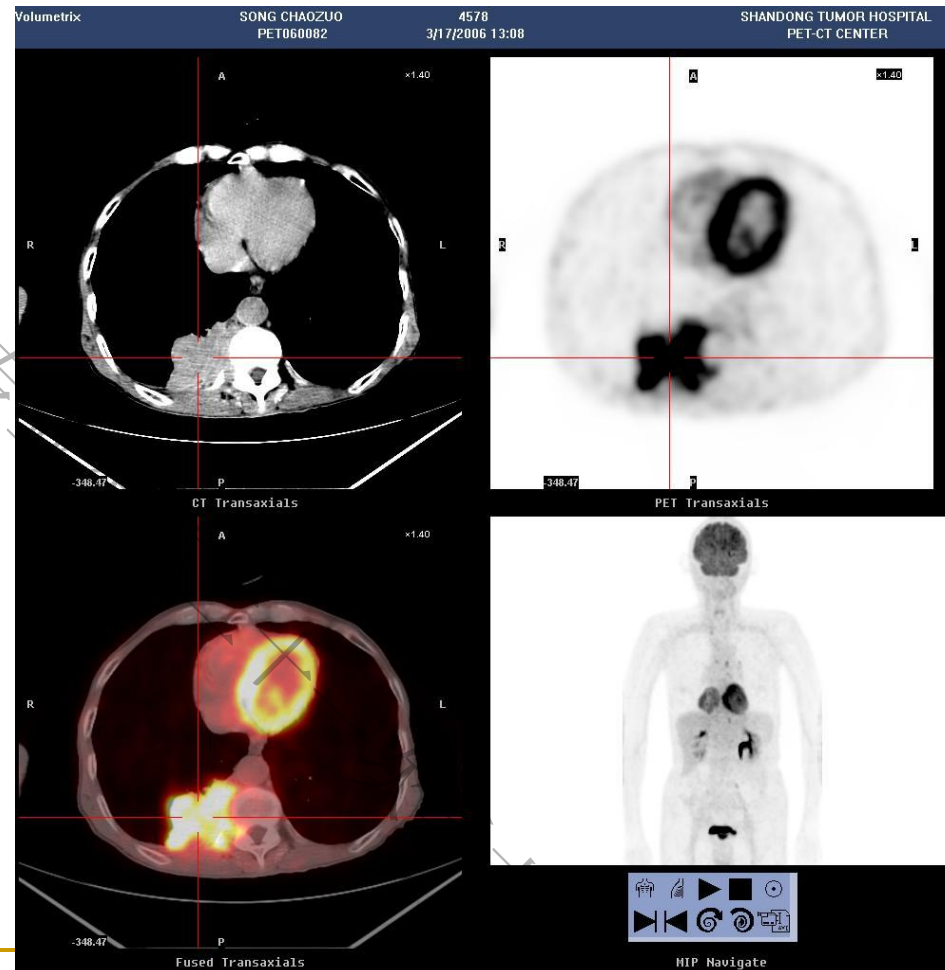
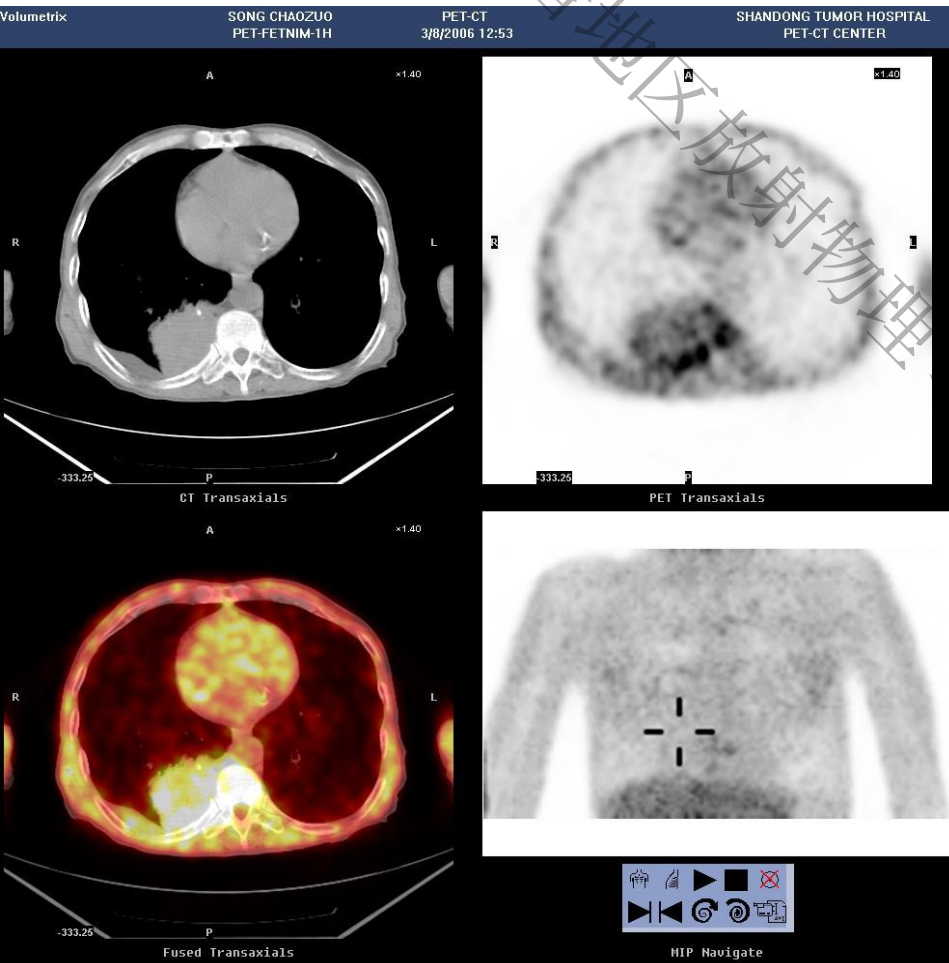
**CT示隆突下
1.5cm的淋巴结**

不同医生勾画靶区的差异

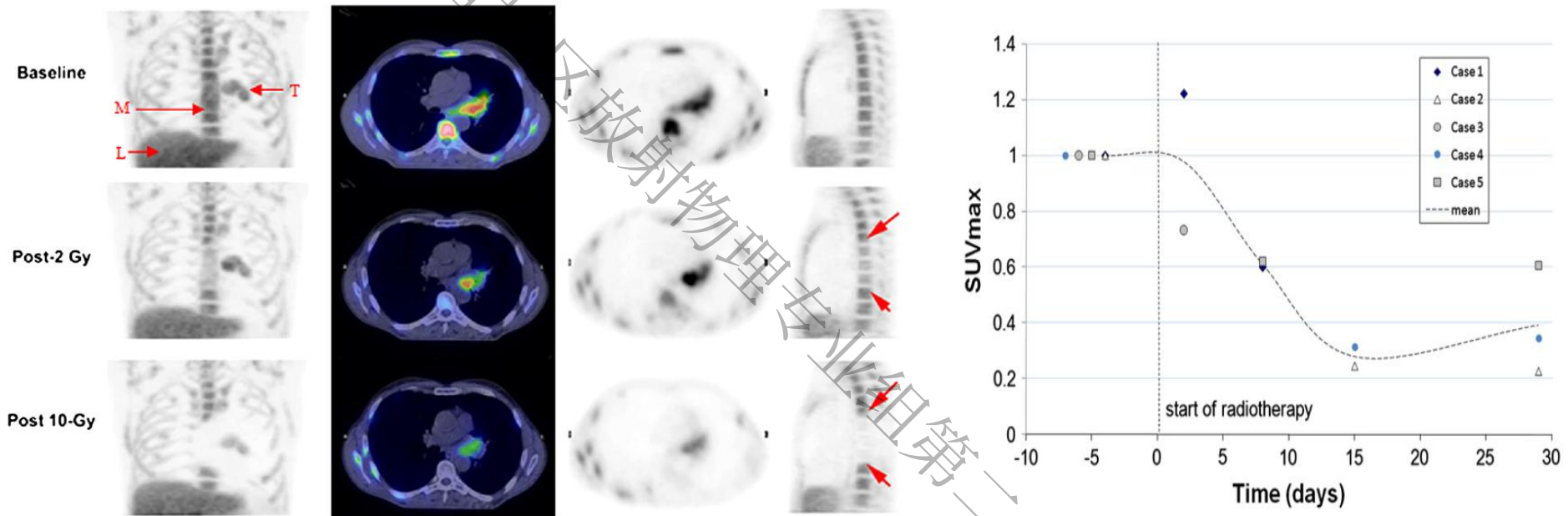
--PET-CT VS CT



肿瘤的乏氧显像 -FETNIM PET/CT

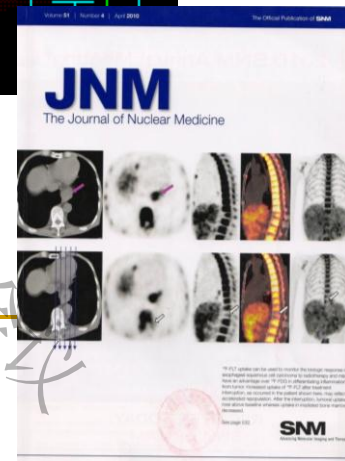
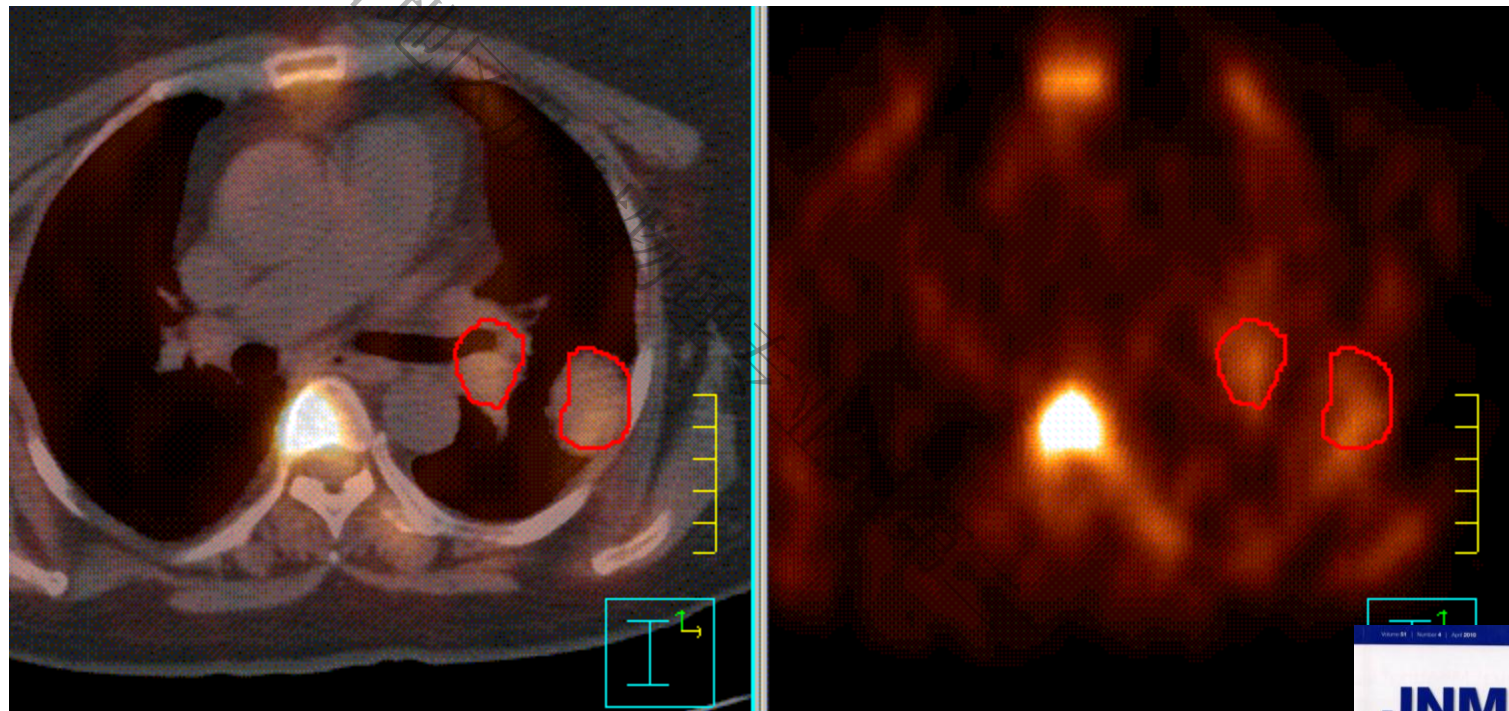


FLT PET/CT检测治疗过程中增殖状态变化



5例NSCLC放疗前后进行FLT PET/CT显像，其中4例放疗过程中肿瘤FLT摄取降低，受照射骨髓的摄取在2Gy后即有明显降低

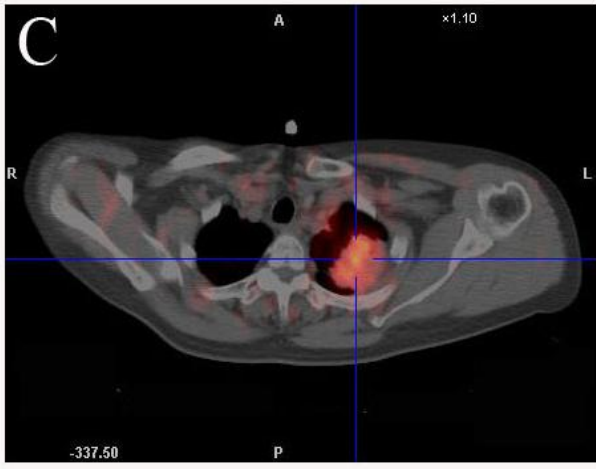
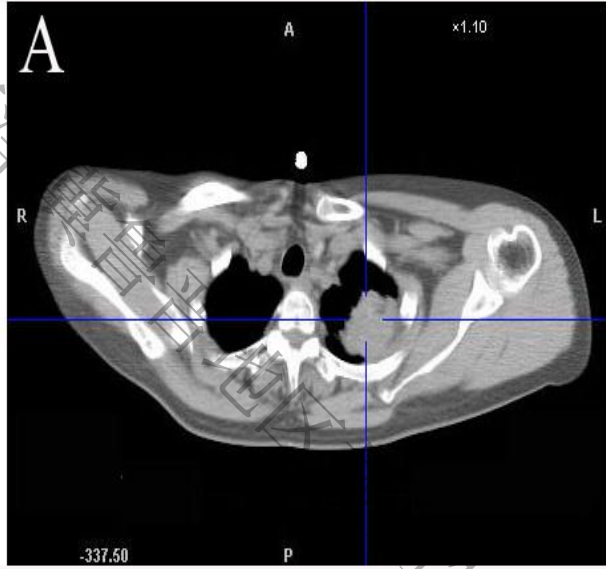
FLT-PET-CT融合图像和PET 图像同一层面勾画的GTV



11C-PD153035

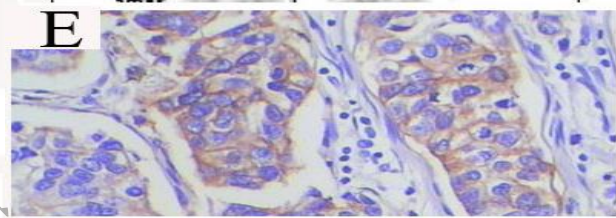
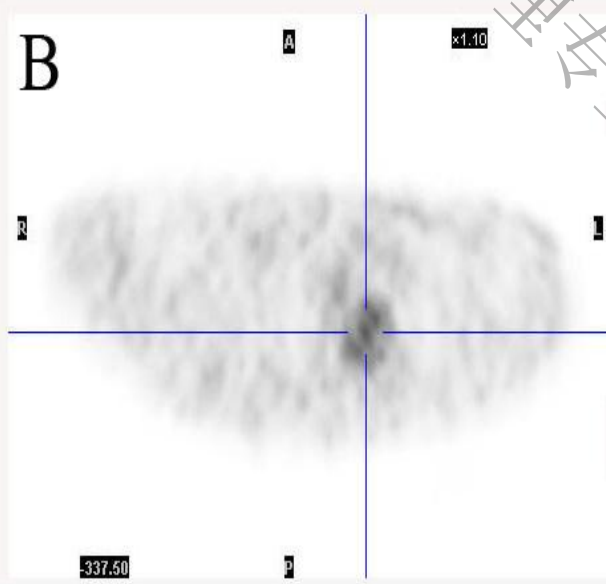
--EGFR

CT

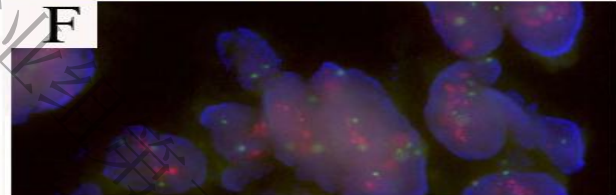


PET-CT

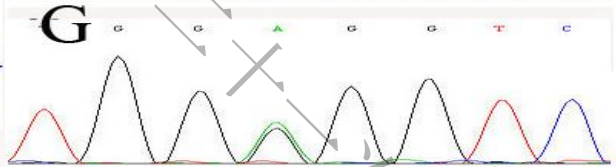
PET



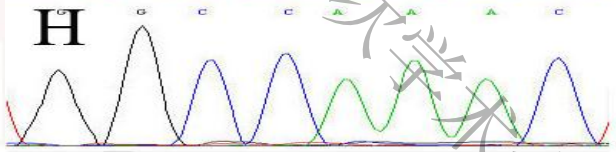
IHC



FISH

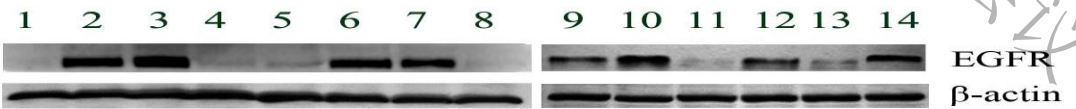


Exon19 mutation



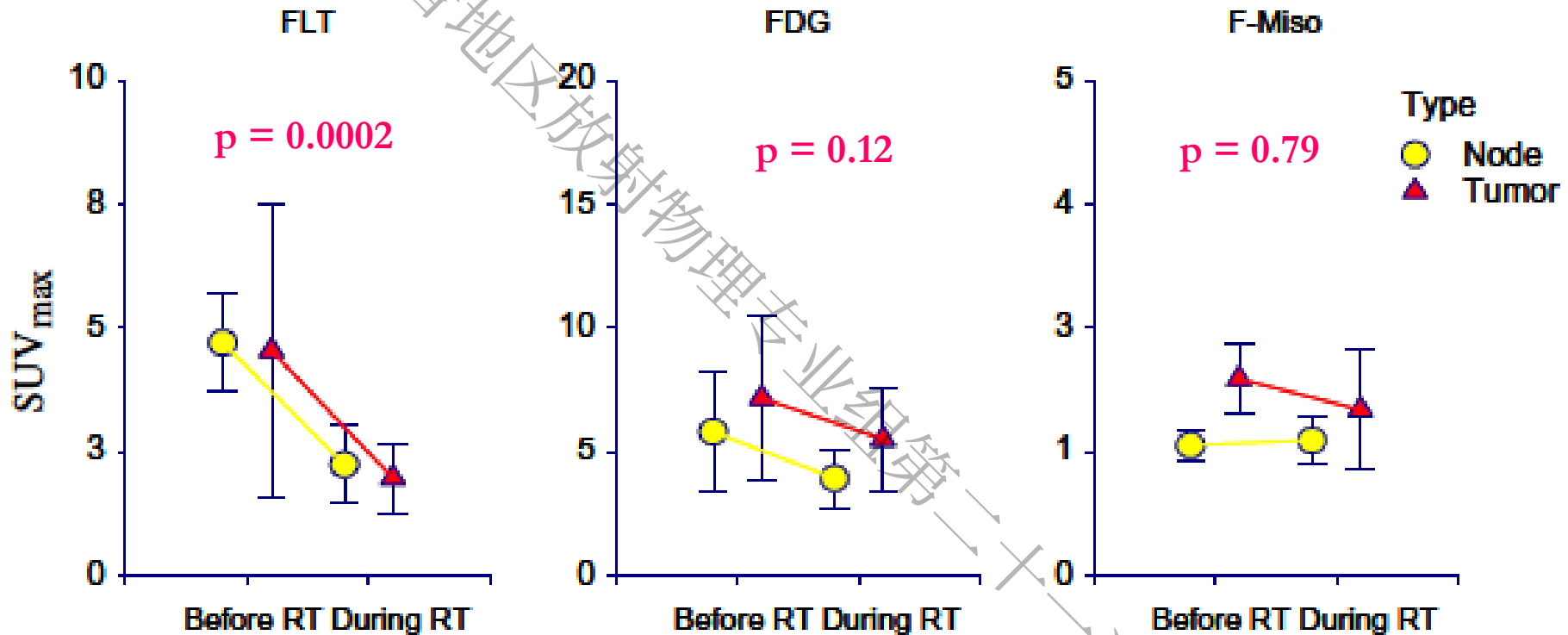
Exon 21

J Yu, et al. JNM



Western-blot

放疗过程中的变化

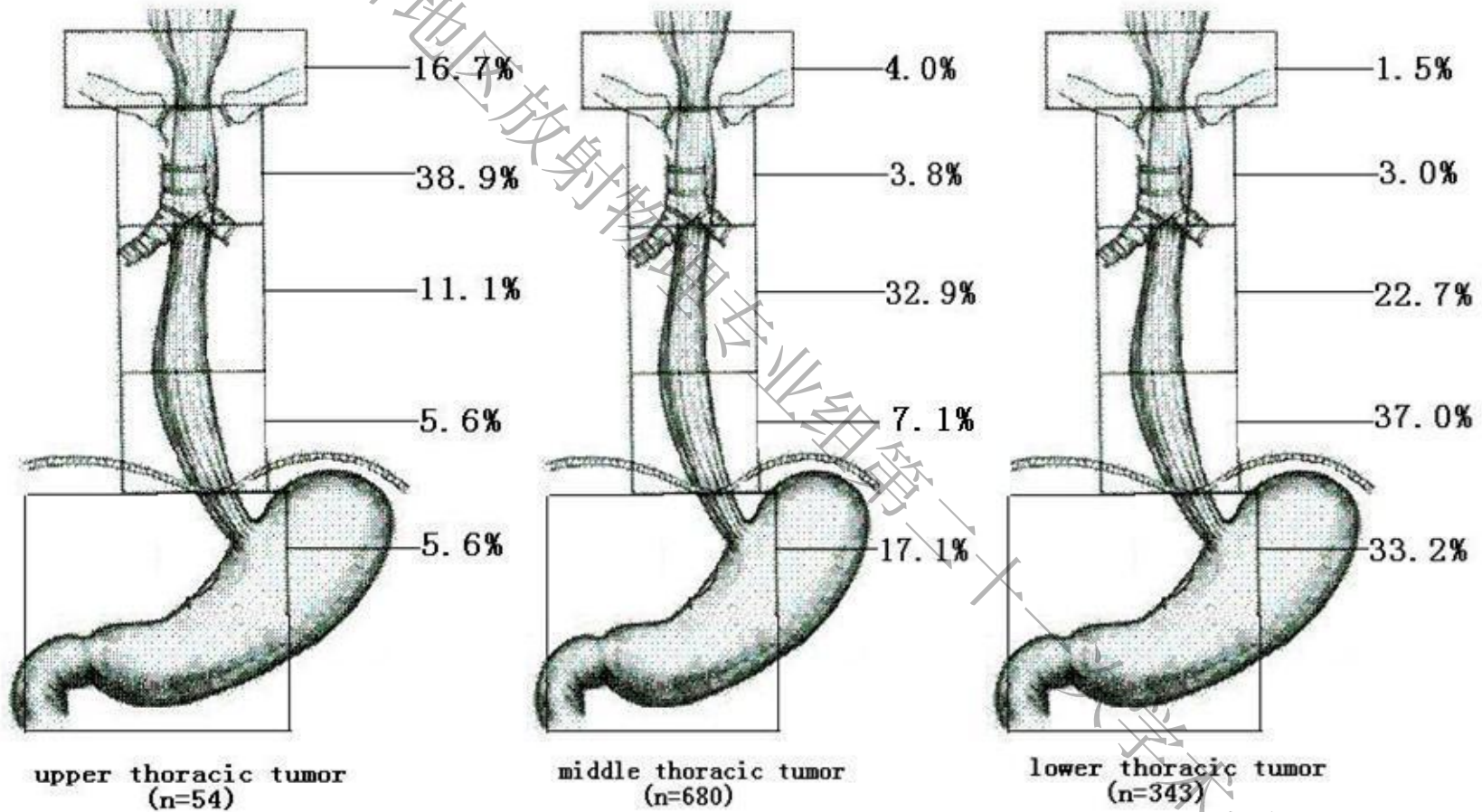


SUVmax for FLT, FDG, and F-miso before and during RT for 4 tumours and 12 nodes. Symbols represent the mean SUVmax. Error bars are the standard error of the mean

CTV

京津冀鲁晋地区放射物理专业组第二十一次学术会议

胸段食管癌术后淋巴结转移

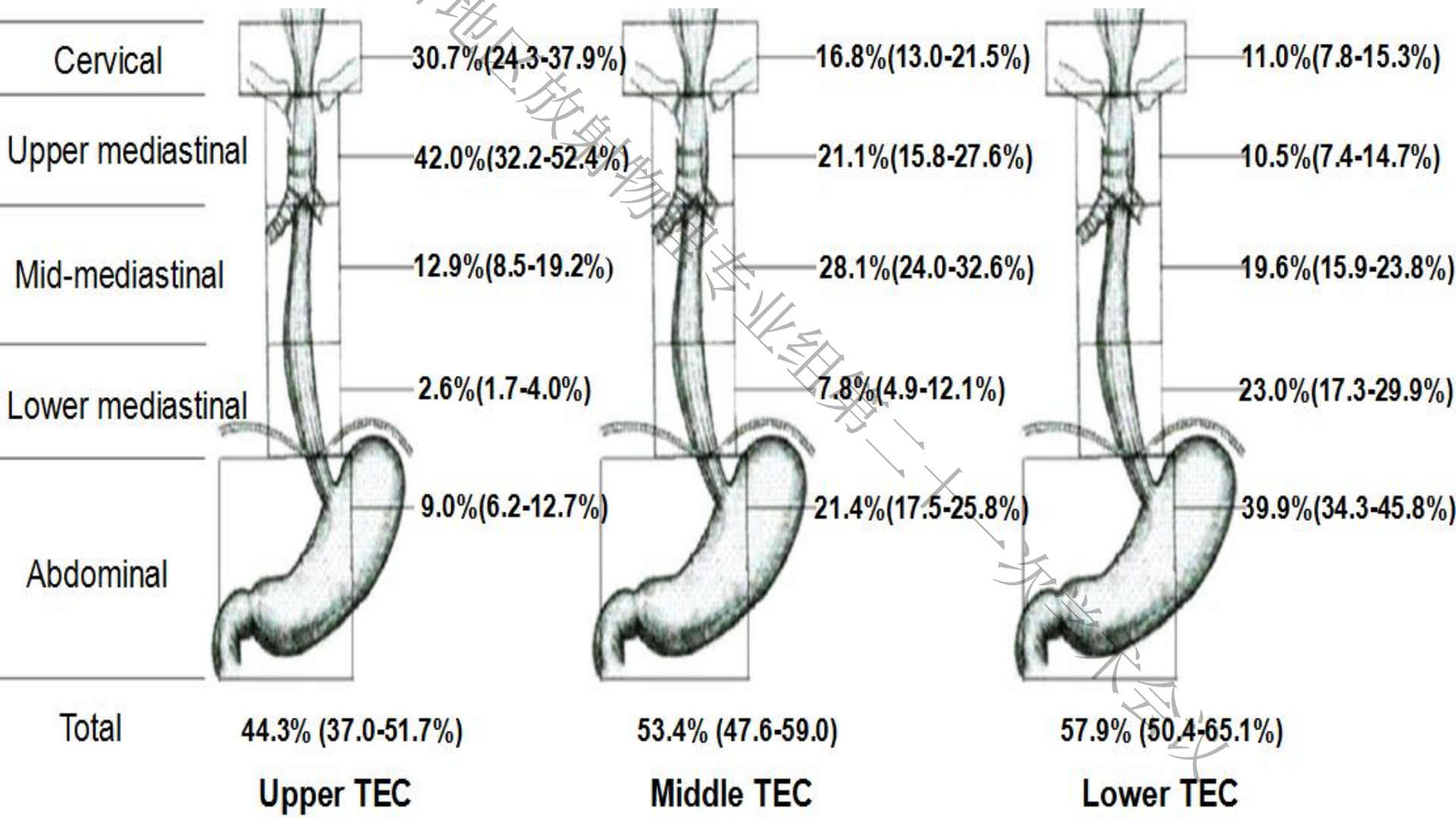


淋巴结转移率荟萃分析结果

Table 2. Pooled LNMRS (%) in lymph node subgroups defined by JSED

TEC		Upper TEC		Middle TEC		Lower TEC	
panatradial	34.7	panatradial	48.3	panasophageal	28.7	panigastnic	47.9
panigastnic	30.0	1006cdR	35.6	panigastnic	26.3	1+2	42.4
panasophageal	28.4	1001	28.3	1008	23.6	7	36.3
1006cdR	24.3	1005	20.5	1006cdR	23.0	panasophageal	34.8
7	22.6	1001R	18.5	panatradial	20.1	1	33.4
1	22.4	1004	18.0	7	19.7	2	27.9
1+2	18.3	1006cdL	17.7	1007	18.6	3	27.6
1007	16.7	panasophageal	16.9	1	17.6	100	22.6
2	16.4	1006	15.2	1+2	16.6	panatradial	18.2
1004	15.7	1006pe	13.2	1009	12.9	9	14.4
1009	13.8	1001L	13.0	1006	12.0	1008	12.7
3	13.0	1007	11.5	2	11.8	10	12.6
100	11.8	1009	11.4	3	10.8	1007	12.4
1006cdL	11.5	1008	11.2	100	10.4	1006cdR	12.1
1001	11.0					102	11.8
102	10.3						

淋巴结转移率荟萃分析结果

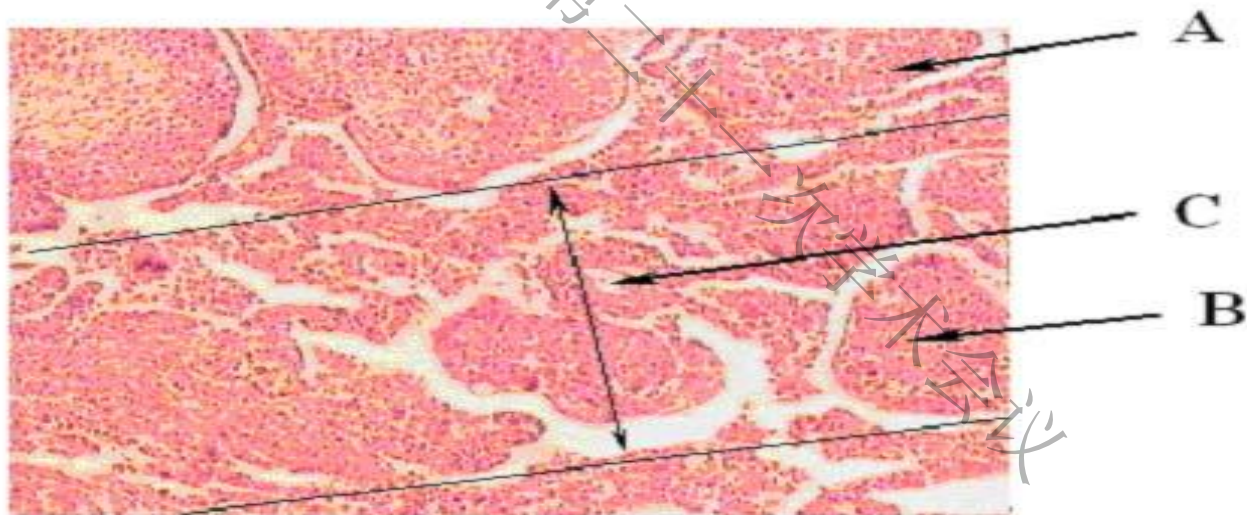


NSCLC镜下侵袭范围(mm)

-我院研究结果

病理类型	X轴	Y轴	Z轴	平均值	95%CTV
腺癌	1.80 ± 1.10	2.86 ± 2.48	2.17 ± 1.58	2.18 ± 1.80	7mm
鳞癌	1.37 ± 0.97	1.45 ± 1.03	1.14 ± 1.26	1.33 ± 1.09	5mm
P值	0.18	0.017	0.035	0.001	

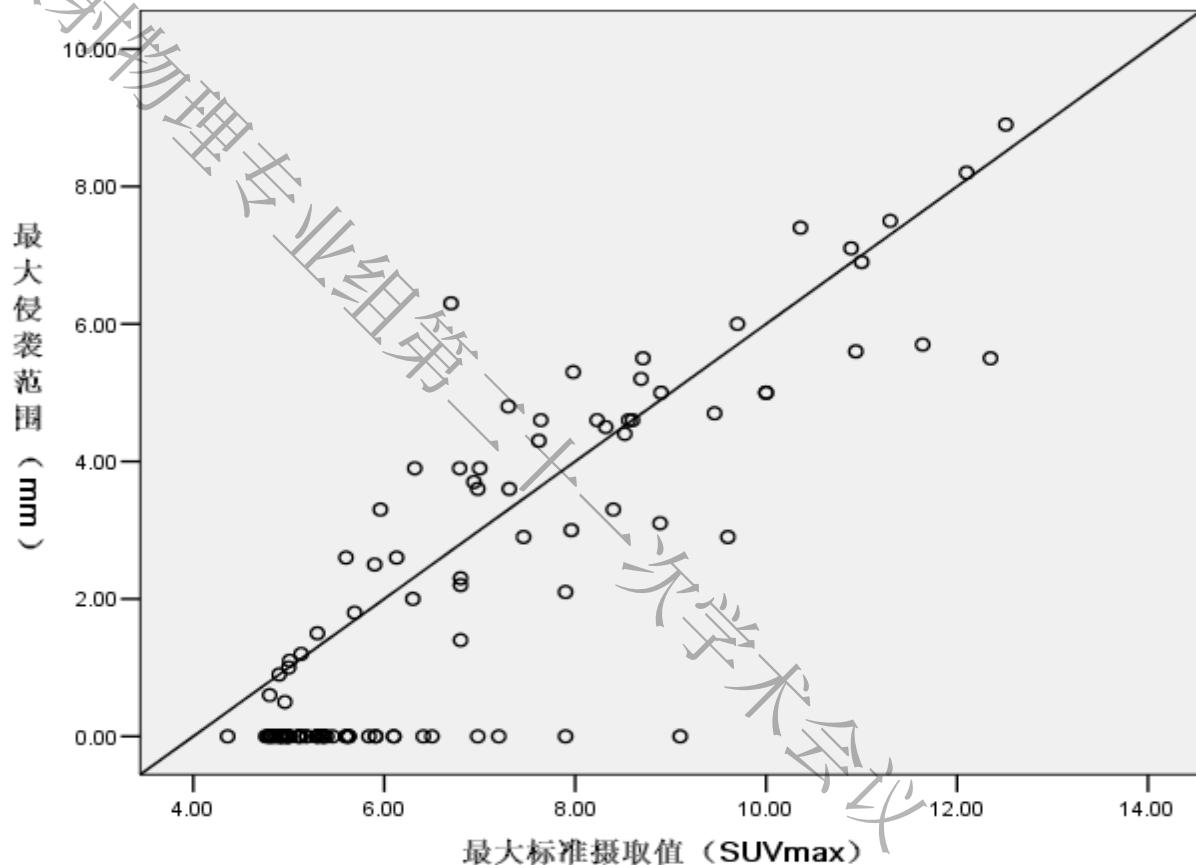
临床靶区的设定
取决于病理和靶
区边界失败频度



SUV与肿瘤镜下浸润关系

- ❑ 121例NSCLC患者, ME平均值为3.22mm(0.5mm-8.90mm)
- ❑ 肿瘤SUVmax和SUVmean的平均值分别为11.53(5.22-30.0)和8.05(4.76-12.51)
- ❑ ME和SUVmax明显相关($P=0.02$)

2006 *Int J Radiat Oncol Biol Phys*





淋巴结外侵与临床病理关

Correlations of ECS & Clini-patho

病理 类型	转移 淋巴结	ECS 淋巴结	ECS淋巴结大小			ECS范围 (mm)
			<1mm	1-2mm	>2mm	
鳞癌	270	(30 %)	20	23	38	2.27 ± 1.67
腺癌	289	(34.6 %)	34	26	40	1.86 ± 1.86
腺鳞癌	38	(36.8 %)	5	3	6	1.95 ± 1.67
其它	43	(44.2 %)	8	4	7	1.89 ± 1.76
	640	214 (33.4 %)	67	56	91	2.02 ± 1.77

❑ 侵出包膜的距离与淋巴结大小有关, 与病理类型及解剖部位和分级无关

❑ 包膜外侵犯距离为0.2mm-7.9mm,多发纵隔肺门淋巴转移大伴有ECS

ITV

京津冀鲁晋地区放射物理专业组第二十一次学术会议

胸上中下段食管肿瘤中心 在X、Y、Z轴运动

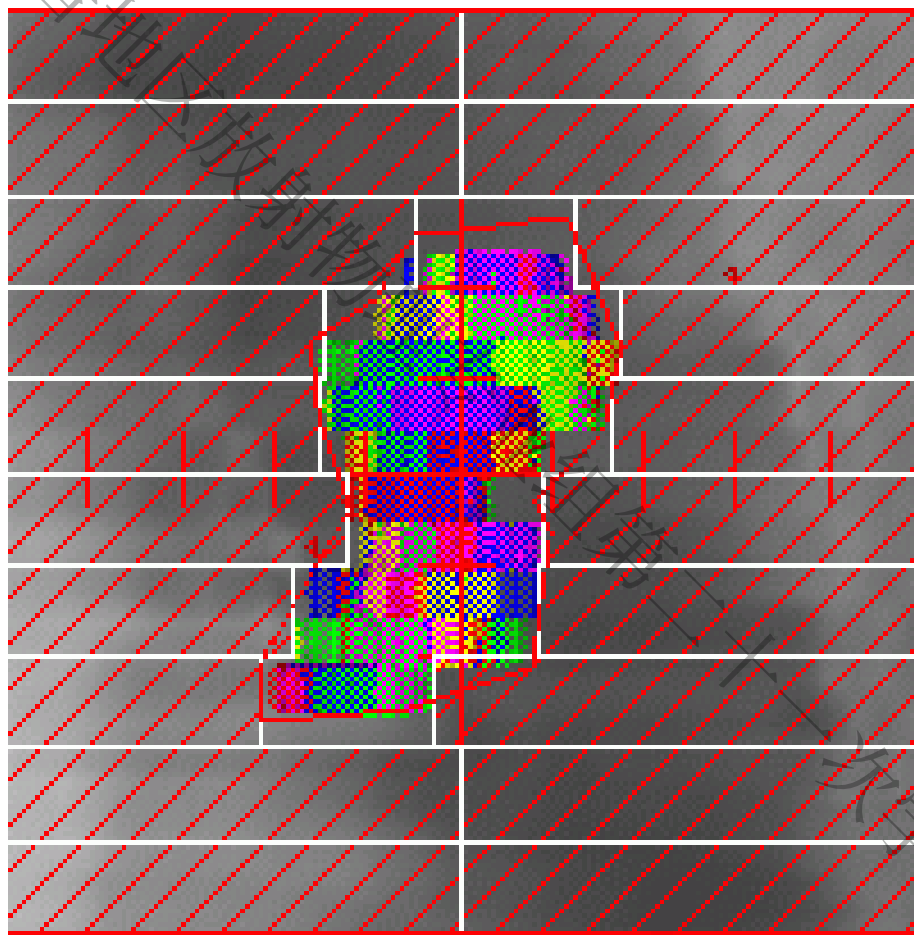
	X (mm)	Y (mm)	Z (mm)
Upper	1.5±0.7	0.63±0.29	1.5±0.7
Middle	0.87±0.42	0.56±0.19	2.19±1.15
lower	0.95±0.27	0.55±0.13	4.95±0.61

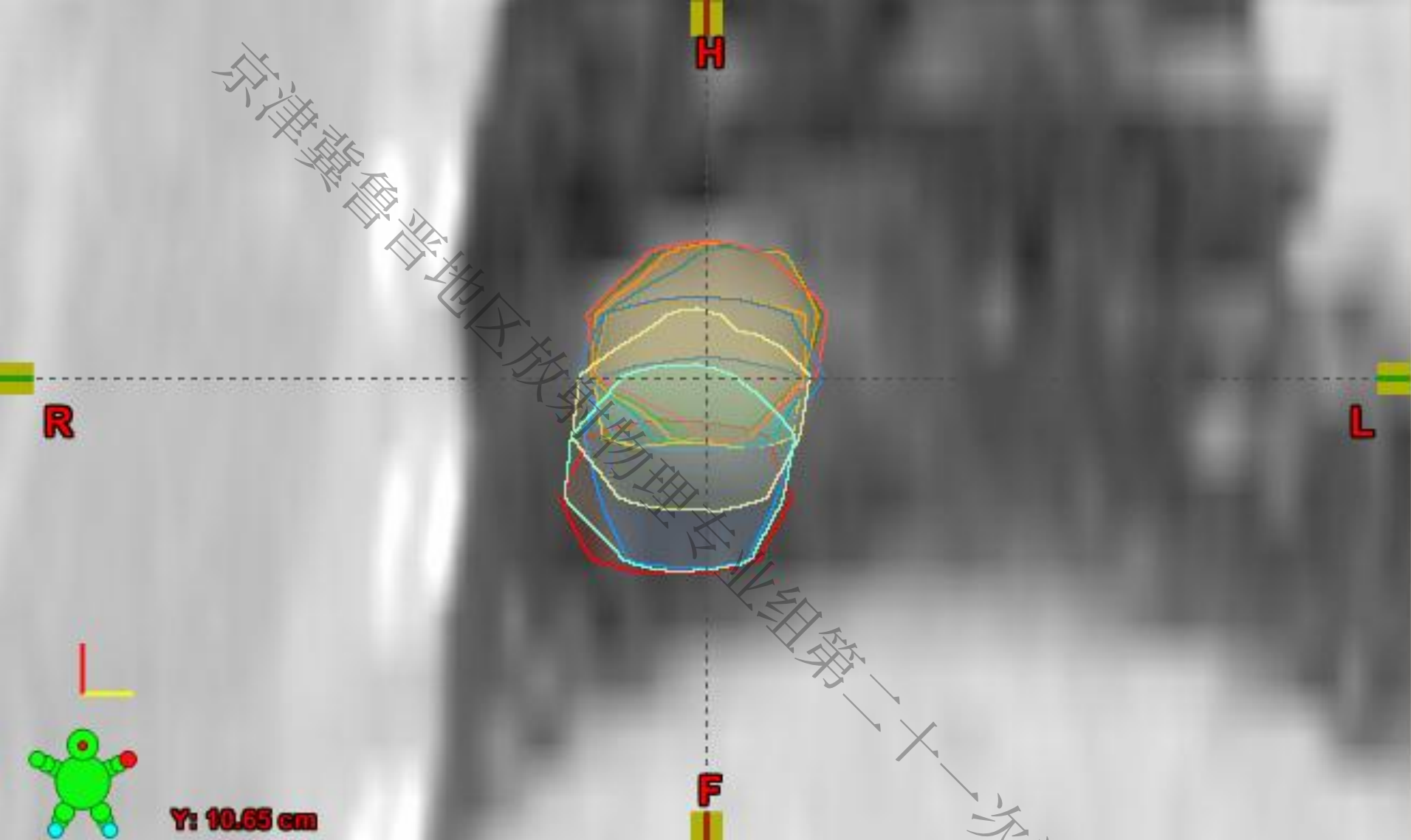
X 上段与中段比较有差异, $F=2.642, P=0.037$ 上段较中段运动大,

Y 上中下段之间比较无统计学差异, $F=0.164, P>0.05$

Z 上段与下段比较有差异, $F=4.016, P$ 值为0.035, 中段与下段之间比较有差异, $F=4.016, P$ 值=0.001, 上段与中段比较无差异 $F=4.016, P$ 值为0.352

多序列图像等中心点取平均值





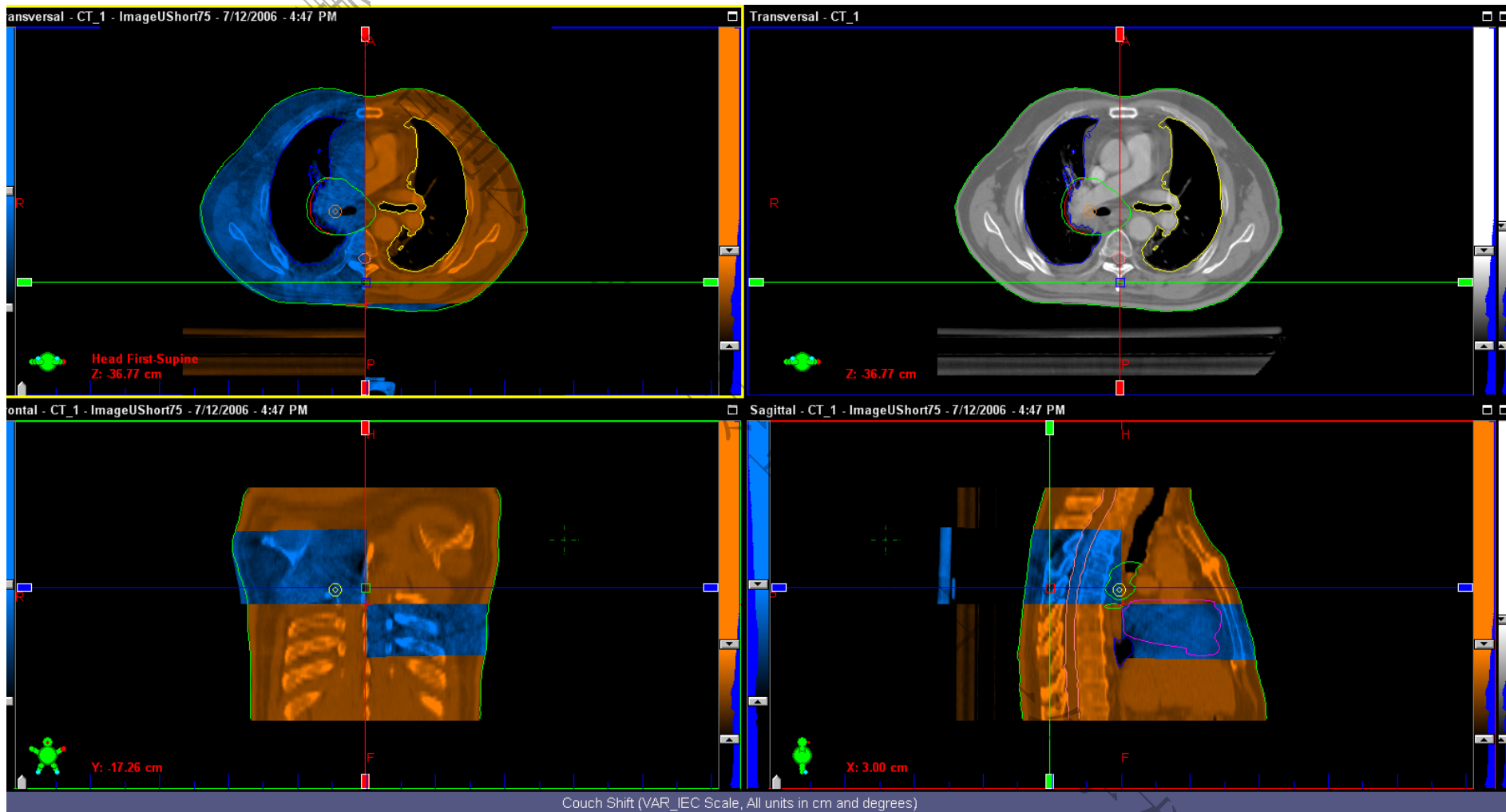
基于4DCT勾画的iGTV

京津冀鲁晋地区放射物理专业委员会第二十二次学术会议



打的准--精准施照

体部肿瘤配准分析



Couch Shift (VAR_IEC Scale, All units in cm and degrees)

Raw Shift Values

	SHIFT		SHIFT
Couch Lat	-0.3	Couch Pitch	-0.8
Couch Lng	-0.5	Couch Roll	-0.2
Couch Vrt	0.2	Couch Rtn	-1.0
		Couch Proj Rtn	-1.3

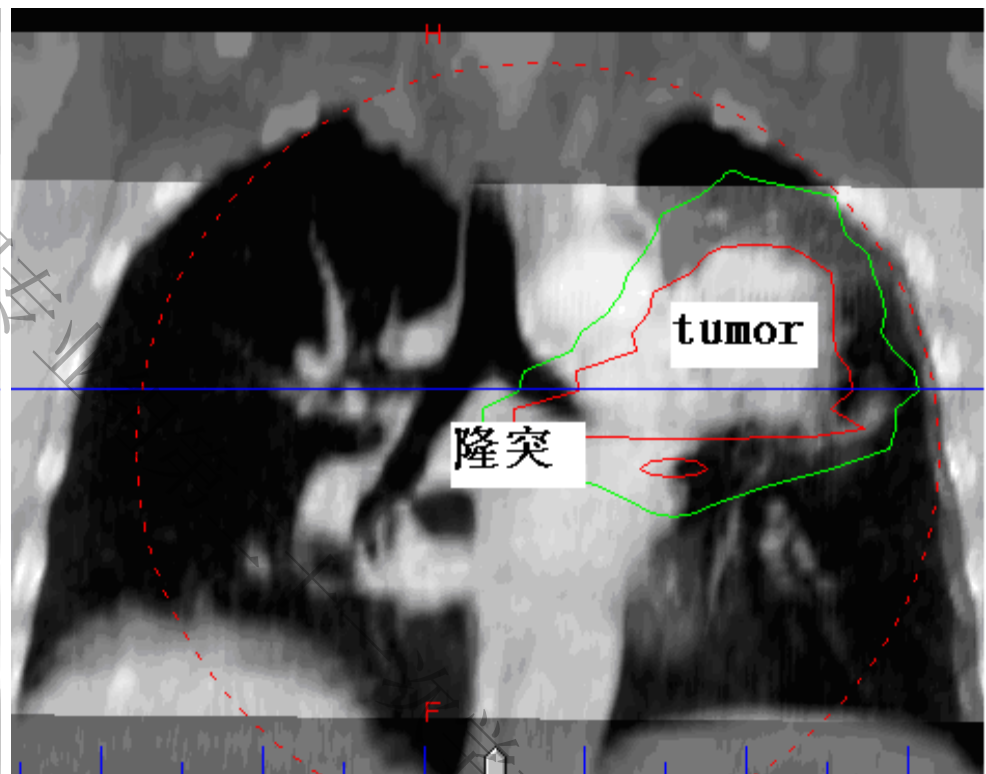
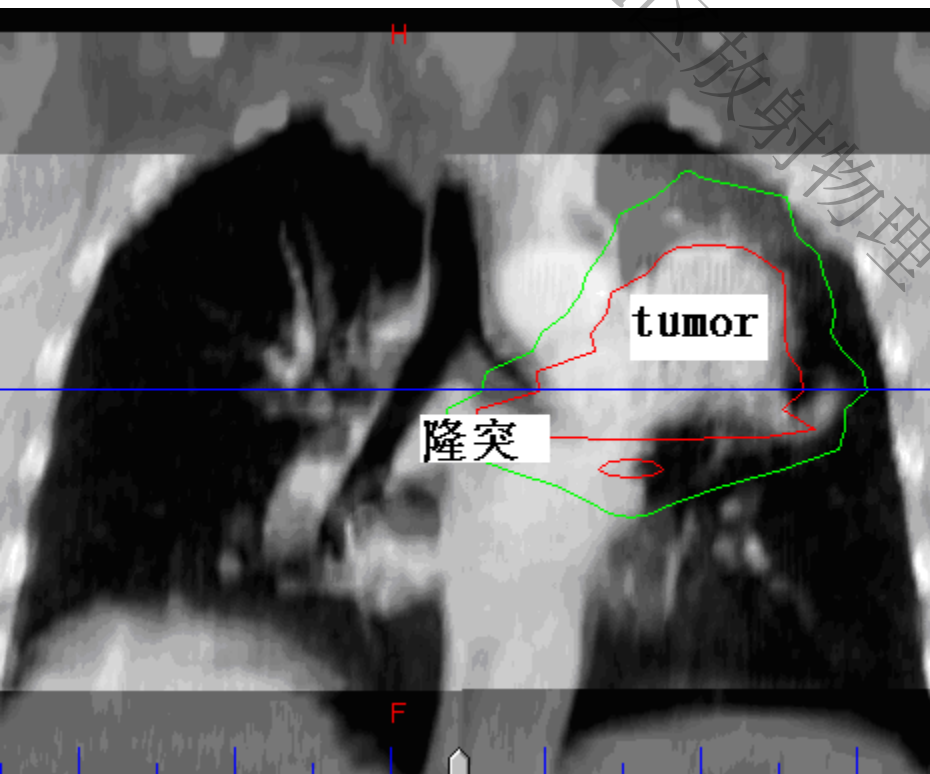
Machine Values

	TARGET	ACTUAL	SHIFT	
Couch Lat	999.8	999.9	-0.3	☒ Include
Couch Lng	132.7	133.2	-0.5	☒ Include
Couch Vrt	15.2	15.0	0.2	☒ Include
Couch Rtn	358.7	0.0	-1.3	☒ Include

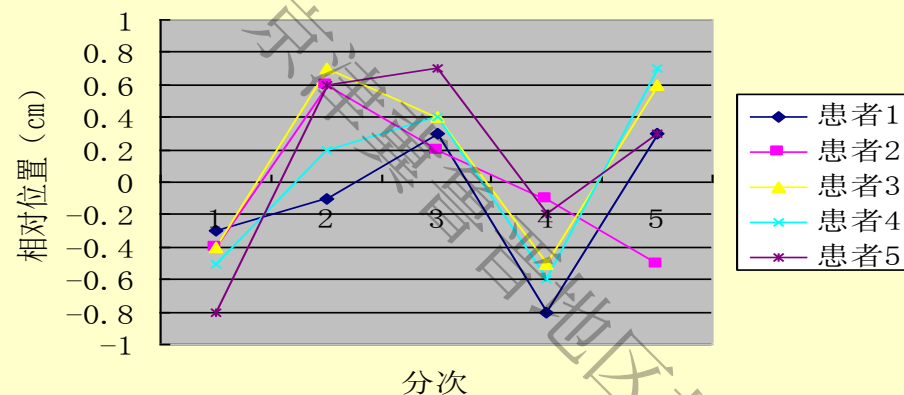
Reset Shift

Apply Shift

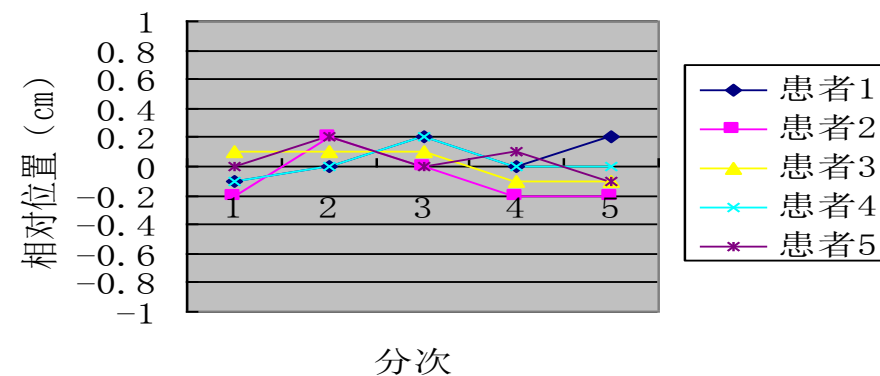
自动+手动配准



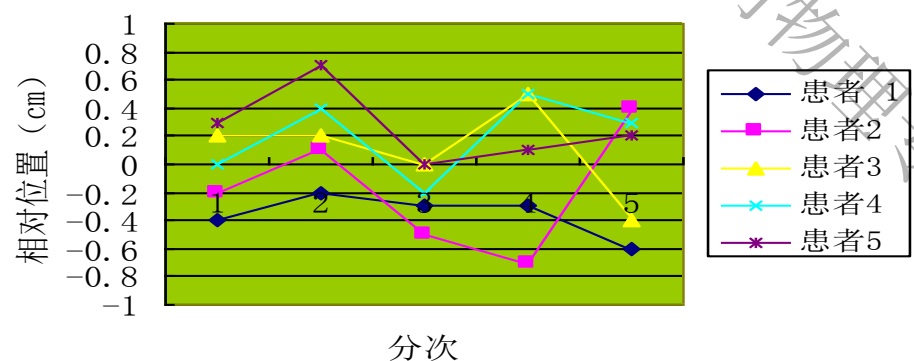
前后方向治疗前误差分析



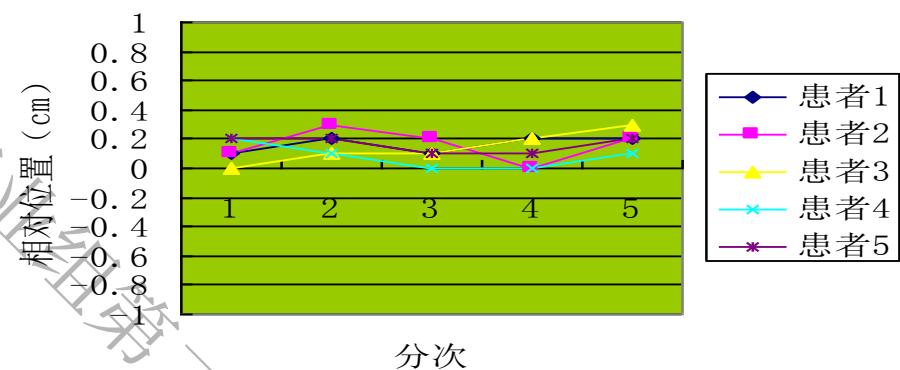
前后方向治疗后误差分析



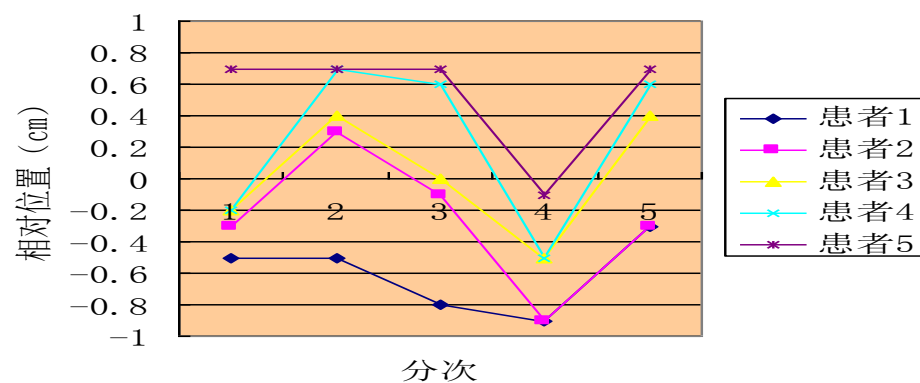
左右方向治疗前误差分析



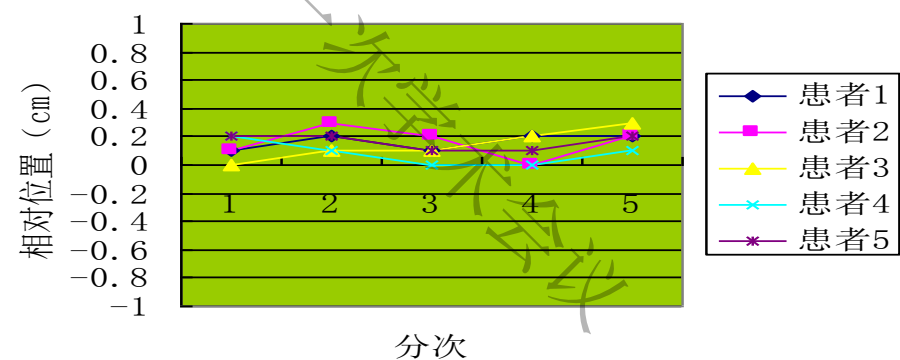
左右方向治疗后误差分析



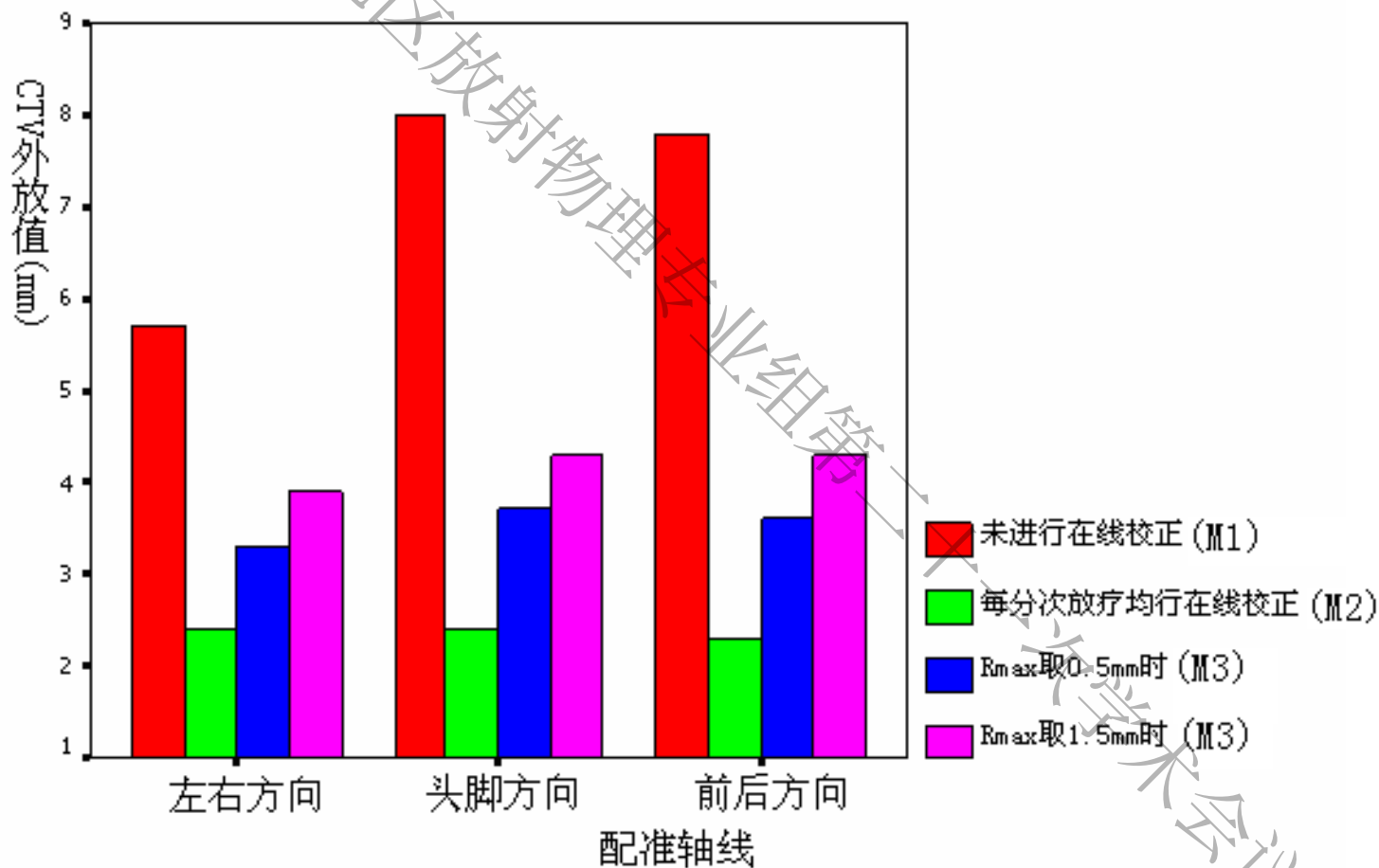
头体方向治疗前误差分析



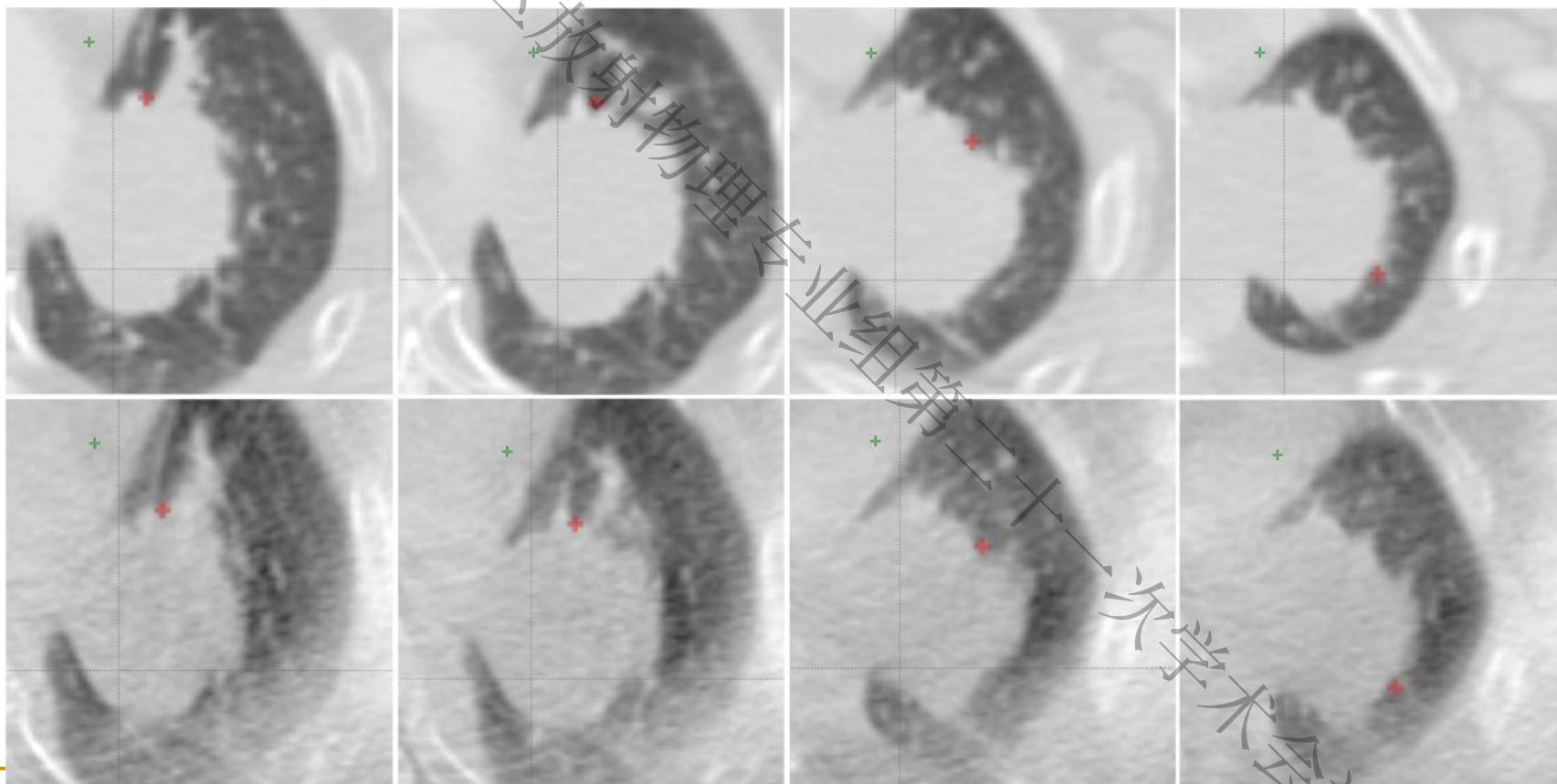
左右方向治疗后误差分析

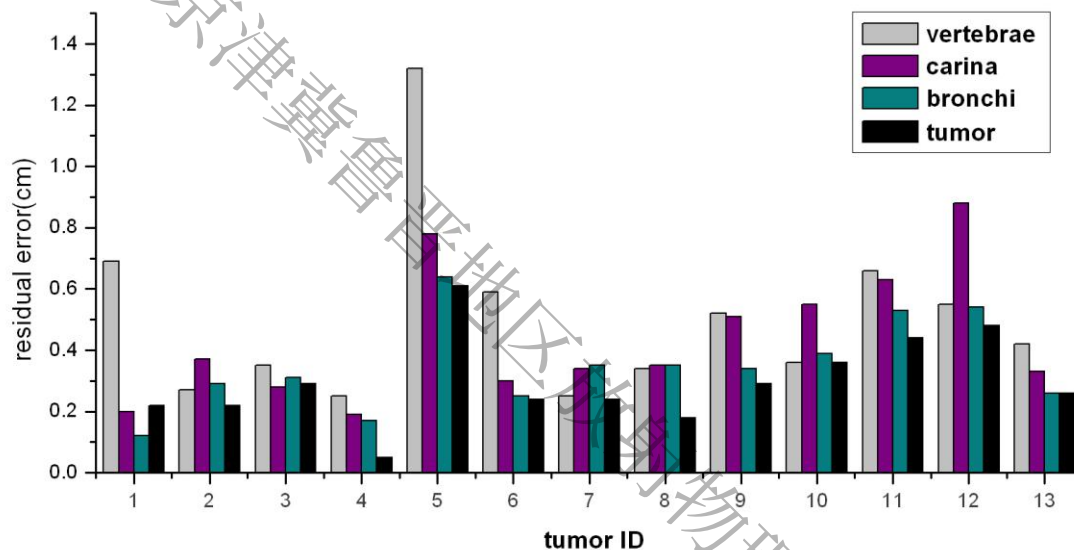


在线摆位校正前后、离线自适应校正后



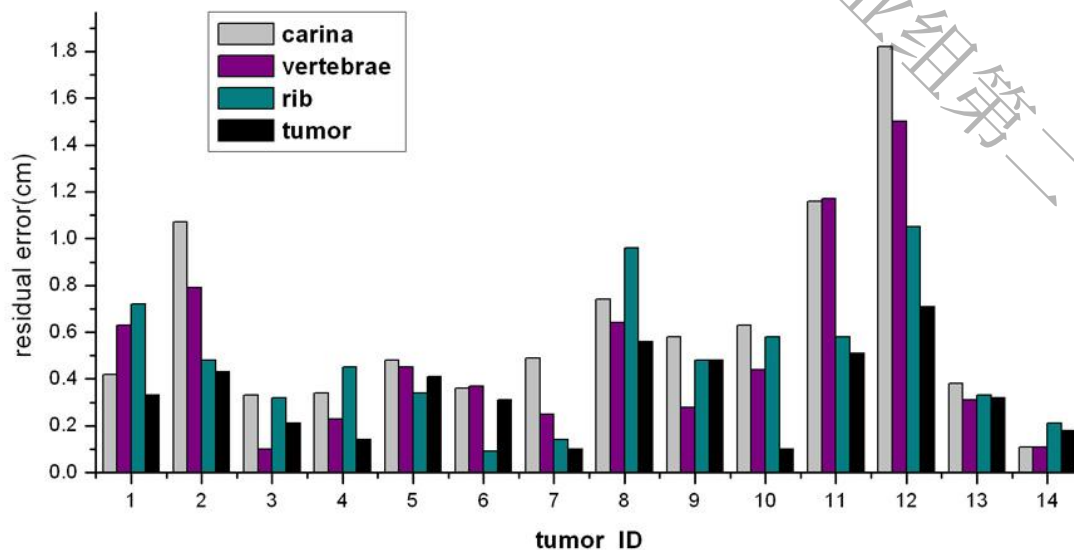
配准模板优化筛选





中心型肺癌手动配准模板

- 肿瘤本身（推荐）
- 靠近肿瘤的大气管（其次）
- 气管隆突（再次）



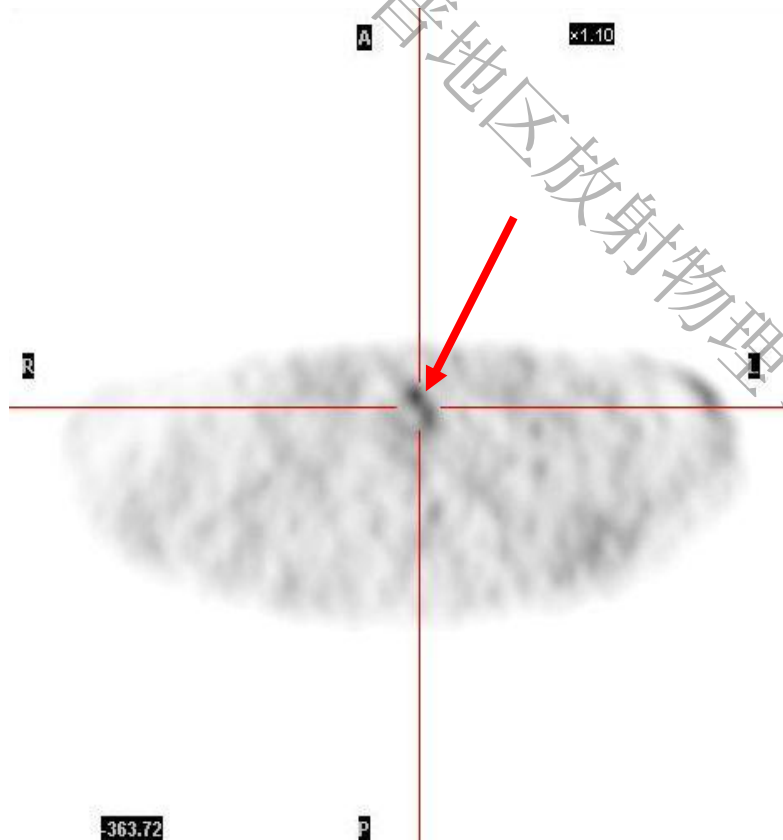
周围型肺癌手动配准模板

- 肿瘤本身（推荐）
- 靠近肿瘤的肋骨（其次）
- 肿瘤层面胸椎椎体（再次）

成效—多学科集成

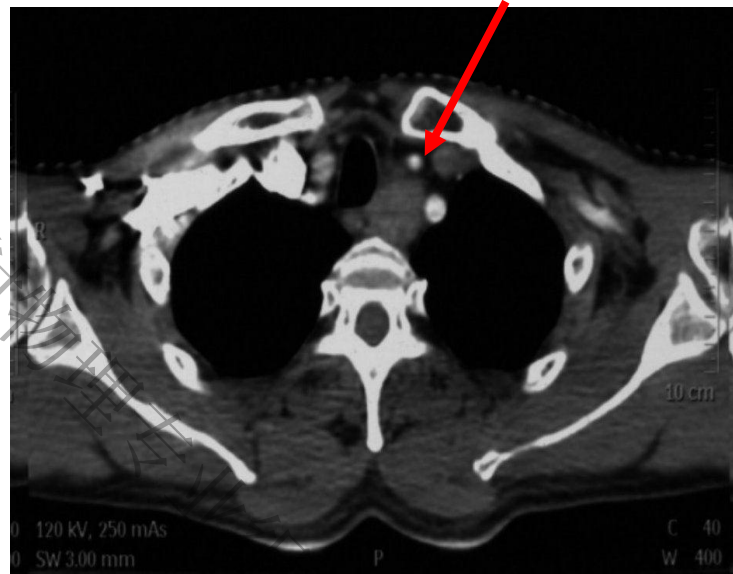
晋地区放射物理专业组第二十一次学术会议

PD153035食管癌EGFR显像



XXX,男性, 64岁, 胸上段食管鳞癌, $SUV_{max}=1.68$, $T/NT=2.8$

C225+同步放化疗治疗的疗效评价



治疗前



治疗后

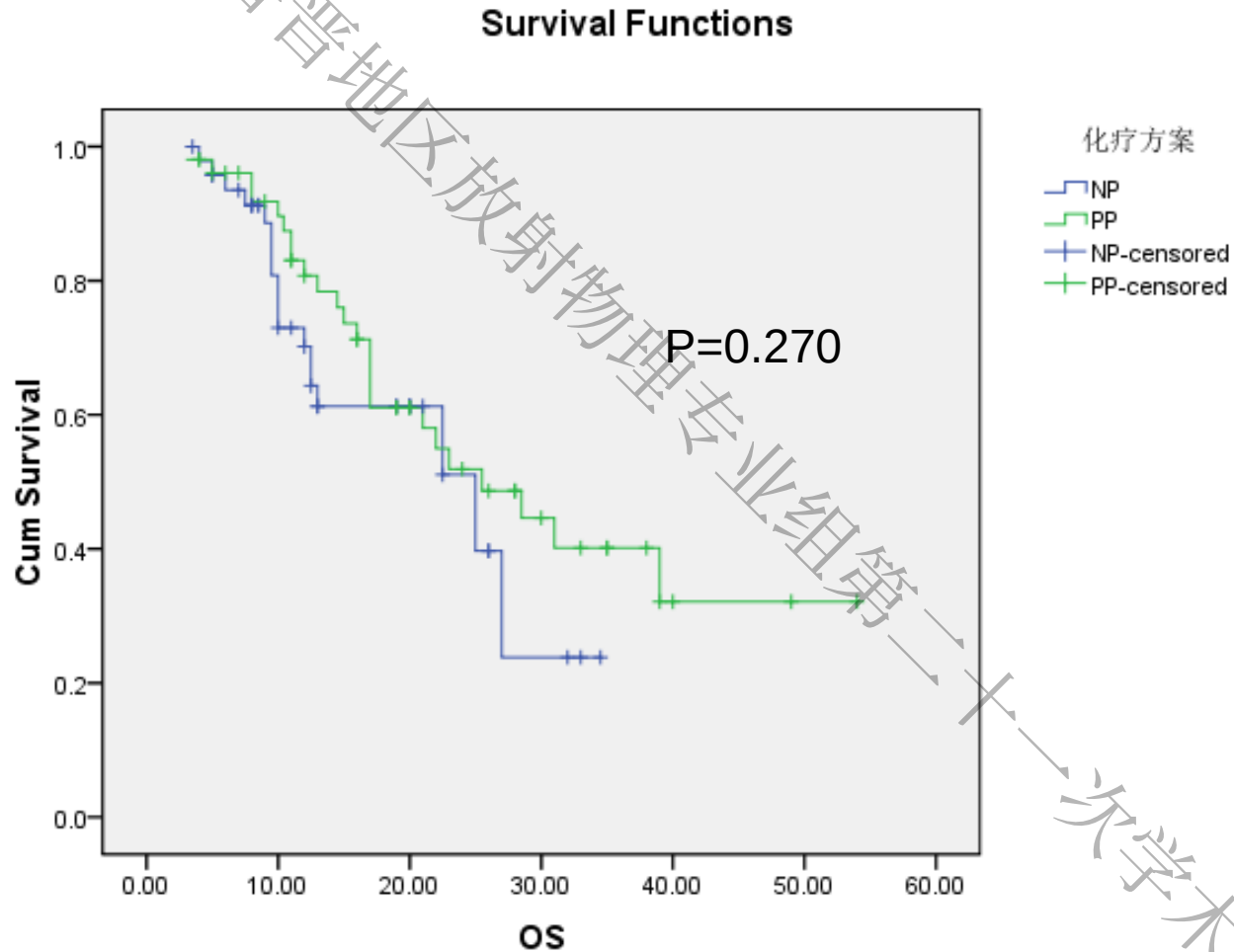
结果-1

- 40例患者入组V20=27%、30%、33%、35%、37%
- 放疗剂量: (62.88 ± 5.92) Gy、 (63.63 ± 7.28) Gy、 (62.20 ± 2.84) Gy、 (71.25 ± 5.41) Gy、 (68.28 ± 8.79) Gy
- 近期疗效: CR 6例(15.0%), PR 25例(62.5%), (CR + PR) 31例(77.5%), NC 9例(22.5%)
- 中位生存/中位无进展生存时间:25个月和 15个月

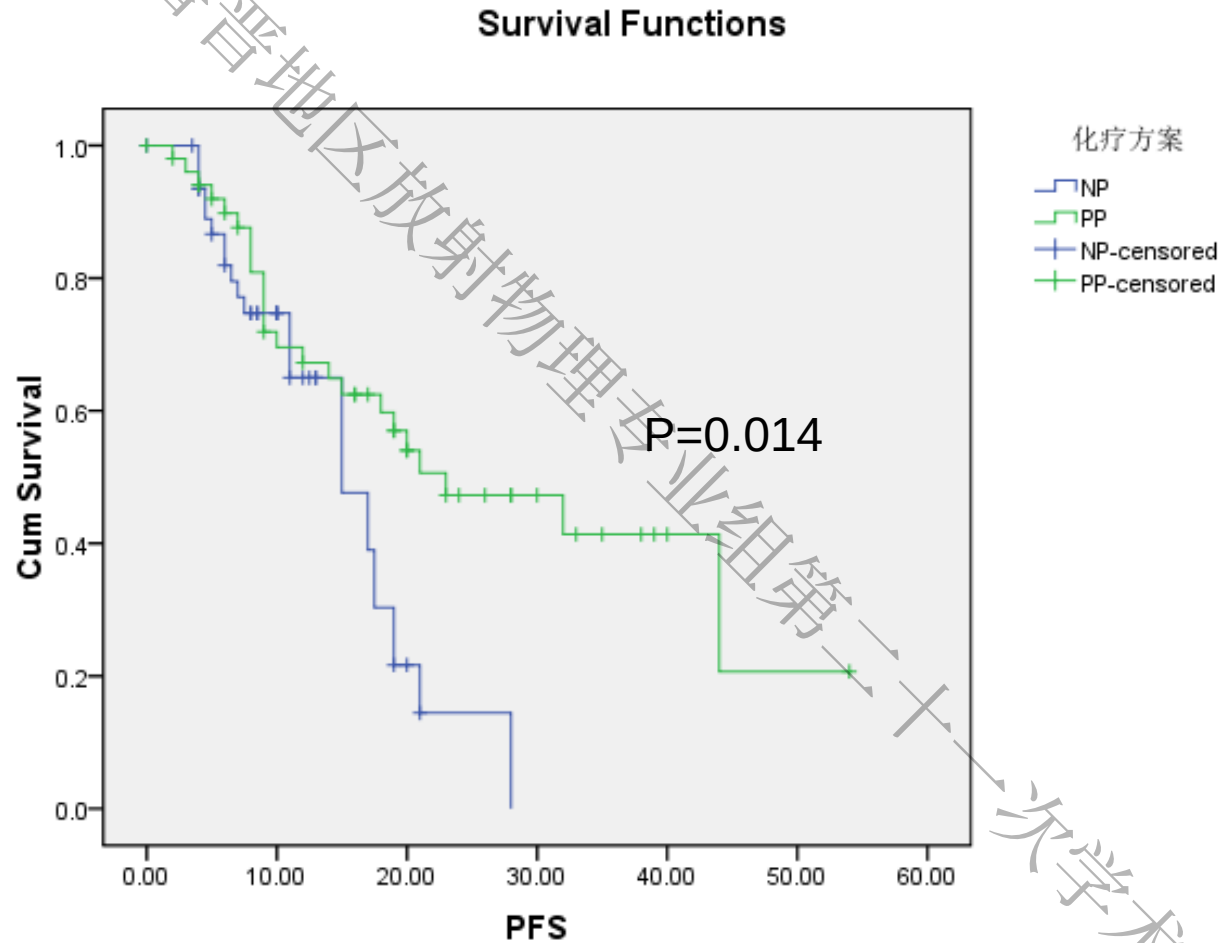
结 果-2

- 1+2级急性放射性肺损伤:18例(45.0%), 3级急性放射性肺损伤2例5.0%(均发生在双肺V20=37%水平组)
- 1+2级急性放射性食管损伤17例(42.5%)
- 1-3级骨髓抑制28例(70.0%), 4级骨髓抑制1例2.5%
- 1-3级胃肠道反应31例(77.5%)
- 晚期放射性肺损伤: 3级3例[V20=35% (1例 12.5%) VS 37% (2例 25%)]

Overall Survival



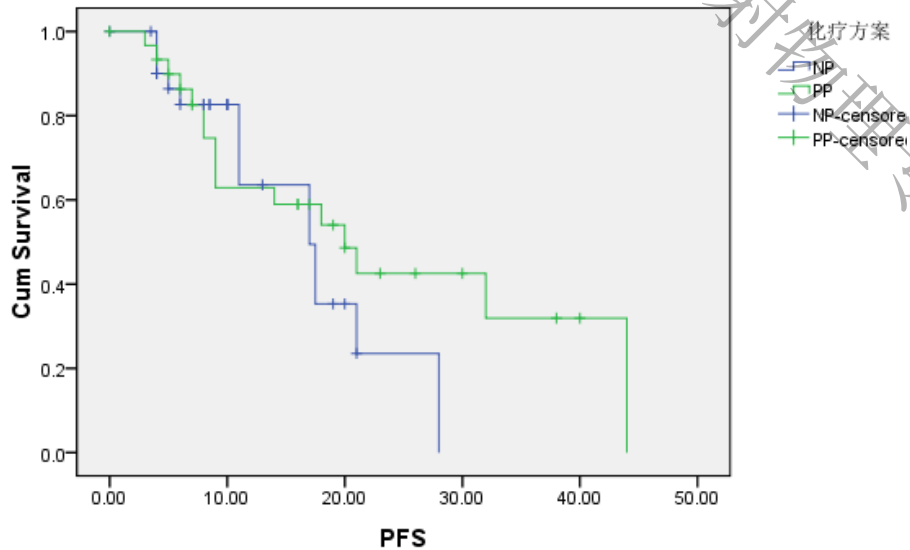
Progression Free Survival



Pathology vs. PFS

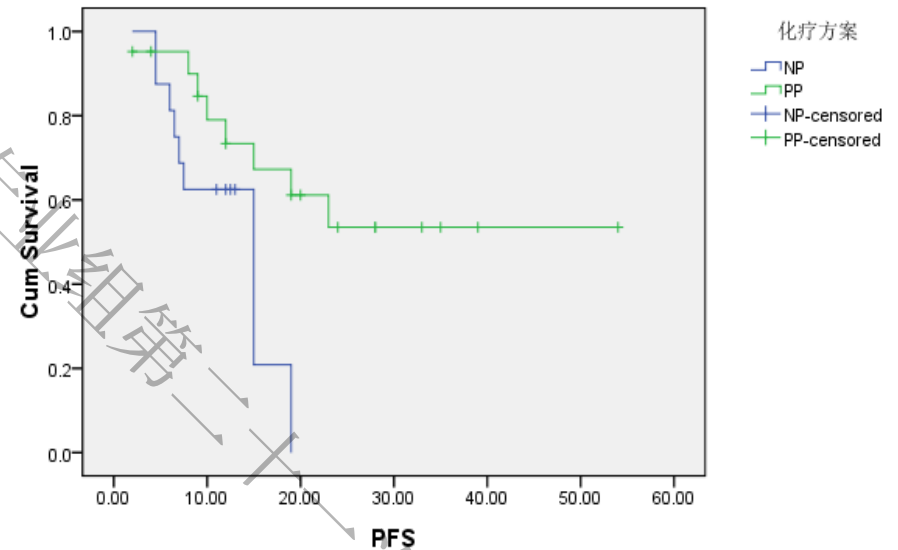
Survival Functions

Squamous Cell carcinoma



Survival Functions

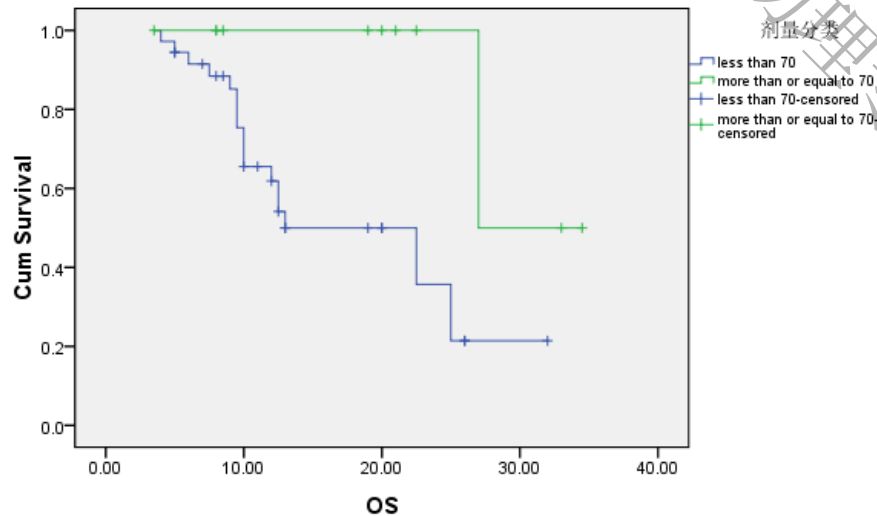
Non-squamous Cell carcinoma



Dose vs. OS

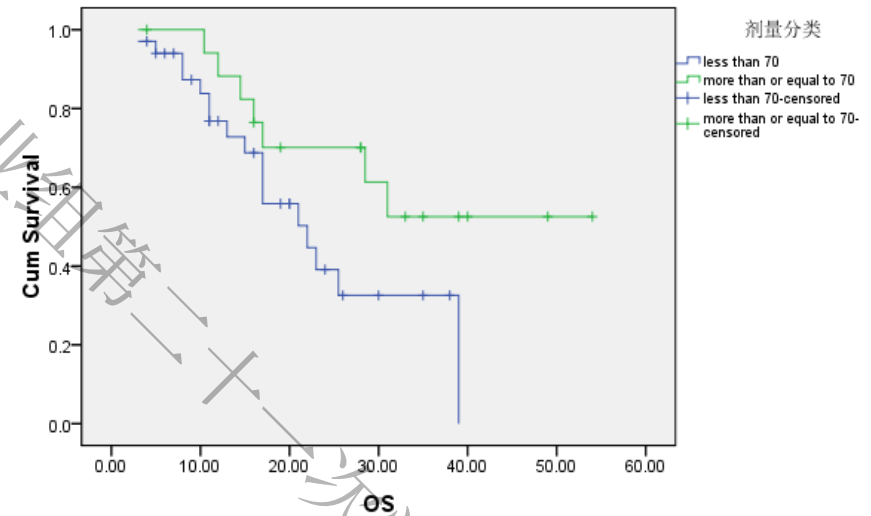
Survival Functions

Chemotherapy:NP



Survival Functions

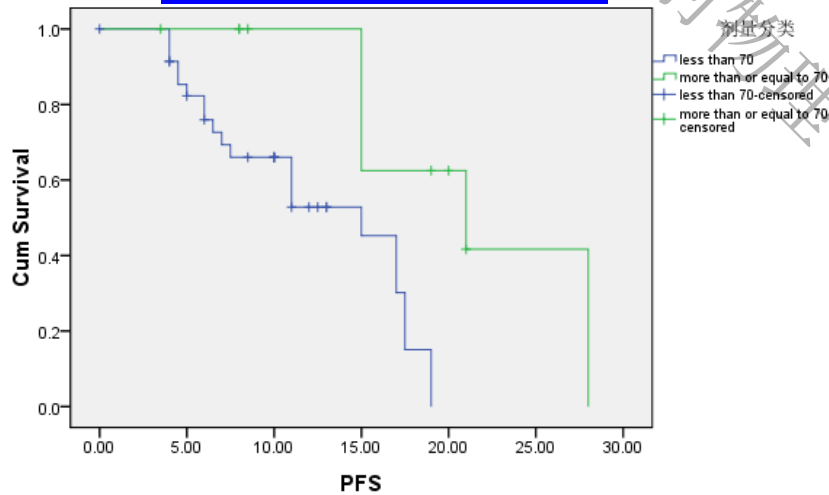
Chemotherapy:PP



Dose vs. PFS

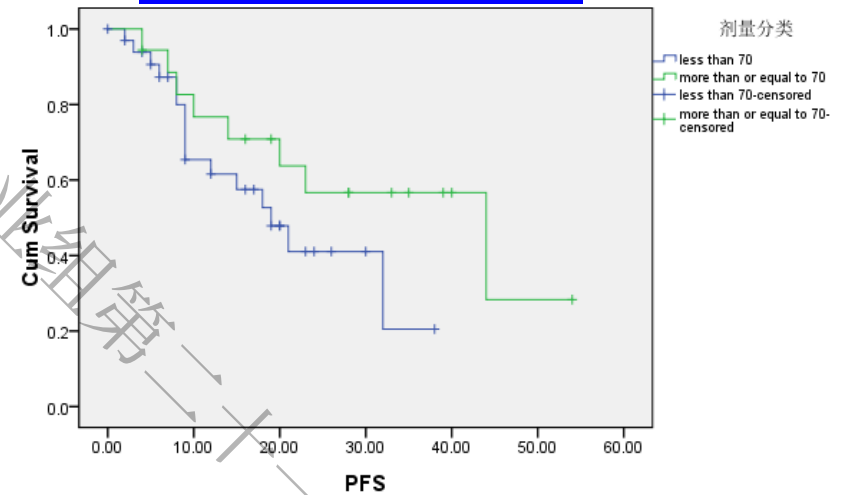
Survival Functions

Chemotherapy:NP



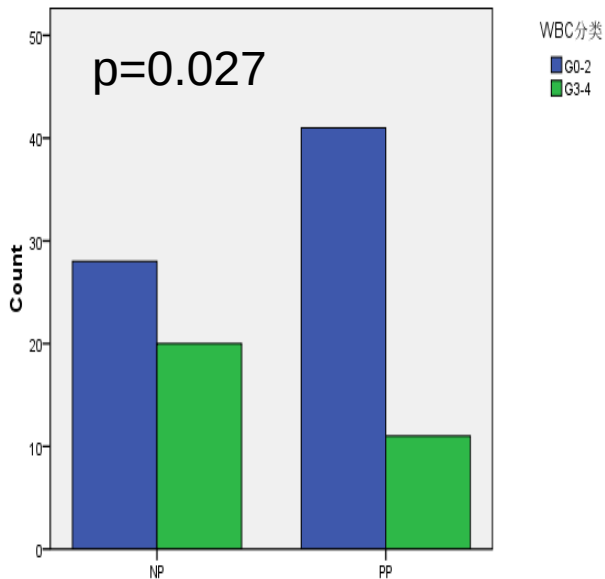
Survival Functions

Chemotherapy:PP



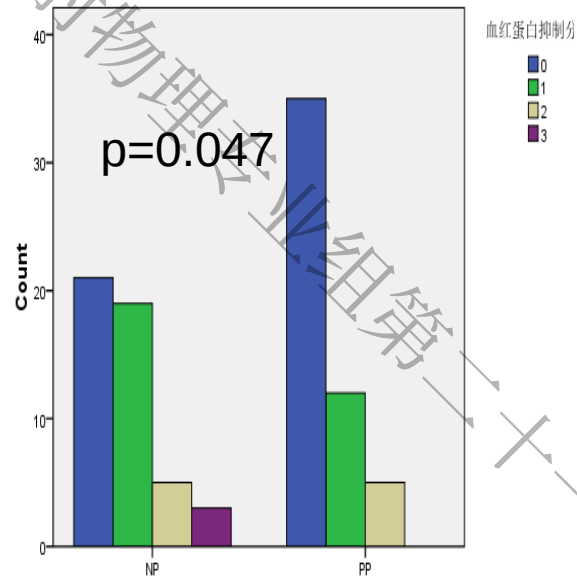
Toxicities

WBC



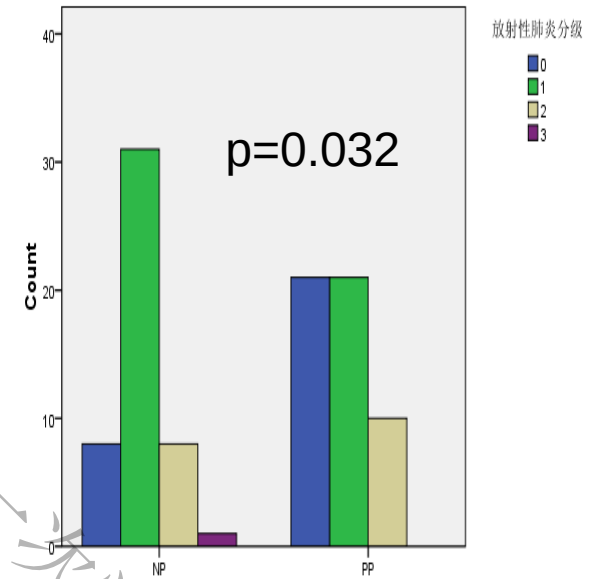
chemotherapy

Hb



chemotherapy

RP



chemotherapy

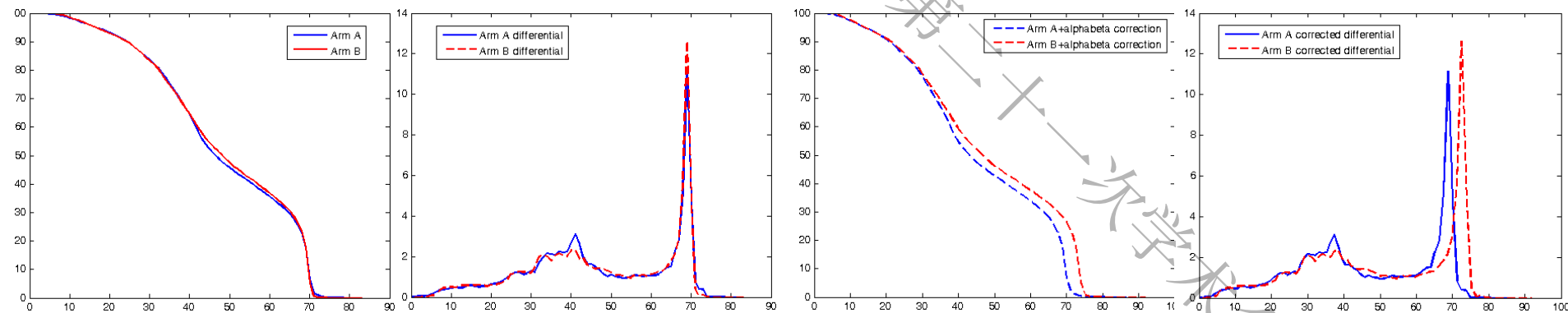
Conclusions

- Comparing with NP, concurrent pem/DDP at full systemic doses and LCAHRT was well tolerated, with promising activity and a significant improvement of QoL in a Chinese population with inoperable stage III NSCLC in spite of histology types.

对传统NTCP模型的改进

——Fractionation corrected model

	Arm A (8 toxicity / 89pts)	Arm B (21 toxicity / 103pts)
observed toxicity rate	8.99%	20.39%
predicted NTCP without α/β correction (LKB: TD=68.59, n=0.09, m=0.09)	15.10%	15.12%
predicted NTCP with α/β correction (LKB: TD=70.93, n=0.08, m=0.09, $\alpha/\beta=7.17$)	8.93%	20.45%



Without α/β correction: cumulative DVH and differential DVH

With α/β correction: cumulative DVH and differential DVH

美国AACR-2012结果 肿瘤规范治疗与过度治疗

□ 对1807名癌症患者调查并中位随访7年

□ 随访期间776名患者死亡，其中

✓ 51%的幸存者死于癌症；49%死于其它因素

- 其中69%死于心血管病

- 15%死于呼吸道类疾病

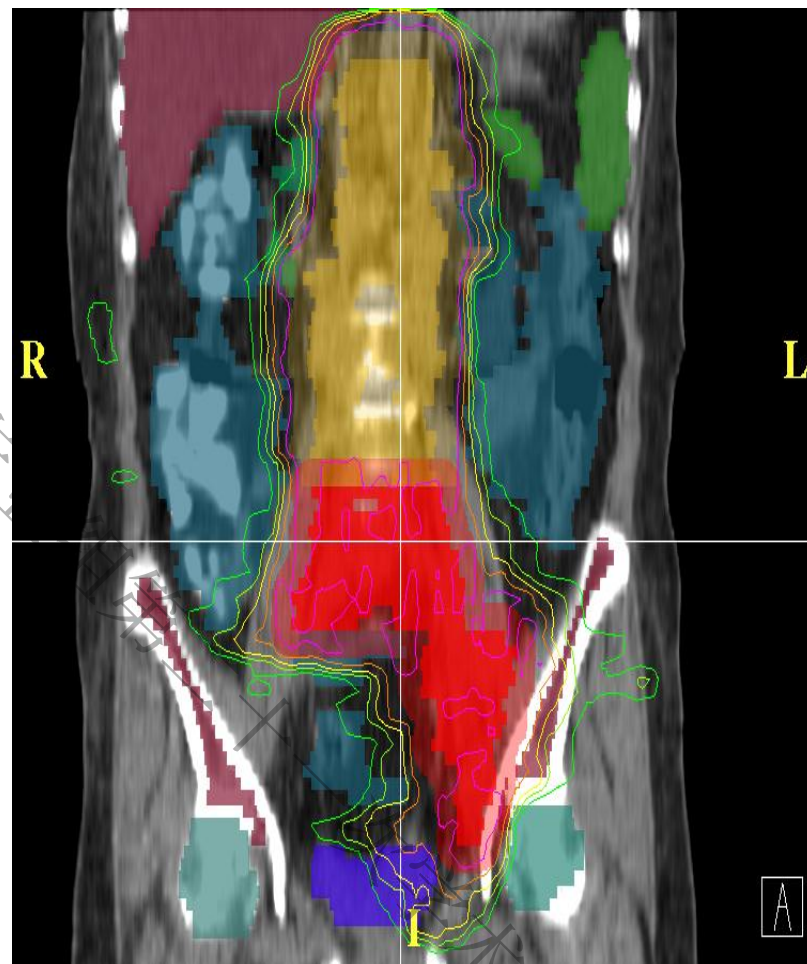
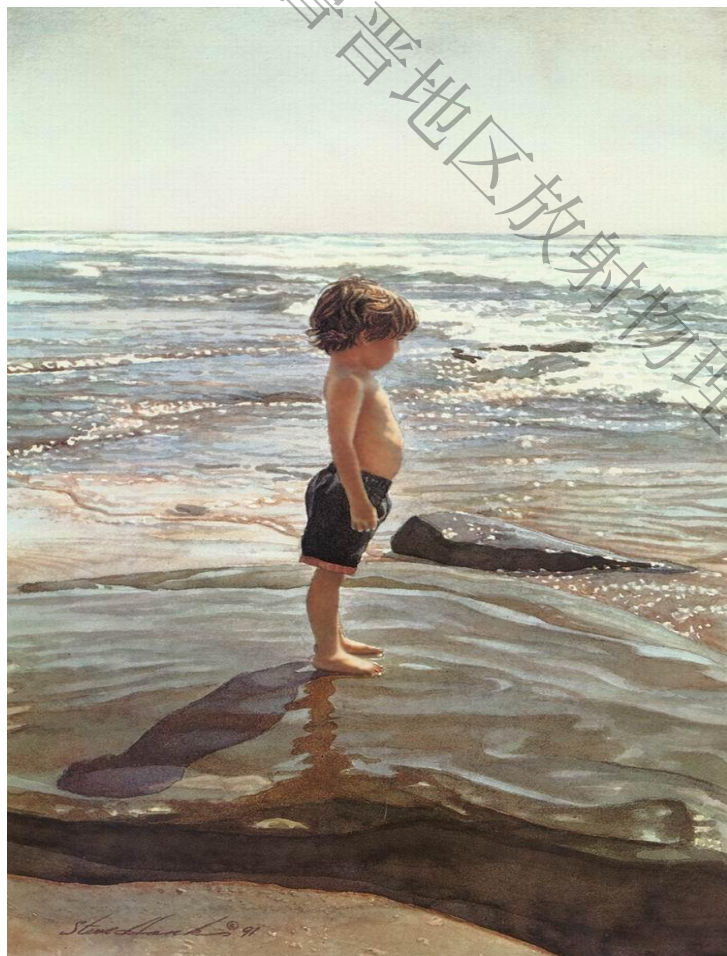
- 26%患者死于其它疾病

□ 由此引发肿瘤规范治疗相关争议很多

展望

- 新装备
- 新技术
- 多中心

科学和艺术的结合



精心制作，认真分析和欣赏

A DREAM of ONCOLOGISTS



广告之

欢迎参加

国家继续教育项目

-肺癌规范化治疗学习班

时间：2013年8月1日-3日

地点：青岛

学分：国家I类继续教育学分10分

京津冀鲁晋地区放射物理专业组第二十

谢谢!



