

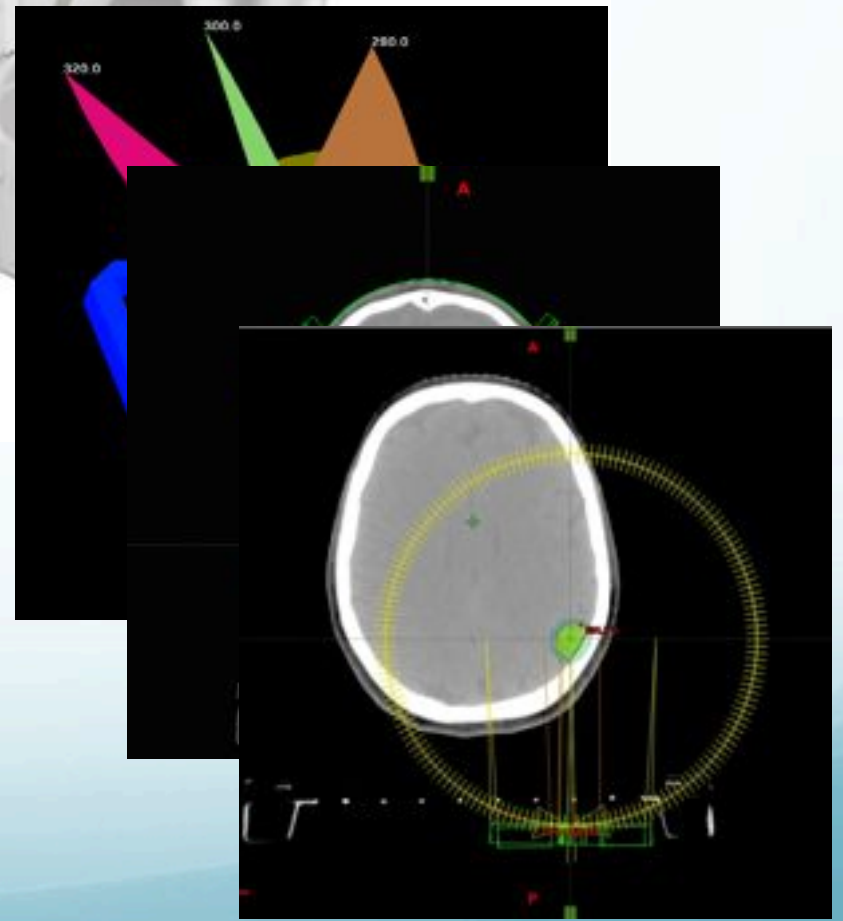
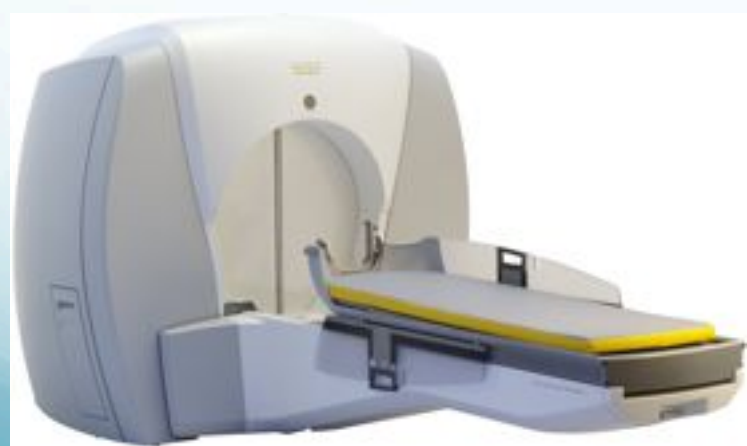
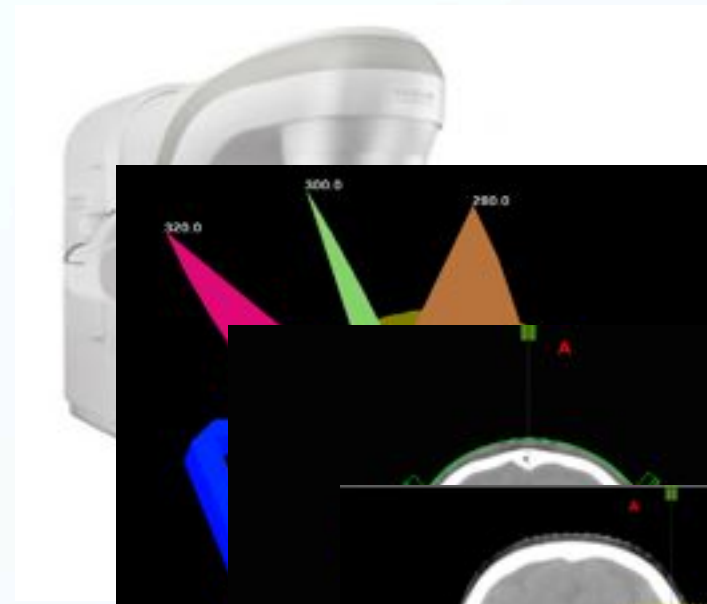
**Radioterapia stereotassica encefalica  
con tecnica IMRT statica o volumetrica  
nel trattamento dei pazienti  
oligometastatici:  
quali differenze dosimetriche?**

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## Role of SRS/SRT in limited metastatic lesions

NCCN National Comprehensive Cancer Network*		NCCN Guidelines Version 1.2014 Limited (1-3) Metastatic Lesions		NCCN CN
CLINICAL PRESENTATION		PRIMARY TREATMENT <sup>f,g</sup>		
Dis sys wit tre:	<b>Solitary metastasis</b>			
	Kondziolka D et al.	IJROBP, Vol.45, No.2, pp. 427–434, 1999		
	Andrews DW et al.	Lancet; 363: 1665–72, 2004		
No sta dis Re: tre: exi	<b>Limited (<math>\leq 4</math>) metastases</b>			
	Aoyama H et al	JAMA, June 7, Vol 295, No.21, 2006		
	Kocher M et al	JCO, 29:134-141, 2011		
	Aoyama H et al	IJROBP, Vol 68, No 5, 1388–1395, 2007		

# Introduction Aim Method and Materials Results Conclusion

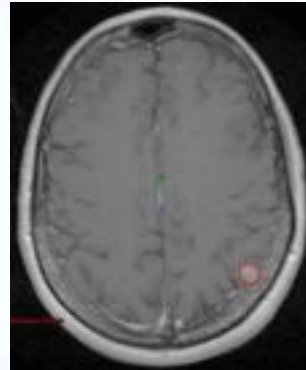


Dosimetric comparison between **static and volumetric IMRT technique** for brain metastases hypofractionated stereotactic treatment

Dosimetric comparison between static and volumetric IMRT technique with **single and multiple isocenters modalities** for multiple brain metastases stereotactic treatment

Oligometastatic pts(2-3 lesions)  
treated in our Department

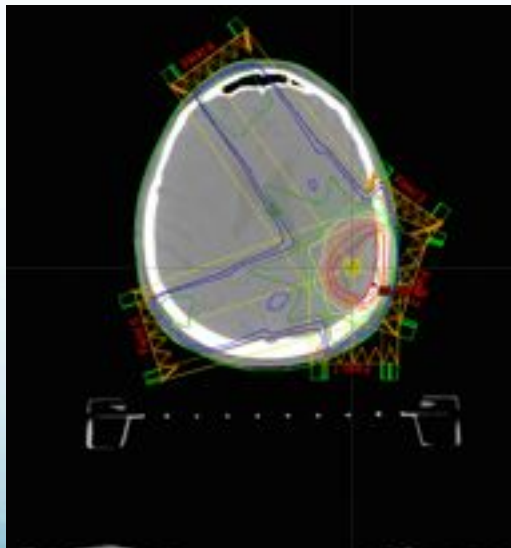
**Single or multiple lesions**  
(same lobe or contiguous)



**PTV: ring enhancement + 3 mm**  
**25.5 Gy/8.5 Gy fr**

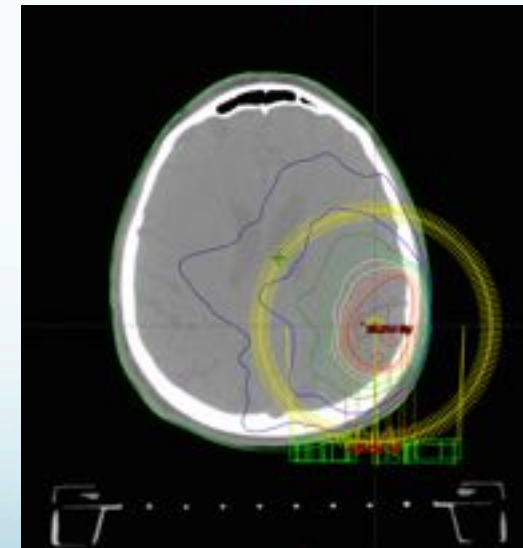
**STATIC IMRT**

5 fields



**VOLUMETRIC IMRT**

2 arc (179°/181°-181°/179°)



MLC Millennium Varian Medical Systems®  
RapidArc Varian Medical Systems® for volumetric IMRT

**MULTIPLE LESIONS** (Same lobe or contiguous)

**25.5 Gy/8.5 Gy fr**

**STATIC IMRT**

5 fields

**VOLUMETRIC IMRT**

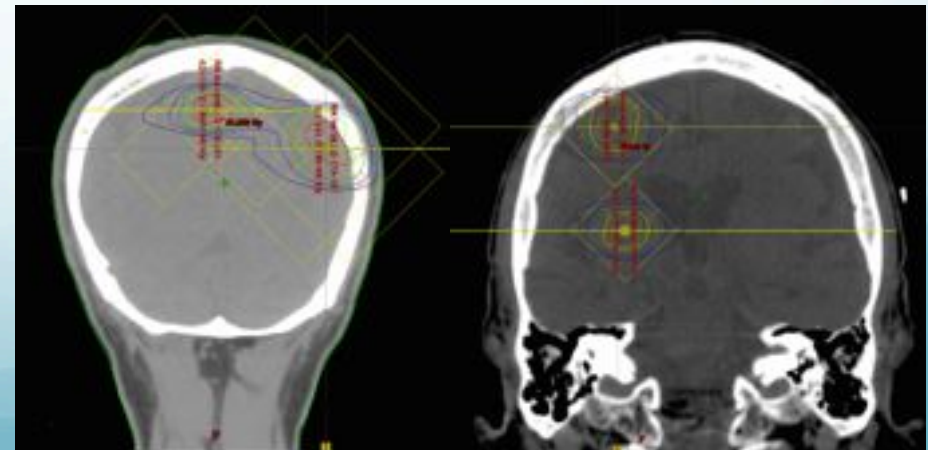
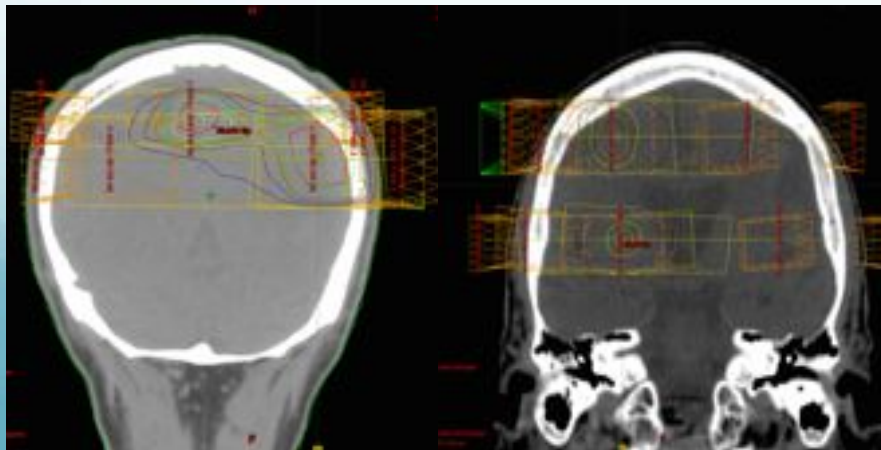
2 arc(179°/181°-181°/179°)

Single  
isocenter

Multiple  
isocenters

Single  
isocenter

Multiple  
isocenters

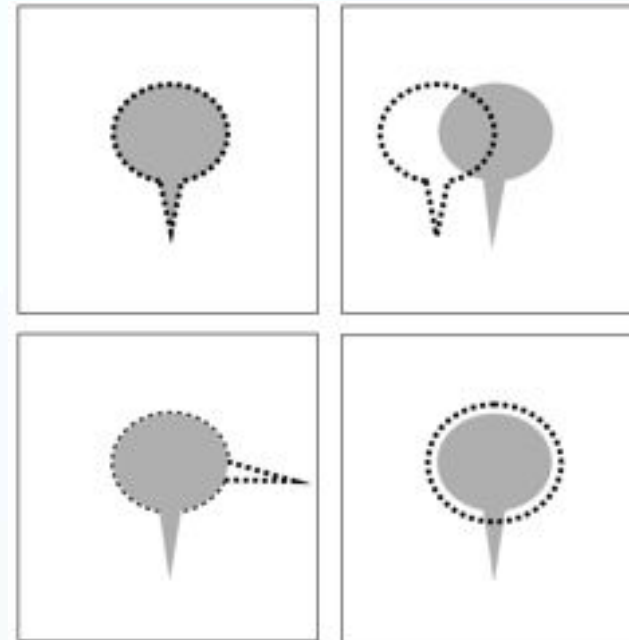


$$CI = V_{PI} / V_{PTV}$$

$$HI = D_{max} / D_P$$

$$PCI = (PTV \cap V_{PI})^2 / (PTV \times V_{PI})$$

$$GI = V_{50\%PI} - V_{PI}$$



- UM
- Normal brain mean dose
- Brainstem, optic chiasm, optic nerves maximum dose
- Hypocampus mean dose (EQD2)

20 lesions	static IMRT (median, range)	Volumetric IMRT (median, range)	P (Friedman test)
CI	1.63 (1.08-2.36)	1.50 (1.17-1.84)	0.236
HI	1.01 (1-1.10)	1.02 (1.01-1.05)	0.021
GI	1.25 (0.95-2.05)	1.15 (0.95-2.05)	0.083
PCI	0.64 (0.52-0.82)	0.58 (0.40-0.88)	0.236
UM	1523 (1195-2727)	1627 (1325-2306)	0.484
Dmean brain (Gy)	1.92 (0.69-8.70)	1.79 (0.68-6.27)	0.024
D max brainstem (Gy)	0.47 (0.09-24.98)	0.45 (0.08-24.26)	0.817
D max optic chiasm (Gy)	0.23 (0.11-11.21)	0.24 (0.09-8.72)	0.609
D max ON dx (Gy)	0.16 (0.07-2.35)	0.15 (0.15 (0.07-3.90)	0.791
D max ON sn (Gy)	0.14 (0.06-7.48)	0.17 (0.08-6.84)	0.805
D mean hippocampus (EQD2) (Gy)	0.22 (0.01-7.91)	0.22 (0.04-7.22)	0.632



13 lesions	Static IMRT		Volumetric IMRT		P (Friedman test)
	Single isocenter	Multiple isocenters	Single isocenter	Multiple isocenters	
CI	1.76 (0.37-12.25)	2.14 (1.51-11.19)	1.51 (1.39-1.65)	1.53 (1.35-1.83)	0.123
HI	1.01 (1.0-1.03)	1.01 (1.00-1.36)	1.02 (1.01-1.08)	1.04 (1.02-1.24)	0.060
GI	1.62 (1.40-2.05)	1.50 (1.30-1.70)	1.60 (1.25-1.95)	1.35 (1.15-1.60)	0.024
PCI	0.54 (0.07-2.59)	0.47 (0.08-0.63)	0.63 (0.58-0.69)	0.62 (0.45-0.71)	0.123
UM	1621.5 (1536-2688)	3323.5 (2693-4245)	1674.5 (1578-2254)	3345.5 (3029-4116)	< 0.001
Dmean brain (Gy)	3.72 (1.80-5.84)	3.52 (2.49-5.67)	3.84 (2.41-6.27)	3.22 (2.02-5.31)	0.009
D max brainstem (Gy)	4.41 (0.70-24.58)	14.84 (0.63-24.62)	4.41 (0.67-24.26)	4.41 (0.59-24.69)	0.419
D max optic chiasm (Gy)	0.78 (0.04-7.91)	0.69 (0.30-11.35)	1.21 (0.56-7.51)	0.61 (0.33-5.26)	0.490
D max ON dx (Gy)	1.33 (0.31-4.19)	1.37 (0.16-3.35)	1.81 (0.44-3.90)	1.23 (0.27-3.72)	0.061
D max ON sn (Gy)	0.87 (0.31-28.37)	0.78 (0.23-6.66)	1.59 (0.49-8.34)	1.37 (0.24-7.54)	0.088
D mean hippocampus (EQD2) (Gy)	0.61 (0.42-9.04)	0.41 (0.37-7.71)	1.16 (0.36-8.25)	0.62 (0.37-6.98)	0.206

*In our experience*

- **Static and volumetric IMRT** are both efficient technique for intensity modulated hypofractionated stereotactic treatment with similar plan quality
- **Volumetric IMRT** seems to results in lower gradient doses and normal brain doses in single isocenter modality
- **multiple isocenters** modality seems to reduce normal brain irradiation in treating multiple contiguous lesions