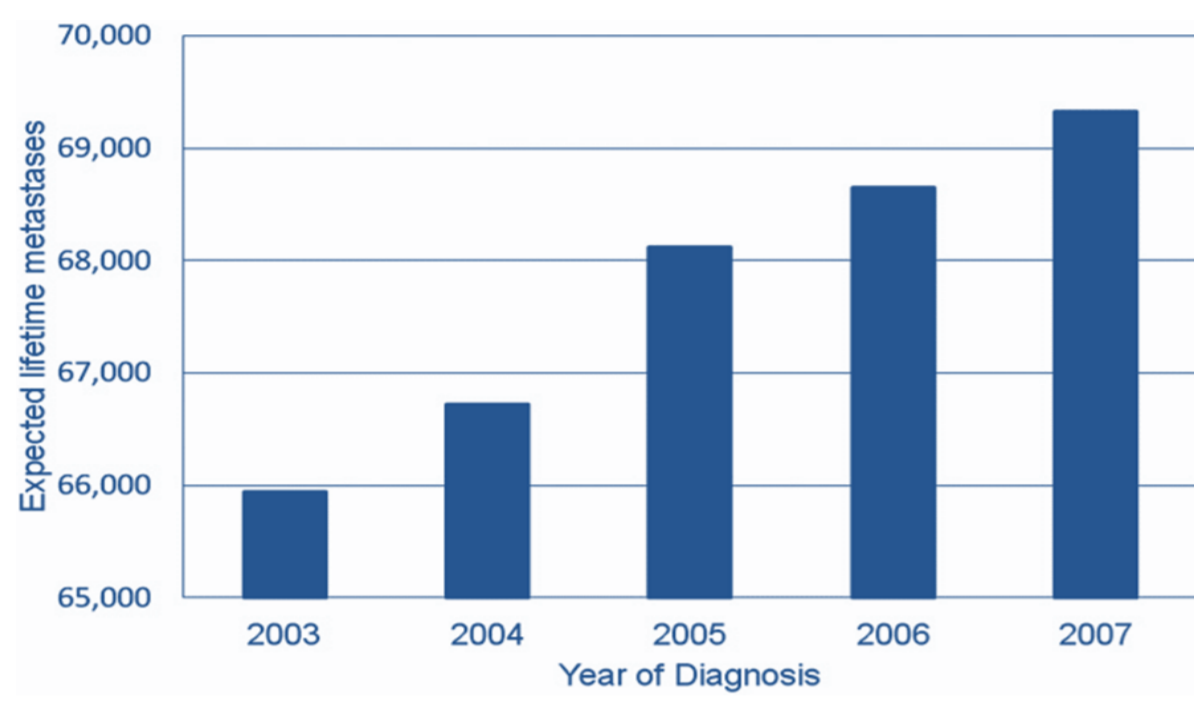


Heterogeneity in brain metastases - advanced MRI at the leading edge relates to recurrence, survival and aggressive growth patterns

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Background

Secondary brain tumours are common and we are seeing more of them



Toward determining the lifetime occurrence of metastatic brain tumours estimated from 2007 United States cancer incidence data (Davis, 2012)

The prognosis has remained dismal (median c. 2-3 months for all-comers) despite advances in treating primary cancers and patients are dying of brain metastases not with them.

WE DO NOT UNDERSTAND HOW LOCALLY INVASIVE THESE TUMOURS ARE

However, there are significant rates of local recurrence and we have shown that diffusion MRI changes at the brain-tumour boundary can predict survival and recurrence, as shown below.

Zakaria et al. BMC Medical Imaging 2014, 14:26
http://www.biomedcentral.com/1471-2342/14/26

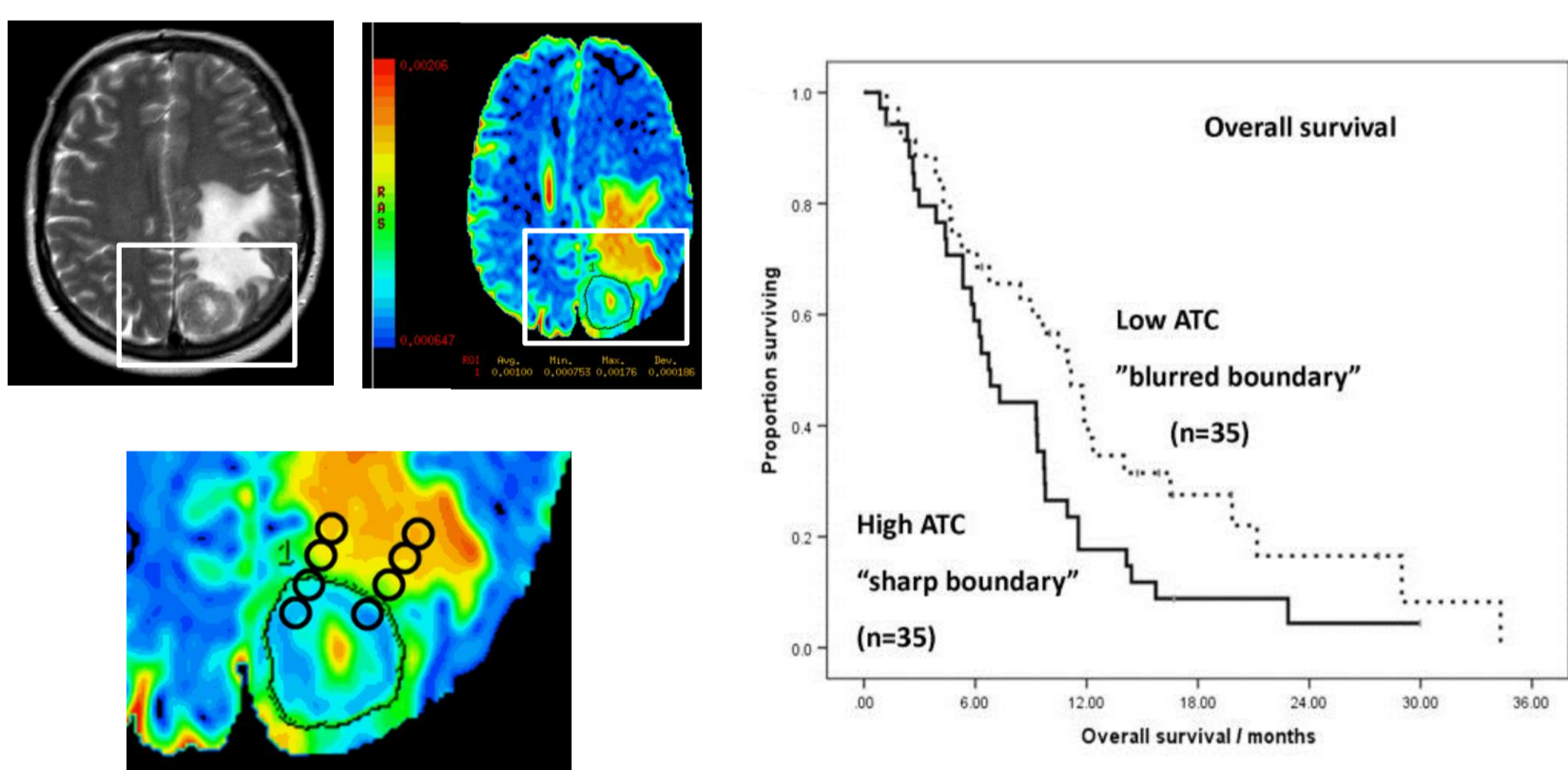


RESEARCH ARTICLE

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Diffusion-weighted MRI characteristics of the cerebral metastasis to brain boundary predicts patient outcomes

Rasheed Zakaria^{1,2*}, Kumar Das³, Mark Radon³, Maneesh Bhojak³, Philip R Rudland², Vanessa Sluming⁴ and Michael D Jenkinson^{1,3}



Advanced MRI is being widely used in clinical practice for diagnosis and surgical planning

Zakaria et al. Cancer Imaging 2014, 14:8
http://www.cancerimagingjournal.com/content/14/1/8

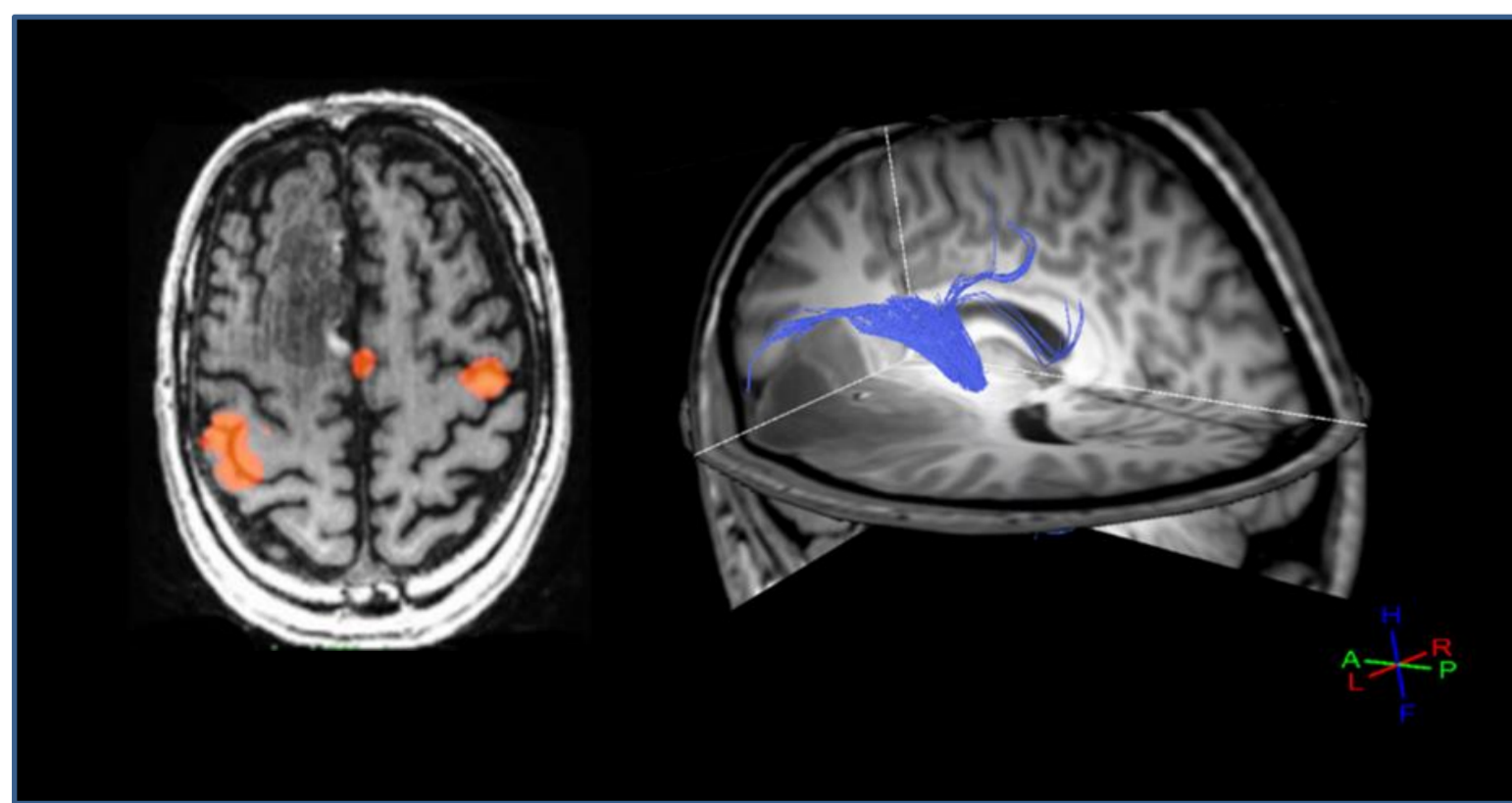


REVIEW

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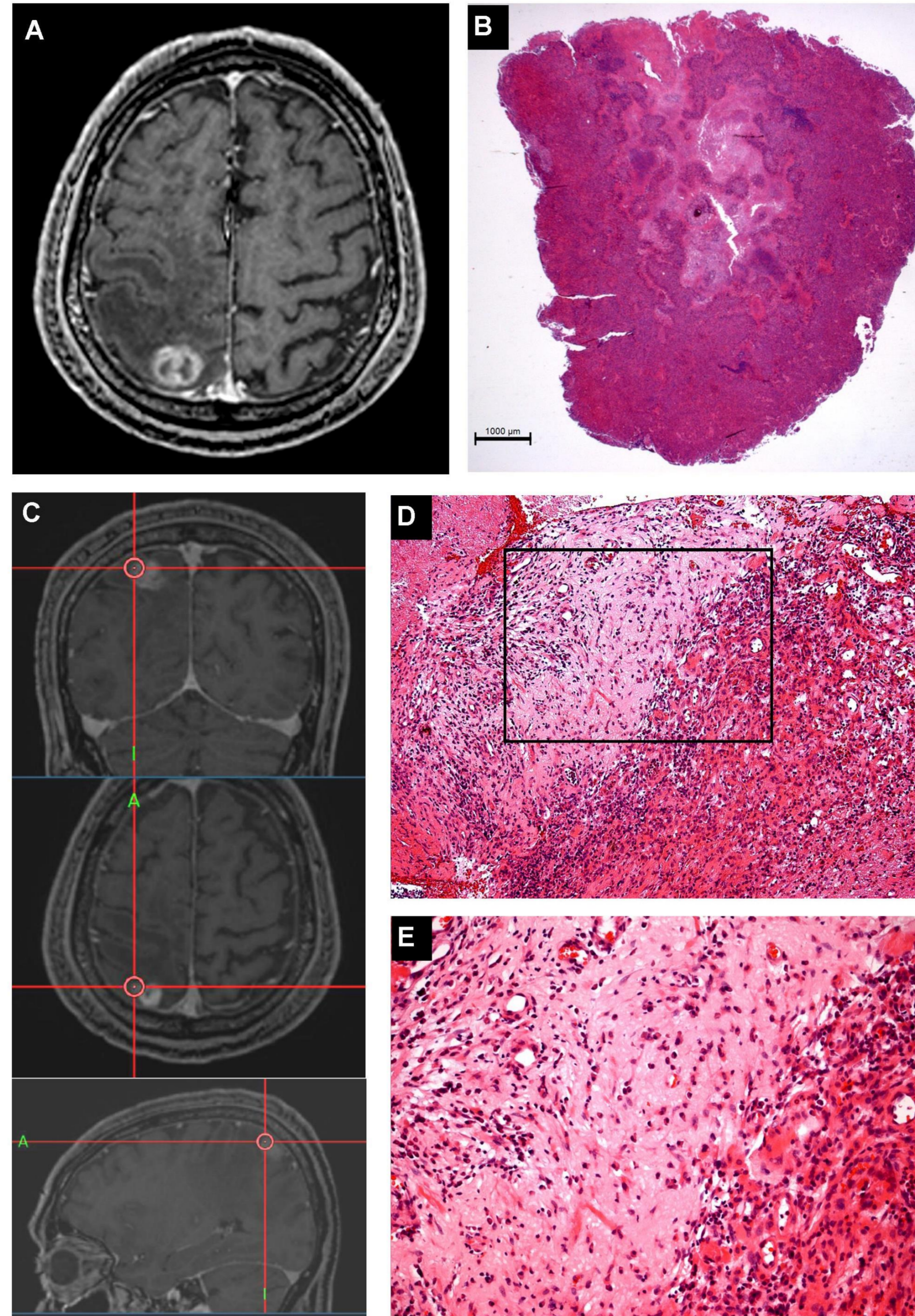
The role of magnetic resonance imaging in the management of brain metastases: diagnosis to prognosis

Rasheed Zakaria^{1,2*}, Kumar Das³, Maneesh Bhojak³, Mark Radon³, Carol Walker³ and Michael D Jenkinson^{1,4}



We prospectively investigated intra- and inter-tumour heterogeneity in a series of brain metastases undergoing advanced MRI followed by image guided neurosurgical sampling from the leading edge in the course of resection.

Methods



Pre-operative 3T MRI was obtained with 32 direction DTI and T1 with gadolinium. Image guided sampling was performed as shown at the leading edge of the tumour as it was removed. Histogram analysis of regions of interest were matched to tissue locations. Growth pattern was assessed by a pathologist using a previously described classification and CD34, Ki67, necrosis and cellularity were scored semi-automatically using NIH ImageJ software. Survival and brain recurrence were recorded.

The Neurology Journal 27: 422-424, 2014 - doi: 10.15274/NRJ-2014-10075

www.centrauro.it

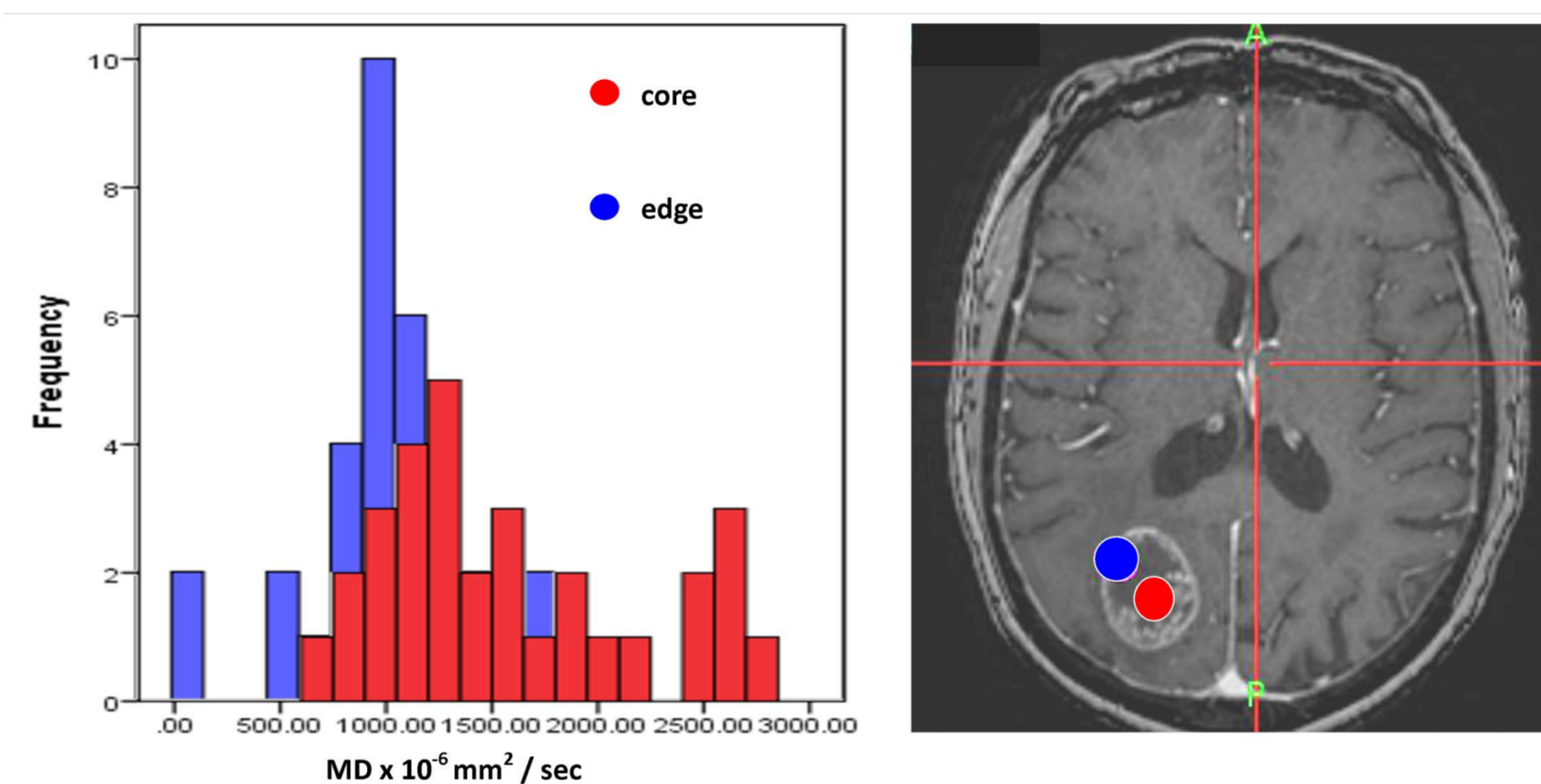
Using ADC Maps with Structural Scans to Improve Intraoperative Biopsy Specimens in Brain Metastases

RASHEED ZAKARIA^{1,2*}, MICHAEL D. JENKINSON¹

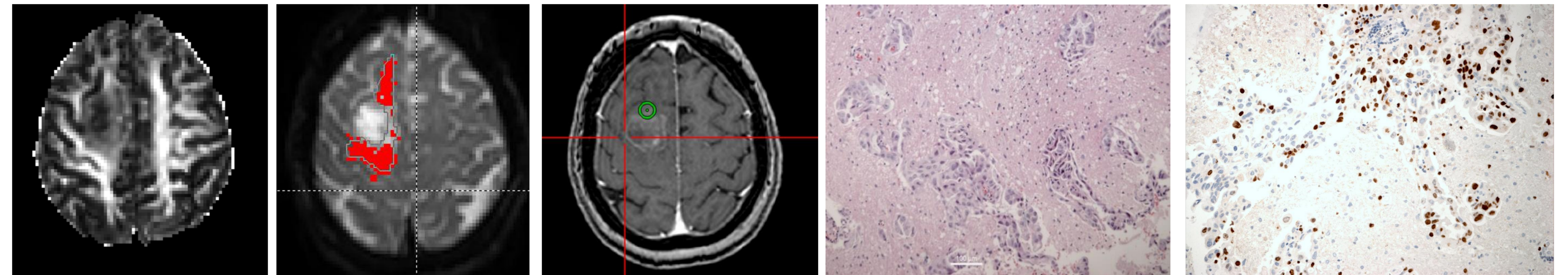


Results

The mean diffusivity (MD) values recorded at the edge of metastases were significantly different in distribution, median and mean from those at the core (Wilcoxon matched pairs, $p=.001$).



There was significantly higher necrosis ($p=.026$) and a trend to higher CD34 density at the leading edge versus the core. MD and the change in MD across the leading edge correlated with cellularity ($p=-.41$, $p=0.047$) but did not predict clinical outcomes nor pathological growth pattern.



Metastases which appeared more diffusely invasive pathologically (above right H&E, Ki67) had a significantly lower peritumoral fractional anisotropy (FA) ($p=0.039$) suggesting more tract white matter disruption (above and left FA map). These tumours also had more dense CD34 staining ($r=-.55$, $p=0.041$) at their leading edge and a trend to lower survival and more rapid intracranial recurrence.

Age at surgery (median, range)	62.9 years	(23.9 – 76.0)
Gender	Female	14 (54%)
	Male	12 (46%)
Primary carcinoma	Non-small cell lung	13 (50%)
	Breast	4 (15%)
	Melanoma	4 (15%)
	Endometrial	1 (4%)
	Colorectal	1 (4%)
	Renal	1 (4%)
Extracranial disease?	Absent	18 (69%)
	Present	8 (31%)
Controlled primary?	Synchronous presentation	9 (35%)
	Yes	17 (65%)
Adjuvant whole brain radiotherapy?	No	5 (19%)
	Yes, 30 Gy in 10#	21 (81%)
Adjuvant chemotherapy?	No	13 (50%)
	Yes	13 (50%)

Conclusions

There is significant intra-tumoral heterogeneity among brain metastases and assessment of the brain-tumour interface radiologically and biologically may yield more useful information about behaviour and prognosis than assessing the whole metastasis.