

LINKING OPTIC NERVE SHEATH DIAMETERS AND GLIOBLASTOMA MULTIFORME: A RETROSPECTIVE ANALYSIS

Alysha Vartevan, Tyler Campbell, and Steven Deprima

DEPARTMENT OF RADIOLOGY, LARKIN COMMUNITY HOSPITAL/NOVA SOUTHEASTERN COLLEGE OF OSTEOPATHIC MEDICINE

Introduction

The optic nerve sheath diameter (ONSD) measurement includes the dural sheath, subarachnoid space and optic nerve (1). Increased ONSD has long been associated with increased intracranial pressure. Increased intracranial pressure is often associated with trauma (1). Some of the clinical symptoms in increased ICP include headache, vomiting, and drowsiness (1). These findings are often non-specific, and there have been attempts to find alternative methods of diagnosing increased ICP including measuring ONSD (1). To our knowledge, there have been no studies examining the specificity of increased ONSD. More specifically, there have not been studies examining the relationship between ONSD and primary intracranial tumors to our knowledge. We are examining the relationship between ONSD with T2 MRI imaging and Glioblastoma Multiforme.

Methods

After Institutional Review Board (IRB) approved the study, images from 24 patients with GBM were retrospectively examined by two independently trained observers. A 1.5 T Siemens magnetom Avanto was used to obtain all MR images. Axial T2 MR imaging was utilized in all patients to measure the ONSD. The right and left ONSD was measured at the insertion to the globe as well as 4 mm posterior to the insertion to the globe. The largest dimension of the tumor was also considered a standard measurement. Three patients were excluded because of infiltrating masses with indistinct dimensions on their MRI scans.

Results

Descriptive Statistics

	Mean	Std. Deviation	N
largestdimesion	54.4286	17.31061	21
ONSD_Right_AVG	6.7707	.63311	21
OSND_Left_AVG	6.5636	.69620	21

Descriptive statistics were 54.4 ± 17.3 cm for the largest tumor dimension, 6.8 ± 0.6 mm for the ONSD on the right, and 6.5 ± 0.7 mm for the ONSD on the left.

Intraclass Correlation Coefficient

	Intraclass Correlation ^b	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.899 ^a	.781	.955	18.770	23	23	.000
Average Measures	.947 ^c	.877	.977	18.770	23	23	.000

	Intraclass Correlation ^b	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.908 ^a	.798	.959	20.631	23	23	.000
Average Measures	.952 ^c	.888	.979	20.631	23	23	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

- The estimator is the same, whether the interaction effect is present or not.
- Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.
- This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

The intraclass correlation for the average measurements between the two observers was 95%. Hierachial multiple regression was used to test the association between tumor size and ONSD size to demonstrate the independent contribution of these predictors in accounting for tumor size variance

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	2041.952	2	1020.976	4.651	.024 ^b
Residual	3951.191	18	219.511		
Total	5993.143	20			

- Dependent Variable: largestdimesion
- Predictors: (Constant), OSND_Left_AVG, OSND_Right_AVG

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	56.847	40.994		1.387	.182					
	ONSD_Right_AVG	-13.187	5.567	-.482	-2.369	.029	-.301	-.487	-.453	.884	1.132
	OSND_Left_AVG	13.234	5.062	.532	2.614	.018	.368	.525	.500	.884	1.132

- Dependent Variable: largestdimesion

When controlling for each of the ONSD sides, the ONSD size was shown to significantly (r=.0489, p = 0.024) predict 24% of the variance in the size of the tumor.

Images

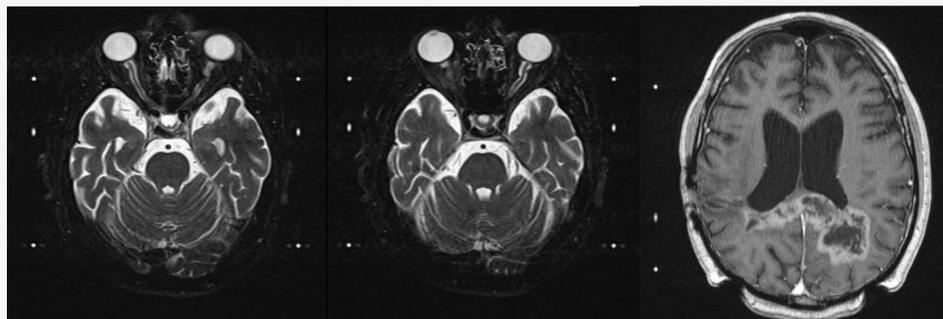


Fig. 1
Axial T2 image shows the right side ONSD at the insertion to the globe measuring 7.015 mm

Fig. 2
Axial T2 image shows the left side ONSD at the insertion to the globe measuring 7.05 mm

Fig. 3
Axial T1+Gad shows a Butterfly Parietal lesions with largest dimension measuring 80 mm

Discussion

One previous study found an increased ONSD on MR imaging was associated with increased intracranial pressure in patients with traumatic brain injuries. The measurement of the ONSD was 6.31 +/- 0.50 mm in patients with increased intracranial pressure and 5.08 +/- 0.52 mm in healthy volunteers. Although increased ONSD has long been associated with increased intracranial pressure, there have been no studies to our knowledge examining the specificity of increased ONSD. Our retrospective analysis found a measurement of 6.8 ± 0.6 mm for the ONSD on the right and 6.5 ± 0.7 mm for the ONSD on the left. We discovered that the ONSD has a direct relationship with GBM tumor size which is statistically significant. In addition, there is no significant difference in measurements obtained between two independently trained observer, which signifies that the ONSD is a measurement that can be utilized in practice.

Conclusion

Although the sample size was small and a larger patient population is needed, these results suggest the ONSD size is strongly associated with tumor size. Our results suggest that ONSD size could be a promising indicator of GBM tumor growth and/or regression after treatment. We are currently examining the relationship between ONSD and treated GBM tumors with gamma knife radiosurgery.

References:

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