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# Experiential Summary of 286 Cases of Brain Surgery in Older Adults Using A Navigable Tubular Retractor System for the Trans-sulcal Removal of Deep-Seated Brain Tumors & Vascular Hemorrhages, Malformations & Lesions

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## DISCLOSURES:

**Martina Cartwright, PhD has received employee compensation and consulting fees from NICO Corporation and has been a co-author of NICO publications. Dr. Cartwright is also on the Abbott Nutrition speaker's bureau and receives consulting fees from Cassiopea SpA Dermatology. Dr. Juan Alzate has received consulting fees from NICO Corporation.**

## INTRODUCTION:

**Older adults have the highest incidence of glioblastoma multiforme (GBM) & glioma. Evidence supports survival & mortality benefits of maximal resection & awake craniotomy in those ≥65 years. Similarly this cohort benefits from rapid evacuation of intracranial vascular events. A-traumatic access & awake surgery are key to functional preservation. We describe a navigable trans-sulcal tubular retractor system (NTRS) engineered to reach deep-seated brain lesions parafascicularly in an older adult cohort.**

## METHODS:

**An observational analysis of adults ≥65 years undergoing mini-craniotomies using a NTRS for brain tumors/lesions & intracranial vascular events was performed. A minimally disruptive, automated, non-heat generating side-cutting resection tool was used in the majority of cases. Demographic characteristics, tumor/lesion location, pathology, size, surgical mortality were examined.**

## RESULTS:

**286 patients >65 years (n=42 >80 years) underwent NTRS surgery between December 12, 2012- September 30, 2017. Demographics, tumor and/or vascular lesion location, operative time and deaths are shown on Tables 1 & 2. Confirmed tumor pathologies included: GBM=26; metastatic tumors =14 & glioma=10. There were 17 metastatic tumors. Awake surgery & maximal resection were performed when feasible.**

**Of the 116 in the vascular cohort, the most common vascular issue was Intracranial Hemorrhage (ICH) affecting 96.5% (112/116) with 4 intraventricular hemorrhages; there was 1 cavernous malformation, 1 ateriovenous malformation & 2 "other." Average vascular size =1.76 cm. No deaths were associated with NTRS surgery in either group.**

**TABLE 1: Demographics & tumor/vascular lesion characteristics, ≥65 years**

| | Tumors & Lesions | Vascular Lesions, Hemorrhages & Malformations | Total |
|---|---|---|---|
| Total N | 170 | 116 | 286 |
| Age Range (years) | 65-92 | 65 – 91 | --- |
| Mean Age (years) | 72.2 | 72.2 | --- |
| Females | 84 | 42 | 126 |
| Males | 79 | 72 | 151 |
| Location | | | |
| Subcortical | 79 | 49 | 128 |
| Subcortical & Cortical | 20 | 29 | 49 |

| | | | |
|---|---|---|---|
| Cortical | 7 | 8 | 15 |
| Intra-ventricular | 9 | 4 | 13 |
| Other | 1 | 0 | 1 |
| Deaths | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| Mean Size (centimeters) | 2.80 | 1.76 | 2.28 |
| Mean Operative Time (minutes) | 178.43 | 123.61 | 151.02 |

**TABLE 2: Demographics & tumor/vascular lesion characteristics, ≥80 years**

| | ≥80 Years (n=35) | ≥85 Years (n=7) | Totals |
|---|---|---|---|
| Tumors & Lesions | 18 | 5 | 23 |

| | | | |
|---|---|---|---|
| **Mean Lesion Size (cm)** | **3.05** | **3.14** | **3.09** |
| **Mean Operative Time (min)** | **185.05** | **189.07** | **187.06** |

| | | | |
|---|---|---|---|
| **Vascular Lesions, Hemorrhages & Malformations** | **17** | **2** | **19** |
| **Mean Lesion Size (cm)** | **1.02** | **0.8** | **0.91** |
| **Mean Operative Time (min)** | **132.5** | **150** | **141.25** |

**CASE: A 76-year-old female presented with a 2.5x2.0x1.7 intraventricular (IV) ependymoma. A right frontal approach via the superior frontal sulcus was planned. A 75mm NTRS sheath was chosen based on the calculated distance. After NTRS cannulation, the hard lesion was resected using the side-cutting tool; although gross total resection was the goal, near total resection was achieved as the posterior of the tumor adhered to the IV wall. Total surgical time=160 min. The patient recovered & received radiation & chemotherapy.**

## DISCUSSION:

**This experiential review represents the largest reported cohort of older adults undergoing NTRS surgery for tumors and vascular malformations & demonstrates its utility in reaching a variety of lesions primarily located in subcortical and intraventricular regions. We demonstrate that a NTRS coupled with multifunctional tool provides a-traumatic access & can be performed under awake conditions with a goal of maximal resection/evacuation. Older age should not preclude patients from receiving brain tumor surgery or timely intracranial hemorrhage evacuation.**

## SUMMARY POINTS:

- Adults >65 years have the highest incidence of glioblastoma multiforme & malignant glioma incidence is greatest among those >85 years
- Age is a predictor of brain tumor surgery & there is growing evidence to support the survival & morbidity benefits of maximal resection in older adults
- Treatment for elderly patients with primary brain tumors should be individualized and age alone should not preclude the use of more aggressive treatments
- Surgery using a NTRS may foster maximal tumor resection under awake conditions, which can mitigate permanent post operative neurological deficits, particularly for tumors located in or around eloquent brain