TRAUMATIC CAROTID & VERTEBRAL ARTERY INJURIES

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DISCLOSURE: NONE
GOALS & OBJECTIVES

- **Understand the meaning of traumatic arterial dissection of the neck**

- **Understand the diagnostic algorithm of traumatic arterial dissection of the neck**

- **Understand the variety of potential therapeutic options**
BACKGROUND

- **Blunt Head and Neck Trauma are Associated with Underlying Carotid and Vertebral Artery Injury**

- **The Degree of Severity of the Arterial Lesion Has a Wide Range**

- **Clinical Presentation: Asymptomatic vs Symptomatic**
SYMPTOMATIC LESIONS:

1. **LOCAL EFFECT**: HORNER’S, LOWER CRANIAL NERVE DYSFUNCTION TINNITUS PULSATILE CERVICAL MASS, PULSATILE PHARYNGEAL MASS

2. **DISTAL ORGAN DAMAGE**: TIA AND OR ISCHEMIC STROKE
CLASSIFICATION OF CERVICAL ARTERIAL DISSECTION

- Spontaneous
- Traumatic (Blunt Trauma)
DIFFERENCES BETWEEN SPONTANEOUS VERSUS TRAUMATIC CERVICAL ARTERIAL DISSECTION

SPONTANEOUS
- NO TRAUMA OR LOW ENERGY (TRIVIAL) TRAUMA (SPORTS, NOSE BLOWING, SNEEZING, COUGHING, SUSTAINED NECK POSTURING, YOGA)
- UNDERLYING VASCULAR OR SYSTEMIC COLLAGEN DEFECT/DISEASE

TRAUMATIC
- BLUNT TYPE TRAUMA
- HIGH ENERGY TRAUMA OR DIRECT BLOW TO THE ARTERY (MVA, FALLS, STRANGULATION)
- INTIMAL DISRUPTION
- HYPERCOAGULABILITY ASSOCIATED WITH BLUNT TRAUMA/TBI
EXTRACRANIAL INTERNAL CAROTID VERSUS Vertebral Artery Traumatic Dissection

ICA Dissection
- Suprabulbar ICA
- Posterior wall is compressed and stretched at the styloid process
- Rapid extension and rotation causes stretching of the ICA
- Skin laceration and hematomas are common
- Politrauma

Vertebral Dissection
- C2 is the most common site
- Subluxation and fractures of C1-C6 including disruption of the foramen transversarium
- Bilateral involvement (more common than carotids)
- Common in elderly
2017 European Stroke Conference in Berlin, Germany

Table 1: Demographic, clinical characteristics, in-hospital events and outcomes of patients with motor vehicle trauma related carotid, vertebral and combined dissections in United States (NIS: 2011-2014)

<table>
<thead>
<tr>
<th></th>
<th>Traumatic carotid artery dissection (TCAD)</th>
<th>Traumatic vertebral artery dissection (TVAD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>1300 (43.7%)</td>
<td>1669 (56.7%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Age (mean years ± SD)</td>
<td>38.2 (116.8)</td>
<td>48.4 (139.4)</td>
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<tr>
<td>Age categories</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤64</td>
<td>830 (63.8)</td>
<td>820 (59.0)</td>
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<tr>
<td>45-64</td>
<td>365 (28.1)</td>
<td>521 (31.0)</td>
<td>0.01</td>
</tr>
<tr>
<td>≥65</td>
<td>104 (8.0)</td>
<td>332 (19.9)</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>571 (43.9)</td>
<td>672 (40.1)</td>
<td>0.34</td>
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<tr>
<td>Race/Ethnicity™</td>
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<tr>
<td>White</td>
<td>852 (71.0)</td>
<td>1094 (72.3)</td>
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<tr>
<td>Black</td>
<td>168 (14.0)</td>
<td>149 (9.9)</td>
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<tr>
<td>Hispanic</td>
<td>119 (10.0)</td>
<td>162 (10.7)</td>
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<tr>
<td>Other (Asian or Pacific Islander, Native American and other)</td>
<td>60 (5.0)</td>
<td>107 (7.3)</td>
<td>0.71</td>
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<tr>
<td>Medical co-morbidities</td>
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<tr>
<td>Hypertension</td>
<td>230 (22.4)</td>
<td>488 (29.2)</td>
<td>0.05</td>
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<tr>
<td>Diabetes mellitus</td>
<td>45 (3.5)</td>
<td>184 (11.0)</td>
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<tr>
<td>Congestive heart failure</td>
<td>8 (0.7)</td>
<td>35 (2.0)</td>
<td>0.10</td>
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<td>Coagulopathy</td>
<td>115 (8.9)</td>
<td>85 (5.3)</td>
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<tr>
<td>Chronic lung disease</td>
<td>93 (7.1)</td>
<td>120 (7.2)</td>
<td>0.99</td>
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<tr>
<td>Atrial fibrillation</td>
<td>19 (1.5)</td>
<td>80 (4.7)</td>
<td>0.02</td>
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<tr>
<td>Dyslipidemia</td>
<td>83 (6.4)</td>
<td>202 (12.1)</td>
<td>0.01</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>182 (14.0)</td>
<td>291 (17.4)</td>
<td>0.26</td>
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<tr>
<td>Nicotine independence</td>
<td>191 (14.8)</td>
<td>372 (22.2)</td>
<td>0.01</td>
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<tr>
<td>In-hospital complications</td>
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BACKGROUND

Carotid and vertebral artery dissections are relatively common causes of ischemic stroke. Comparative analysis between carotid and vertebral artery dissections related to motor vehicle trauma at the national level is not well studied.

OBJECTIVE

To compare patterns of injury and in-hospital outcomes in motor vehicle related traumatic carotid versus vertebral artery dissections at national level.

METHODS

A retrospective study was conducted using a national database (years 2001 to 2014).

To identify the patients from the database who suffered motor vehicle, we used ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification) E-codes: motor vehicle crash – driver E811-E816(0); motor vehicle crash – passenger E811-E816(1); motorcycle – driver E811-E816(2); motorcycle – passenger E811-E816(3); and pedestrian E811-E816(7).

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Out of this motor vehicle accident traumatic group, we identified patients admitted with primary diagnosis (DX1) of carotid and vertebral artery dissection using respective ICD-9-CM respective codes: 443.21 and 443.24.

We compared traumatic carotid and vertebral artery dissections for baseline demographics, medical co-morbidities, in-hospital complications, in-hospital procedures, neurological insults, head and neck injuries, other injuries, total hospital charges, length of stay, discharge disposition and in-hospital mortality.
• RESULTS

❖ A TOTAL OF 2969 PATIENTS HAD EITHER CAROTID (N= 1300, 44%) OR VERTEBRAL (N= 1669, 56 %) ARTERY DISSECTION DURING THE STUDY PERIOD (2011-2014).

❖ PATIENTS WITH VERTEBRAL ARTERY DISSECTIONS WERE OLDER (MEAN ±SD: 46.4 ±19.4 YEARS VERSUS 38.2 ±16.8 YEARS, P = 0.01) AND HAD MORE VASCULAR RISK FACTORS (HYPERTENSION, DIABETES MELLITUS, ATRIAL FIBRILLATION, DYSLIPIDEMIA AND NICOTINE DEPENDENCE).

❖ VERTEBRAL ARTERY DISSECTION PATIENTS WERE MORE COMMONLY ASSOCIATED WITH (83%) FRACTURES OF CERVICAL VERTEBRAE EITHER WITHOUT SPINAL CORD INJURY (66.5%) OR WITH SPINAL CORD INJURY (16.5%).
IMAGING:
NON INVASIVE NEUROVASCULAR IMAGING

1. DSA CTA MRA

2. MRI Wall Imaging/Dissection protocol
Grade I: intimal irregularity with <25% stenosis
Grade II: intimal irregularity with >25% stenosis
Grade III: >50% stenosis and or pseudoaneurysm
Grade IV: Vessel occlusion
Grade V:
Vessel rupture, extravasation or fistula
PROGNOSIS
WHAT’S THE FATE OF ARTERIAL DISSECTION?

1. Heal back to normal
2. Defective healing (worsening stenosis, interval symptomatic or asymptomatic arterial occlusion and occasionally enlarging pseudoaneurysm)

- Grade I & II: Can spontaneously heal; observation is a valid option
- Grade III: Course can be unpredictable
- Grade IV: Quite stable and fixed lesion (remains occluded)
- Grade V: Require urgent treatment (hemodynamic compromise)
Medical Therapy: Antithrombotics
Anticoagulation challenges,

- Ongoing hemorrhage
- Impending surgery
- Bleeding diathesis
- Intracranial hematomas
- Recent cerebral infarction
- Sub-therapeutic
ALGORITHM

Grade I
- Aspirin
- Follow up CTA in 1 to 2 weeks
  - Stent/coil if no improvement Vs Aspirin if improving

Grade II
- Aspirin
- Follow up CTA in 1 to 2 weeks
  - Stent/coil if no improvement Vs Aspirin if improving

Grade III
- Aspirin
- Follow up CTA in 1 to 2 weeks
  - Stent/coil if no improvement Vs Aspirin if improving

Grade IV
- Aspirin
- Follow up if no improvement
  - Stent/coil if no improvement Vs Aspirin if improving

Grade V
- Aspirin
- Follow up at the operator's discretion
  - Endovascular
WHEN TO CHECK FOR TRAUMATIC DISSECTION?

- Neck soft tissue injury, cervical expanding hematoma or arterial hemorrhage
- Near hanging
- GCS <6
- Basilar skull fracture
- C-spine fracture
- LeFort II or III fracture
- New Stroke on follow-up Head CT
- Focal neuro deficit
- Horner’s syndrome
CASE PRESENTATION

- Middle age woman presented persistent pain in the lateral aspect of the neck (right side) getting worse in the last 6 months plus multiple episodes of transient visual obscuration (OD) and right Horner’s syndrome
- Victim of domestic violence in the past
- Symptoms started a year ago when her partner strangulated her neck
TAKE HOME MESSAGES

• **Traumatic Injury (dissection/tearing/occlusion/rupturing) of the cervical and cerebral arteries is not uncommon in tertiary center (Level I Trauma)**

• **Established protocol lead to early detection**

• **Early diagnosis favors improve outcomes**
TAKE HOME MESSAGES

- **Single antiplatelet agent (aspirin)** is the universal treatment
- **Dual antiplatelet therapy (ASA & PLAVIX) in preparation for endovascular vessels reconstruction (stent placement)**
- **Parenteral and oral anticoagulation only in special circumstances**
- **Expert consultation (Neuro-IR) is recommended**