Aviation Neurology

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Neurological Disorders: Considerations in decision making

**Deficit**
- Is there a focal deficit? If so, is it functionally significant?
- Is there cognitive impairment?
- Is there risk of an event in flight?

**Episodic**
- What is the recurrence risk in flight?
- Is there predictability?
- Are there measures to reduce recurrence?
- Does risk lower with the passage of time?
- Is there a focal deficit? If so, is it functionally significant?
Annual Incidence of Most Common Adult-Onset Neurologic Disorders

- HIV (AIDS) dementia, 0.1%
- ALS, 0.4%
- Multiple sclerosis, 0.9%
- Brain tumor, 2.8%
- Parkinson's disease, 4.7%
- Traumatic brain injury, 6.8%
- Epilepsy 11.6%
- Alzheimer's disease 21.4%
- Stroke 51.3%
Common neurological conditions in aviators

- Syncope
- Seizure
- Migraine
- Traumatic Brain Injury
- Neoplasm
- Vascular
- Neurodegenerative?
Syncope
Syncope

• LOC and postural tone due to global cerebral hypoperfusion, followed by spontaneous recovery

• Vasovagal, neurocardiogenic, neuroregulatory, neurally mediated syncope are synonymous

• Often benign, but may indicate serious disease such as cardiac syncope
Syncope

- hypotonic, flaccid, limp, “dead weight”
- pallid, colorless, white, sometimes grayish
- shallow to nearly imperceptible respirations
Pallid Syncope: Features

- Nearly always when upright
- Lengthy prodrome of 2-5 minutes in vasovagal syncope
- GI, respiratory, visual autonomic symptoms
- “Syncopal slump”, brief LOC for 10-15"
- Shallow nearly imperceptible respirations
- Little or no confusion
Syncope: Accompaniments

- Urinary incontinence in 10-15%
- Convulsive accompaniments in 10%
- (state of functional decerebration)
- May lead to incorrect diagnosis of seizure disorder, so beware of possible incorrect diagnosis
Mechanisms of Syncope

• Vasovagal (~50%): pain, sight of blood, exertion, micturition, medical procedure

• Orthostatic/dysautonomic: hypovolemia (blood loss, dehydration), medication, alcohol

• Cardiac:
  - Output: Valvular stenosis, IHSS
  - Rhythm: Brady, tachy, mixed arrhythmias
Syncope: disposition

- Single vasovagal, explained: may be fit
- May need further evaluation (cardiac, neurologic)
Spartan Executive
Seizure (s)
Seizure Disorder

- Definition: A tendency to recurrent (two or more) unprovoked seizures

- Epilepsy and convulsive disorder are synonymous terms

- An abnormal excessive discharge of cerebral cortical neurons
Basic Seizure Classification

• Partial (focal) seizures
  Simple partial: consciousness preserved
  Complex partial: consciousness impaired

• Partial with secondary generalization
  (culminating in grand mal seizure)
Generalized tonic-clonic seizure

- Aura, epileptic cry, posturing: “the turns”
- Tonic phase: stiffening, collapse, cyanosis, apnea
- Clonic phase: rough noisy respirations, tongue biting, incontinence, blood tinged saliva
- Post-ictal phase: confusion, combativeness, sleep
- Amnesia for the event
- Headache, nausea/emesis, muscle soreness
- Duration: 1 minute
Etiology of Seizures

- Lesional: scar, stroke, malformation, neoplasm
- Hereditary
- Acute symptomatic (hyponatremia, other)
- Medication/controlled substances/alcohol
- 66% idiopathic
Epilepsy Needs:

- Need Detailed clinical story
- Need EEG (capturing wake and sleep)
- Need MRI
Seizures: Aeromedical Disposition

- Seizures tend to recur, must defer

- Febrile seizures OK, and certain childhood seizures may enjoy permanent remission

- Adult-onset single unprovoked seizure, no risk factors: four years medication-free observation, then OK
Seizures: Aeromedical Disposition

- Recurrent seizures: ten years seizure free, three years medication free

- Single seizure with no risk factors (history, EEG, MRI, prior insult, family history), OK exam

- Few have been certified following epilepsy surgery
Migraine
Migraine

- Common migraine: no aura
- Classic migraine: aura followed by headache
- Migraine equivalent (migraine variant, acephalgic migraine): aura without headache
Migraine: Aeromedical Disposition: consider......

- Prodrome
- Precipitating factors & predictability
- Aura
- Rapidity of onset
- Severity
- Frequency
- Treatment (acute, prophylactic, life style change)
Migraine Treatment

- Beta Blockers OK
- Calcium channel blockers OK
- Triptans OK (12 hour no fly)
- NSAIDs
- OTC non sedating
- No anticonvulsants (topiramate, valproic acid)
AME Guide: Migraine

- Requires FAA decision if significant complications
- Submit all pertinent medical records, neurologic report to include characteristics, frequency, severity neurologic phenomena, medication, side effects.
- Defer initially if in doubt
Traumatic Brain Injury

Figure 2: July 1917, von Richthofen with his nurse Sister Käte at field hospital No 76 in Kortrijk, Belgium, after having received a head wound during aerial combat.
Nature of TBI

Concussion
Closed
Penetrating
Diffuse axonal injury
Contusion
Laceration
Intracranial hematoma
# Severity of TBI

<table>
<thead>
<tr>
<th>Glasgow Coma Score</th>
<th>Post Traumatic Amnesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>13-15</td>
</tr>
<tr>
<td>Moderate</td>
<td>9-12</td>
</tr>
<tr>
<td>Severe</td>
<td>6-9</td>
</tr>
<tr>
<td>Very severe</td>
<td>3-6</td>
</tr>
<tr>
<td>Mild</td>
<td>0-1 hour</td>
</tr>
<tr>
<td>Moderate</td>
<td>1-24 hours</td>
</tr>
<tr>
<td>Severe</td>
<td>1-7 days</td>
</tr>
<tr>
<td>Very severe</td>
<td>&gt; 7 days</td>
</tr>
</tbody>
</table>
Epidural Hematoma
Subdural Hematoma
Parenchymal Blood

- Petechial hemorrhage
- Contusion
- Organized hematoma
- Diffuse axonal injury (DAI)
Mild TBI, no LOC or AOC, no PTA, Glasgow Coma Score 13-15
Post Traumatic Epilepsy (PTE)

- Incidence as high as 40% in penetrating head injury (meningo-cerebral cicatrix of Penfield)

- In closed head injury incidence is closer to 5%
• Immediate (impact) seizure may be a non-specific reaction to trauma

• Early seizure (first week) carries 25% risk of further seizures

• Late seizures (beyond first week) suggest cicatrix and portend recurrent seizures
Pathogenesis of PTE

- extravasated RBC into neural tissue
- iron liberated from hemoglobin
- highly reactive free radical oxidants are produced in the metabolism of iron
- Lipid peroxidation leads to cell membrane and organelle injury
First Seizure in PTE

- 50% within 6 months
- 75% within one year
- 83% within two years
- 95% within three years
TBI FAA Disposition

Clinical criteria considered: Glasgow Coma Score, Posttraumatic Amnesia

Imaging criteria: Intracranial blood: Epidural, subdural, subarachnoid, ventricular, parenchymal

Two year observation common related to PTE risk

With severe TBI, five years observation
Douglas DC3
Intracranial Neoplasm
Characteristically a benign extraparenchymal neoplasm
Gliomas

An intraparenchymal neoplasm without definitive borders, infiltrating projections, and a tendency to recur
Glioblastoma multiforme
Oligodendroglioma
Neoplasms
Aeromedical Disposition

• For benign extraparenchymal neoplasms, generally one year with freedom from complications and recurrence

• For parenchymal infiltrating gliomas, recurrence is the rule, ordinarily precluding certification
Cerebrovascular Disorders

- Plugs: thrombosis
- Leaks: hemorrhage
Large Vessel Stroke: Middle Cerebral Artery

- Primary thrombosis
- Embolic source
  - Artery to artery
    - intracranial
    - siphon
    - cervical carotid
    - aorta
- Cardioembolic
Small Vessel Stroke: Lacunar Infarct

- Commonly related to hypertension
- May be multiple
- May be silent
Cerebral Aneurysm
Arteriovenous Malformation

- Often present with seizures rather than hemorrhage
- Surgery may be curative for hemorrhage, but not seizures
Cavernoma
(cavernous angioma)
Ischemic Stroke
Aeromedical Disposition

• For TIA and ischemic stroke (primary or embolic usual observation period is two years with documentation of risk factor attention

• Aneurysm: one year without isolation from the circulation and lack of complications

• Malformations, cavernomas: individual assessment
Other Major Conditions

- Neurodegenerative
  - Dementias
  - Parkinson’s disease
  - ALS

- Inflammatory
  - Multiple Sclerosis
# Montreal Cognitive Assessment (MoCA)

**Name:**

**Education:**

**Date of birth:**

**Sex:**

**Date:**

## Visuospatial / Executive

- **Copy Cube:** 
- **Draw Clock:** (Ten past eleven) (3 points)

## Naming

- [ ]
- [ ]
- [ ]
- [ ]
- [ ]
- [ ]
- [ ]

## Memory

- **Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.**
- **Face:**
- **Velvet:**
- **Church:**
- **Daisy:**
- **Red:**

  1st trial: [ ]
  2nd trial: [ ]

## Attention

- **Read list of digits (1 digit/sec.)**
  - Subject has to repeat them in the forward order: [ ] 2 1 8 5 4
  - Subject has to repeat them in the backward order: [ ] 7 4 2
- **Read list of letters. The subject must tap with his hand at each letter A. No points if 2 or more errors.**

## Language

- **Repeat:** I only know that John is the one to help today.
  - The cat always hid under the couch when dogs were in the room.
- **Fluency / Name maximum number of words in one minute that begin with the letter F.** [ ] (N ≥ 11 words)

## Abstraction

- **Similarity between e.g. banana - orange = fruit**
  - Train - bicycle
  - Watch - ruler

## Delayed Recall

- **Has to recall words with no cue**
- **Face:**
- **Velvet:**
- **Church:**
- **Daisy:**
- **Red:**

  Points for uncued recall only

## Orientation

- [ ] Date
- [ ] Month
- [ ] Year
- [ ] Day
- [ ] Place
- [ ] City

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Normal: 26 / 30

Total: ___ / 30

Add 1 point if ≤ 12 yr edu