

# Carbon Monoxide Poisoning May Produce Long Term Electroencephalographic Abnormalities Consistent With Permanent Cerebral Network Dysfunction

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# Disclosures

none



# Rationale (why do I need to be here?)

## Example

- History and Physical consistent with delayed neurologic symptoms of CO poisoning 1 yr ago.
  - No other explanation for Sx's
  - No CO levels
- If there was a test:
  - noninvasive, inexpensive
  - abnormal in 1/3<sup>rd</sup> of CO poisoned with continued symptoms >1 year.
  - Normal 99/100 similar controlled without these Sx's
- **Would this be a helpful test?**  
**"Maybe"**



## Literature with EEGs months to years after exposure.

Study	Year	N	Ab	Conclusions	Time after exposure
Chang DC	2010	9	0	Normal	1-2 mo's
Fitz-Gerald MJ	1991	2	2	No low voltage, generalize slowing.	1-2yrs
Harada M (in <i>Japanese</i> )	1971	?	?	?	5yrs
Garland H	1967	4	1	Diffuse, bilateral slow delta wave activity with intermittent theta.	1 mo
Tatetsu S (in <i>Japanese</i> )	1967	?	?	?	2yrs
Inanaga K (in <i>Japanese</i> )	1966	?	?	Monorhythmic frontal delta waves, marked low voltage or flat EEG changes.	?
Bokonjic	1963	47	32	Frontal, fronto-temporal bilateral 1-4hz, and 4-7hz background slowing.	?
Grudzinska B (in <i>Polish</i> )	1963	12	3	Flat, low voltage tracings with scant alpha activity.	5-10yrs
Lennox MA	1958	33	8	Fronto-temporal slowing	3 mo's

**Total documented EEGs long after poisoning**

**107**

**Total Abnormal documented EEGs long after poisoning**

**46**



# Electroencephalography and CO

- **Background:**

- The purpose: **descriptive analysis** of EEG findings in a retrospective cohort with CO related continued neurologic symptoms.

- **Methods:**

- A query of the Hyperbaric Medicine CO patient database at LDS Hospital from 1/1/2006 - 8/31/2013
- Pt's with chronic CO-related neurologic symptoms
  - Excluded if on psychiatric/sleep/pain meds
  - Excluded if Hx of head trauma or other neurologic disease.



# Results

## Patients with EEGs and Persistent Neurologic Symptoms, **N=73**

<b>Abnormal EEG, N=23*</b>	<b>Normal EEG, N=50§</b>
Met Inclusion Criteria, <b>N=12</b>	Met Inclusion Criteria, <b>N=36</b>
Age,Y(Mean/Median/Range): <b>34</b> /32/17-63	Age,Y(Mean/Median/Range): <b>38</b> /36/7-76
M/F: <b>3/9</b> (p= 0.067)	M/F: <b>20/16</b>
HbCO%: (Mean/Median/Range) 20/18/7-32	HbCO%: (Mean/Median/Range) 17/16/3-39

**\*Exclusions: Medication (N=9), Epilepsy/epileptiform EEG (N=1), Trauma (N=1).**

**§Exclusions: Medication (N=12), Epilepsy (N=1), Trauma (N=1)**



# Results

- Specific EEG wave findings include:
  - 7 diffuse generalized slowing
  - 2 with abnormal delta waves (1-3Hz)
  - 3 with abnormal excess theta waves (4-7Hz)
  - 3 with abnormal alpha wave activity (8-15 Hz)
  - 1 with abnormal mixed delta and theta slowing.

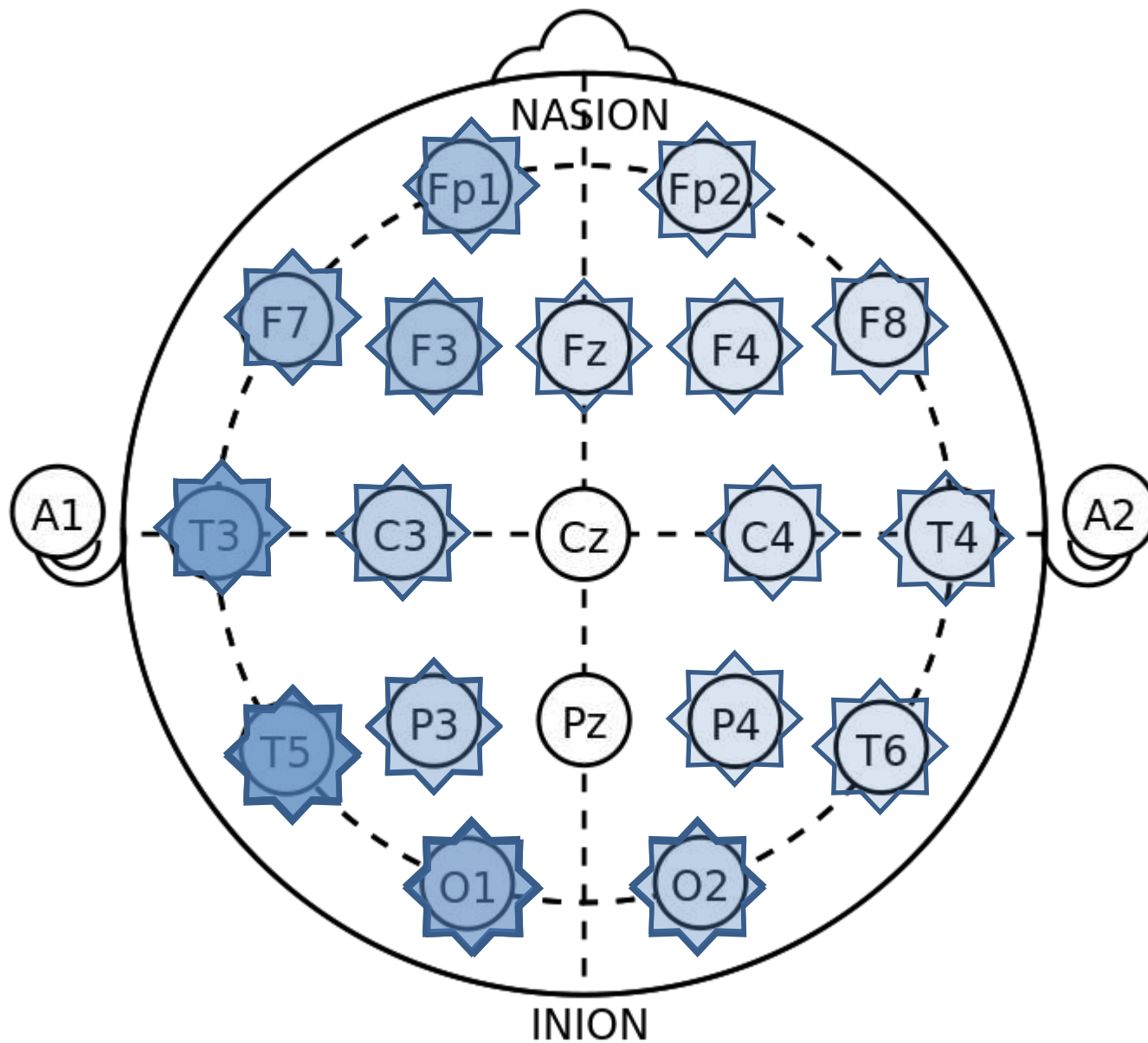


# Results

- **Focal abnormalities** present in 7 pts (58%)
  - Left sided:
    - 3 left temporal
    - 1 left fronto-temporal
    - 2 left hemispheric
    - 1 left posterior
  - Right sided
    - 1 right hemispheric.
  - Bilateral
    - 2 posterior
    - 1 frontal







Template Image from: [http://en.wikipedia.org/wiki/10-20\\_system\\_\(EEG\)](http://en.wikipedia.org/wiki/10-20_system_(EEG))

# Results

- Twelve (33%) of 36 patients with persistent symptoms have abnormal EEGs greater than 1 year after exposure (mean 2.01yrs, median 1.05 yrs).
- The disproportion of females with abnormal EEGs approaches significance ( $p= 0.067$ ).



# Results

- **All 12 patients** with abnormal EEGs described chronic headaches (5/week ave), memory, and balance disturbances since their poisoning.

Other complaints included:

- 6 anxiety
- 4 vision changes
- 4 depression
- 3 irritability



# Conclusions

- **One third (12/36)** of patients we evaluated with persistent symptoms have abnormal EEGs > 1 year after CO poisoning.
  - 1/100 asymptomatic patients in a similarly controlled cohort have abnormal EEGs.
- Pt's with a Hx of CO exposure with continued symptoms can **have abnormal EEGs**
- CO poisoning may cause longstanding focal and/or generalized EEG abnormalities consistent with focal or generalized cerebral network dysfunction and neuronal loss.





# Questions?

