Environmental Contaminants & Reproductive Health: Preconception Counseling for Lead Exposure?

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Objectives

• Preconception counseling case
• Things our pts can do
  – Top Ten Changes to make
Flint: Lead in the Water

“Lead is a potent, known, irreversible neurotoxin.” “in 10, 15, 20 years, we can see the consequences of lead poisoning — ...kids in special ed, ... problems in our mental health system, we can see the problems in our criminal justice system. “

Mona Hanna-Attisha, MD
NPR interview, 1/23/16

Hanna-Attisha M, AJPH 2016
Preconception counseling for a toxic exposure...

- What is the exposure(s)?
- What studies exist?
- Translation of population studies to individual women
Mental Development Index Scores in Infants According to Umbilical-Cord Lead Level

Mean blood lead levels
Low: 1.8 mcg/dl at birth, 4-6 later
Medium 6.5 at birth, 7-8 later
High 14.6 at birth, 7-8 later

Blood Lead Levels in Infants Classified According to Cord-Blood Lead Group.

<table>
<thead>
<tr>
<th>Cord-Blood Lead Group</th>
<th>Blood Lead Level (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Birth*</td>
</tr>
<tr>
<td>Low</td>
<td>1.8±0.6</td>
</tr>
<tr>
<td>Medium</td>
<td>6.5±0.3</td>
</tr>
<tr>
<td>High</td>
<td>14.6±3.0</td>
</tr>
</tbody>
</table>

*Each value is significantly different from the other two (Tukey’s studentized range test; \( \alpha = 0.05 \)).

†The value for the low-lead group is significantly different from the other two values (Tukey’s studentized range test; \( \alpha = 0.05 \)).

33 y/o G0 with a 7 year hx chronic abdominal pain, admitted for intractable abdominal pain

- **CC:** “Squeezing my guts from the inside"
- **ROS:** Associated with nausea, anorexia, 15 lbs weight loss
  - Mild constipation. Not associated with food or reflux.
  - Menses regular. No abnl discharge, no recent sex.
  - No dysuria or a change in urination.
  - Occasional headaches.
**Past Medical History:**
- Chronic abdominal pain
  - IBS
  - Fibromyalgia
  - Endometriosis
  - PCOS
- Appendectomy (2012)
- Repair of torn labrum right hip

**Meds:**
- Dicyclomine 10mg tid
- Zofran prn
- Oxycodone prn
- Hydromorphone prn

**NKDA**

**Family History:** Neg

**Social History:**
- Single, no children.
- Parents from India
- Grew up in TX, moved to NY in 2002, then CA in 2007
- Hasn't worked outside the home since 2006, as she has been on disability. Previously was trained as an accountant, has recently been licensed a residential realtor
- No tobacco. 2 drinks/week. No elicits.
- Not sexually active
Exam

Vitals: 36.4, 122, 90/58, 16, 100% RA, BMI 20

Gen: Alert, uncomfortable.

HEENT: NC/AT. No icterus. PERRL.

Neck: Supple, no LAD, nl thyroid. No JVD.

Chest: Breathing comfortably. CTAB.

CVR: RRR. NI S1, S2. No m/r/g. No LE edema.

**Abd:** NABS. Soft, **diffuse ttp w/o rebound, guarding.** No masses. No HSM.

Extrem: Warm, no cyanosis or clubbing. No joint deformities, effusions or warmth.

Skin: No rash.


Laboratories

WBC 6.4
**Hgb 9.9**, MCV 84
Platelets 379
Total Bilirubin 0.8
AST 39
ALT 63
Alk Phos 62
Albumin 4.3

Lipase 16
Urinalysis neg
Pregnancy test neg
Gallbladder and biliary tree normal on ultrasound
Differential Diagnosis?

- Chronic Abdominal Pain? – Very Broad
  - Gallstones
  - Appendicitis
  - Endometriosis
  - PCOS
- Anemia
  - Iron Deficiency
- Abdominal Pain + Anemia
  - Porphyria
A diagnostic test returned...

- **Fractionated urinary porphyrins:**
  - **Uroporphyrin 31** (ref <22)
  - **Coproporphyrin 2060** (ref 23-130)
  - **Porphobilinogen 2** (ref <2)
1 week after discharge from hospital: Another diagnostic test returned(!)

- **Lead level:** 82 mcg/dL
- **Arsenic & mercury levels were negative**
- **Repeat lead level 90 mcg/dL**
- **Environmental History Obtained:**
  - Condo built in 1977
  - Copper pipes, municipal water
  - No pottery or ceramics, No hobbies: jewelry making, stained glass, painting, or exposure to battery or radiator recycling.
  - 20 herbal preparations
Course

- 2005: Abdominal pain, Rx: Opioids
- 2007: Abdominal pain worse
- 5/2013: Seen at an OSH → appy
- 11/2013: Eval for pelvic pain → dx with endometriosis & PCOS
- 2/2014: Hospitalized for abdominal pain, with N/V, constipation & 15# weight loss
- 3/2014: Referral to UC for treatment of porphyria
## Lead Levels

<table>
<thead>
<tr>
<th>BLL (mcg/dL)</th>
<th>Hgb (g/dL)</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>3/23/14</td>
<td>92</td>
<td>4/2/14 Start IV Ca EDTA</td>
</tr>
<tr>
<td>70</td>
<td>4/5/14</td>
<td>50</td>
<td>4/8/14 Completed Ca EDTA</td>
</tr>
<tr>
<td>68</td>
<td>4/9/14</td>
<td>22</td>
<td>4/15/14 Started Succimer 1st round</td>
</tr>
<tr>
<td>10</td>
<td>4/29/14</td>
<td>30</td>
<td>6/10/14 Completed 1st Round</td>
</tr>
<tr>
<td>14.5</td>
<td>6/10/14</td>
<td>29</td>
<td>6/24/14</td>
</tr>
<tr>
<td>27</td>
<td>7/8/14</td>
<td>27</td>
<td>6/24/14</td>
</tr>
<tr>
<td>8</td>
<td>8/5/14</td>
<td>18</td>
<td>9/5/14 Completed 2nd Round</td>
</tr>
<tr>
<td>18</td>
<td>9/23/14</td>
<td>18</td>
<td>9/23/14</td>
</tr>
<tr>
<td>5</td>
<td>10/23/14</td>
<td>8</td>
<td>11/4/14 Completed 3rd Round</td>
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<tr>
<td>12</td>
<td>11/23/14</td>
<td>12</td>
<td>11/23/14</td>
</tr>
<tr>
<td>16</td>
<td>1/6/15</td>
<td>16</td>
<td>1/6/15</td>
</tr>
<tr>
<td>2</td>
<td>2/13/15</td>
<td>2</td>
<td>2/13/15</td>
</tr>
<tr>
<td>10</td>
<td>3/7/15</td>
<td>10</td>
<td>3/7/15</td>
</tr>
<tr>
<td>12</td>
<td>4/1/15</td>
<td>12</td>
<td>4/1/15 Completed 4th Round</td>
</tr>
</tbody>
</table>
AOEC Guidelines: Lead & Pregnancy

• “On a population basis it is important to reduce fetal exposure to lead, & maternal lead levels less than 5 µg/dL are optimal.”

• “Because fetal blood contains ~ 80% of the blood lead concentration of the mother, & because of the risk of spontaneous abortion, the panel’s recommendation is that the mother’s BLL should be kept below 5 µg/dL (0.24 µmol/L) from the time of conception through pregnancy.”
Course

• 4/2016: Preconception consult: 34 years old, married, interested in pregnancy

• Lead levels stable at 12-16 mcg/dL, not a candidate for further chelation

• Counseling re: age related decline in fertility, risk associated with elevated lead level
  – For women w/ hx lead exposure, Ca2+ supplements to minimize release of lead from bone stores
  – Increase dietary Fe, vit C
Translating Population-Wide Risks into Individual Risks

- Clinicians work with individuals, not populations
- Elevated population-wide risks may be extremely small for an individual
Lead levels in US Repro-aged Women

CDC Lead in Pregnancy 2010:
Course

• 6/2016: Lead level stable at 11 mcg/dL

• Spontaneous conception

• 8/2016: Counseling re: risk associated with elevated lead level, including preterm birth
  – Ca2+ supplements to minimize release of lead from bone stores, iron, PNV
  – Serial lead levels
  – Plan for breastfeeding (BLLs <40 µg/dL should breastfeed)

• 2/2017: Healthy baby
So what can we do today? - Top 10

1. **Choose fresh or frozen fruits & vegetables**
   - Canned foods may contain toxic chemicals
   - Wash produce
   - Buy organic if you can $$$
   - Avoid fast food & processed food
   - Limit foods high in animal fat $
2. **Avoid food w/ substantial plastic contact:** canned foods/sodas, wet foods in plastic pouches/boxes

   - **Avoid:** #3: PVC or vinyl, #6: PS (Styrofoam), #7 (= other): polycarbonate (some water bottles, & 5-gallon jugs) or may be untested

   - **Choose:** #1 PETE, #2 HDPE, #4 LDPE or #5 PP, likely lower health risks. But, if your community does not recycle these, try to avoid them
2. Avoid plastic: Don’t microwave it!

- Heating increases leaching of chemicals, especially with fatty foods. Use a paper towel or glass lid to cover food in the microwave

http://www.healthandenvironment.org/
3. Eat low-mercury fish $-$$$$

- Smaller fish generally have lower mercury levels
- Up to 12 oz/wk of shrimp, catfish, pollock, canned light tuna, salmon
  
  • Consumer Reports says no tuna!
  
  - [http://www.montereybayaquarium.org/cr/seafoodwatch.aspx](http://www.montereybayaquarium.org/cr/seafoodwatch.aspx)
  
  
  - Check local advisories if eating local fish
  [http://oehha.ca.gov/fish/so_cal/index.html](http://oehha.ca.gov/fish/so_cal/index.html)
4a. Wash hands prior to eating

- Use plant-based soap (no fragrance!)
- Especially important when hands are exposed to toxins
  - Agricultural areas
  - Use of fragranced lotion, etc.
  - Pt or spouse works in occupation w/ pesticides, solvents, lead, etc.
4b. Avoid carbonless receipts

- Many contain phthalates or BPA
- Don’t take receipt if you don’t need it
- If your patient works as a cashier, recommend:
  - wear gloves
  - wash hands thoroughly prior to eating

Urinary BPA after handing receipts
5. Limit pesticide & solvent use in home

- Clean with soap, vinegar
- Baking soda for ants, etc.
- Keep counters clean
- Use integrated pest management strategies in the garden
6. Be thoughtful about body products $-$$

- avoid phthalates, fragrances, triclosan
- risk stratify (“windows of susceptibility,” dosage, water vs. fat soluble chemicals)
- www.ewg.org (Skin Deep)
- https://safecosmetics.cdph.ca.gov/search/ (CA Safe Cosmetics Program Database)

http://www.ewg.org/skindeep/app/
7. Bust the Dust! $-$ $$

- Dust/damp mop/vacuum daily
- Take shoes off outside
- Especially important when dust is particularly likely to have toxins
  - Agricultural areas
  - Urban neighborhoods
  - Pt or spouse works in occupation w/ pesticides, solvents, lead, etc
8. Get rid of old foam furniture $$

- Flame retardants worst in foam from prior to 2005 (less likely prior to 1975)
  - Risk higher if crumbling
- Dust mopping, vacuuming with HEPA filter
- Also, avoid fatty animal foods
  - Flame retardants are fat soluble
  - Half-life 1-3 years in human fat
9. **Avoid tobacco smoke**

- Quit smoking
- Avoid 2nd hand smoke
- Who knows what’s in e-cigarettes
  - Nicotine itself not good for reproduction
  - Phthalates, etc.
  - “E-Cigarettes Expose People to More Than ‘Harmless’ Water Vapor: First Comprehensive Analysis Shows that Industry Health Claims are Unsupported by Data”

Grana Circulation 2015
10. Avoid lead $-$$$$

- Frequent dust-mopping
- Avoid hobbies, lipstick, other sources
- Paint abatement for baby
- For women w/ hx lead exposure, Ca2+ supplements to minimize release of lead from bone stores
- Increase dietary Fe, vit C
10b. Lead in unexpected places: ethnic products

- **Mexican treatments:** Azarcon and greta (also known as liga, Maria Luisa, alarcon, coral, rueda)
- **Asian treatments:** chufong, tokuwan, ghasard, bali goli, kandu, bo ying*
- **Middle eastern, Ayurvedic treatments or cosmetics:** alkohl, saoott, cebagin
- **Lipstick:** drugstore brands
PRHE: All That Matters Publications

• UCSF Reproductive Environmental Health & Justice elective for Fellows & Residents
Special situations:

- Patient with occupational or home exposures to lead, mercury, pesticides—or ?s you can’t answer
  - Work Matters brochure
  - Local Pediatric Environmental Health Unit
    [http://www.pehsu.net](http://www.pehsu.net)
    UCSF/ Western States PEHSU: 1-866-827-3478
  - CDC/ATSDR creating app for OBGYNs
  - Occupational Medicine resources, OSHA
Many Reproductive Aged Women at Risk for Pregnancy

- 6.6 million pregnancies/yr in US
- 51% of US pregnancies unplanned

https://www.guttmacher.org/pubs/FB-Unintended-Pregnancy-US.html#6
Conclusions

• Concerning health trends may or may not be related to environmental toxins, but the basic science & epidemiology is concerning enough that the precautionary principle makes sense

• Specific chemicals of concern
  – Lead

• Things we can do
  – Top Ten Changes to make
Other Resources

- ACOG/ASRM statement
  http://www.acog.org/Resources_And_Publications/Committee_Opinions/Committee_on_Health_Care_for_Underserved_Women/Exposure_to>Toxic_Environmental_Agents

- Environmental Working Group (& Skin Deep website)
  http://www.ewg.org/
  http://www.ewg.org/skindeep/

- EPA/state Pediatric Environmental Health Specialty Units
Other Resources

- Collaborative on Health and the Environment (Toxicant & Disease database)  http://www.healthandenvironment.org/
- NIH NLM  
- TEDX (includes List of Possible Endocrine Disruptors & Critical Windows of Development)  
  http://www.endocrinedisruption.com/home.php
- CDC (esp re: lead)  
- Preconception Health Council of California  
  http://www.everywomancalifornia.org