Presentation 1: Fetal Alcohol Syndrome Update

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Indian Health Service
Fetal Alcohol Syndrome Update
Part I: Timing of Exposure

- Elise Leonard, MD
- Phoenix Area IHS
Objectives

• become an effective teacher about risk of alcohol toxicity to a developing fetus
• understand the indirect harms of alcohol use in pregnancy
• be able to correlate stages of pregnancy with harms of alcohol exposure
Introduction

• a mother’s alcohol use endangers the fetus in many ways
• until recently, focus was directed mainly on children with **facial** characteristics of alcohol exposure
• **but very few alcohol exposed children will show ANY visible signs**
Historical view

• in 1865 a French physician named Lanceraux observed that a child born to alcoholic parents:

  – “bears the special characteristics: the head is small... his physiognomy vacant, a nervous susceptibility more or less accentuated, a state of nervousness bordering on hysteria, convulsions, epilepsy... the sorrowful inheritance a great number of individuals given to drink bequeath their children.”
Current terminology

• all fetal alcohol problems fall under the ‘umbrella’ of Fetal Alcohol Spectrum Disorders (FASD’s)
  – Fetal Alcohol Syndrome (FAS)
  – Alcohol-Related Neuro-developmental Disorder (ARND)
  – Alcohol-Related Birth Defect (ARBD)
Effects of alcohol exposure

Alcohol damage varies by different stages of pregnancy:

• before implantation

• during major organ and structure development
  – heart, kidneys, eyes
  – head, face, hands

• during brain growth, interconnection, and specialization
...ladies and gentlemen, it’s embryology time!

Carnegie Institution of Washington Department of Embryology, founded in 1914
Conception to implantation: 9-10 days

DAY 0
- Ovulation
- Oocyte

DAY 1
- Fertilized Egg (zygote)
- First Cleavage

DAY 2
- 2-cell stage
- 4-cell stage

DAY 3-4
- 8-cell uncompacted morula
- 8-cell compacted morula

DAY 4

DAY 5
- Early blastocyst
- Late-stage blastocyst (hatching)

DAY 6-7

DAY 8-9
- Implantation of the blastocyst
Alcohol exposure from conception to 10 days

• alcohol can interfere with implantation of the early embryo (blastocyst) in uterine wall
  – this pregnancy would never be detected

• but if implantation does occur, damage from alcohol in this stage appears to be slight
  – at this early stage, all cells still have the potential to become anything
Leanne had been a binge-drinker, but she broke up with her boyfriend and stopped drinking about a week after conception. What effect might this have on her pregnancy?

a. the fertilized egg might not implant, so Leanne would never realize she had been pregnant

b. if the fertilized egg does implant, the embryo is likely to do well because its cells are not yet differentiated

c. both
From two to eight weeks

- in the 3rd week, cells begin **differentiating** into one of 3 “**germ layers**”
  - **ectoderm**: brain, spinal cord, eyes, hair, nails, tooth enamel
  - **mesoderm**: muscle (heart), circulatory system, bone, genitourinary system
    - heart starts beating at 22-23 days, divides into chambers by 5 weeks
  - **endoderm**: stomach, bowel, liver, lungs
From two to eight weeks

- these specialized cells *migrate* to the proper location where they will *differentiate* into organs/structures
- alcohol interferes with healthy cell migration
# CRITICAL DEVELOPMENTAL PERIODS

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<th>Conceptus</th>
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<th>Fetal period (weeks)</th>
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**Embryonic development**:

- **Neural**
  - Heart
  - Upper limbs
  - Lower limbs
  - Ear
  - Eye
- **Palate**
- **Teeth**
- **External genitalia**
- **Loss**
  - Major abnormalities
  - Functional and Minor abnormalities

*University of New South Wales Embryology, Foundations course*
From two to eight weeks

- organ development involves rapid cell division and gene expression with critical timing
- if proper nutrients are not available at critical moments, irreversible harm to that organ can result
  - *folic acid* is crucial for normal cell division
  - *alcohol blocks folate absorption*
From two to eight weeks

- this is when the embryo is at highest risk for major physical abnormalities
  - heart (weeks 3 - 5)
  - facial features (weeks 3 - 6)
  - eye (weeks 3 - 8)
By 8 weeks, all basic structures are present. The embryo is now a *fetus*, a little over half an inch in size. Eyelids and ears are forming, and you can see the tip of the nose. The arms and legs are well-formed. The fingers and toes grow longer and more distinct.
By 8 weeks, all basic structures are present

- if a mother begins alcohol use after 8 weeks, her baby is likely to have
  - normal facial features
  - grossly normal major organs
- but: the brain stays vulnerable through the entire pregnancy
CRITICAL DEVELOPMENTAL PERIODS

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- **Neural**
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- **Loss**
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  - Functional and Minor abnormalities

*University of New South Wales Embryology, Foundations course*
Rachel was a frequent binge drinker from weeks 3 to 7 of pregnancy. What is her baby at increased risk for?

a. failure of implantation
b. major organ problems or visible abnormalities
c. both
Second and third trimester

- established organs grow in size and complexity
- why does the brain stay so vulnerable throughout pregnancy?
  - cell migration and specialization continue
  - connections are forming, requiring constant gene expression and nutrient availability
Most alcohol exposure problems are INVISIBLE

• prospective cohort study of 9,628 women in Chile

• 101 women were drinking 4 or more drinks per day at time of first visit
  – matched with 101 non-drinking controls
  – children evaluated up to age 8.5

Most alcohol exposure problems are INVISIBLE

- 73 alcohol-exposed children and 75 unexposed children were evaluated by geneticists
- **NOT ONE ALCOHOL-EXPOSED CHILD** met criteria for full FAS facial phenotype
  - one child met criteria for “moderate” FAS features

**********take-home message slide**********
Most alcohol exposure problems are INVISIBLE

• though none of the alcohol-exposed children had the full FAS phenotype appearance)

• 44% of the alcohol-exposed children had brain abnormalities which impaired function

…………….take-home message slide
Most alcohol exposure problems are INVISIBLE

- what were the functional problems?
  - 26.8% had *hyperactivity* (1.5%)* (p< 0.0001)
  - 35.3% had *IQ < 80* (6.3%) (p= 0.0004)
  - 14.3% had *attention problems* (4.6%) (p= 0.11)
  - 42.0% had *language delay* (23.8%) (p= 0.0223)

* lower than US or world prevalence data
• Olivia, a heavy binge drinker, learns she is pregnant 3 weeks after her missed period. She stops drinking immediately. What is true of her pregnancy?

a. the baby should be safe from facial or organ abnormalities

b. if she stops now, it’s too late to prevent mental retardation and learning problems

c. neither
It’s never too late to stop

- if alcohol exposure was lower, and/or stopped early in pregnancy, small size at birth normalized more with age

- but when mothers drank throughout pregnancy, and/or binge drank (>4 drinks at a time), growth restriction persisted up to/ into adulthood
  - especially if mother is small (higher BAC ?)

US alcohol use

• of all U.S. females 12 and older,*
  – 47.5% have used alcohol in the past month
  – 16.0% binge alcohol use in last month
  – 3.3% heavy alcohol use in last month

* 2013 National Survey on Drug Use and Health: Summary of National Findings, DHHS Substance Abuse and Mental Health Services Administration Center for Behavioral Health Statistics and Quality
Question

- when do most women find out they are pregnant?
  - 2 weeks after conception
  - 5 to 6 weeks
  - 7 weeks to 2 months
  - more than 2 months
- women with SA problems find out even later
• on average, U.S. women who are pregnant drink less than their non-pregnant peers
  – true
  – false

• on average, U.S. adolescents who are pregnant drink less than their non-pregnant peers
  – true
  – false
Fetal Alcohol Exposure Update
Part II: working with mothers and children

• Elise Leonard, MD
• Phoenix Area IHS
Fetal Alcohol Syndrome criteria

- all three facial abnormalities (smooth philtrum, thin vermilion border, and small palpebral fissures);
- growth deficits
- CNS (brain) abnormality
Facial assessment

• observe the patient in the “Frankfort horizontal plane”, a line defined by:
  – your eye
  – patient’s cheekbone
  – patient’s tragus

• use Lip-Philtrum Guide

Lip-Philtrum Guide

5: No visible folds*, thin/flat upper lip
4: Suggestion of folds*
3: Mild definition
2: Well-defined folds from lip to nose
1: Extremely well-defined, raised folds

*FAS criteria include a facial phenotype rank of 4 or 5

Eye openings

- **Palpebral Fissure:** width of the eye opening
  > 2 SD below mean
- **Epicanthal Fold:** skin fold over the tear duct area
  (a normal finding in some ethnic groups)
Other clues

“railroad track” ear

“hockey stick” palmar crease
curved, short 5th finger

(clinodactyly)
Brain abnormalities in FAS

• structural
  • head circumference < 10\textsuperscript{th} percentile
  • significant abnormalities on CT, MRI

• neurological

• functional
  • IQ< 3\textsuperscript{rd} percentile, or
  • below 16\textsuperscript{th} percentile in 3 of the following: developmental delays, executive function, motor delay, inattention or hyperactivity, social skills, language problems, memory problems
Alcohol as an indirect toxin

- lifestyle - irregular eating, poor hydration, other drug use, STD’s, poor or no prenatal care
- environment - domestic violence, sexual assault, fall injuries, MVA’s
- spiritual – disconnection from community, culture, support
FAS: risk amplifiers

- age > 25
- having 3 or more pregnancies
  - placental factors?
- longer drinking history
  - nutritional effects
  - cumulative stress
FAS:
risk amplifiers

• drinking outside of meal time
• poor diet
• skipping meals during binges
• cigarette smoking
  – low birth weight, other problems
FAS: risk amplifiers

• short stature, low birth weight, low BMI
  – mother may have alcohol exposure
• higher blood alcohol levels
  – smaller mothers get there on fewer drinks
• genetics
  – alcohol dehydrogenase polymorphisms
FAS: risk amplifiers

• having a partner who is a heavy drinker
  – father’s alcohol use up to conception may have an effect
• low socioeconomic status
  – multifactorial stresses
• infrequent practice of spirituality
Mothers of children with FAS

- study of 80 mothers of FAS children
- 96% had at least one psychiatric diagnosis
  - 93% had 2 or more lifetime diagnoses
  - mean # diagnoses = 4.7
- 86.4% had a mental health problem which started before age 18

Mothers of children with FAS

- 79% reported having a birth parent with an alcohol problem
- 95% had been physically or sexually abused during their lifetime

FAS Surveillance Network data from 4 states

- Arizona, New York, Alaska, and Colorado
- In Arizona, 59% of FAS mothers were AI/AN (7% of population is AI/AN) - 8 times expected rate
- In Alaska, 86% of FAS mothers were AI/AN (24% of population is AI/AN) - 3 times expected rate

Cannon M et al: Characteristics and behaviors of mothers who have a child with fetal alcohol syndrome. Neurotoxicology and Teratology Vol 34 No 1, Jan-Feb 2012 pp90-95
Working with children

• **ask** about alcohol use in pregnancy

• **be alert for** *clues*
  
  – out of home placement
  
  – speech delay, hearing or vision problems
  
  – small size
  
  – learning problems
  
  – mood dysregulation, poor judgement, **ADHD**
Working with children

• early assessment and intervention
  – vision, audiology, genetics if appropriate
  – AZEIP up to 36 months
  – school system from 3 years up
• what is the leading cause of mental retardation in the US today?
  a. Down’s Syndrome
  b. Fragile X Syndrome
  c. Fetal Alcohol Spectrum Disorders (FASD)
Working with children

• watch for children who show unexpectedly poor judgment for their level of maturity and intelligence
  – stealing to impress peers
  – impulsive sexual behavior

• remember that behavioral interventions work, but *more slowly* in children with FAS/ARND
Working with children

- watch for children who are failing but being promoted
- ask if children with ‘504’ accommodations are comprehending grade level work
- listen for, “he can do it, but he just doesn’t want to”
question

- heavy alcohol exposure in the second half of pregnancy causes damage to which of these?
  a. learning
  b. emotional control
  c. memory
  d. judgment
Working with children

- know your IDEA !!
- Individuals with Disabilities Education Act
- public schools must respond within 60 days to a written request from parent/guardian or public agency for a formal evaluation for learning problems
the school may have refused parent or guardian’s verbal request for evaluation (sometimes for years)
  – it is very helpful to have a letter ready which you both can sign

school may not demand medical information unless student is seeking services under the “OHI” (other health impaired) designation
4 August 2015

To Whom It May Concern:

Joe Student (dob: ____________) is receiving treatment for ADHD and mood problems. He has a long history of struggling with mathematics. It is likely that Joe has a learning problem in the area of math.

Please initiate a psychoeducational evaluation to determine if Joe would benefit from special educational services.

Sincerely,

__________________________________
Jane Student
Mother

__________________________________
Elise Leonard, MD
Child and Adolescent Psychiatrist
Chief of Mental Health
Working with children

- the school must either complete the evaluation or send “prior written notice” to parent/guardian explaining why they feel an evaluation is not indicated
- parent can appeal
- [http://www.parentcenterhub.org/repository/evaluation/](http://www.parentcenterhub.org/repository/evaluation/)
Working with children

• an individual education plan (IEP), once implemented, is transferable

• when a child moves to another school or district, the new school must provide those services
  – “we’ll do our own evaluation”…not !!!
Summing it up

• alcohol exposure has different effects during different stages of pregnancy
• by the time most women are aware they are pregnant, major organs and structures are established (exception?)
• it is never too late for a pregnant woman to stop drinking and improve nutrition
the vast majority of alcohol-exposed children will show no visible signs

many children diagnosed with ADHD, mood disorders, learning problems are showing invisible effects of alcohol exposure

- look for and document known or suspected alcohol exposure
Break and Transition
to Sessions:
PC1, PC2, PC3