Anxious Thoughts in Pregnancy and Heart Rate Variability

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Introduction

Anxiety in pregnancy is a common, underrecognized, and undertreated illness. Antenatal anxiety is significantly associated with a two-fold risk of postpartum depression regardless of prenatal depression, increased risks of suicidal ideation and suicide completion, and increased use of psychiatric medications, alcohol, and illicit substances. It is associated with lower odds of breastfeeding and with increased rates of preterm birth, postpartum hemorrhage, and neonatal morbidity. It is also a potent predictor of poor neonatal and child outcomes, including infant mental and psychomotor development, child temperament, and brain morphology in young children. It warrants further investigation.

One physiological measurement that may be useful in perinatal anxiety is heart rate variability (HRV). HRV is a measure of flexibility in the autonomic system. When there is less flexibility (aka lower HRV), the system is "less healthy" -- less adaptative to stress. Low HRV can be a marker of poor health, poor fitness, depression, anxiety, and a harbinger of early mortality. In pregnancy, HRV progressively decreases during pregnancy as the body undergoes myriad changes.

While evaluating the precursors and repercussions of perinatal anxiety, we sought to evaluate stress responsiveness in pregnant women with and without clinically significant anxiety using HRV. The measurement that we have focused on is root mean square of successive differences between normal heartbeats (RMSSD). RMSSD reflects parasympathetic nervous system activity and provides an index of overall variability in heart rate .

Methodology

Participants (n=54) were part of a larger study (n=95) that followed pregnant women with and without clinically significant anxiety from the second trimester to six months postpartum.

Inclusion Criteria for Anxious Group: met criteria for an anxiety disorder without comorbid active depressive disorder on SCID-V interview (confirmed by psychiatrist) or a Perinatal Anxiety Screening Scale ≥ 21.

Inclusion Criteria Health Control: no history of anxiety/depressive disorders and/or current antidepressant use.

Exclusion criteria: multifetal pregnancy, autoimmune/endocrine disease, meeting criteria for a major depressive episode or active suicidal ideation at study entry, bipolar disorder or primary psychotic disorder, current or recent (within 90 days) substance use disorder.

At the third trimester, participants were brought in for HRV evaluations. They were connected to the BioPac system with ECG leads on left rib and right clavicle. They completed a baseline HRV measurement followed by a Stroop stressor and then recovery. Each measurement was 3-5 minutes. All visits were between 10AM and 2PM and concluded with a 5-point Likert scale about difficulty and stressfulness of the task.

The following scale were completed:

- Perinatal Anxiety Screening Scale (PASS)
- Edinburgh Postnatal Depression Scale (EPDS)
- Penn State Worry Questionnaire (PSWQ)
- Spielberg State-Trait Anxiety Inventory (STAI)
- The Pittsburgh Sleep Quality Index (PSQI)
- Perceived Stress Scale (PSS)
- Obsessive-Compulsive Inventory-Revised (OCI-R)

Data was stored and cleaned in AcKnowledge 5.0 software. Analysis was done In R version 4.1.0 using linear mixed effects models to evaluate each HRV measure against each psychological measure while controlling for age, gestational age, and BMI. Because this study was exploratory and we did not want to miss potential relationships that would be worthy of future study in a larger sample, we made no corrections for multiple comparisons.

Results

Participant Demographics

Forty-nine participants were ultimately included in analysis.
Active and prior anxiety diagnoses:

- Generalized Anxiety Disorder (n=20; active n = 13, prior n = 12)
- Panic Disorder (prior n = 3)
- Obsessive Compulsive Disorder (active and prior n = 1),
- Social Phobia (active and prior n = 1)
- Agoraphobia (active n = 1, prior n = 2)
- Specific Phobia (active and prior n = 4)

Table 1

Characteristics at Intake	N = 49[1]
Age	32.5 (23, 39)
BMI	27.2 (19.2, 41)[2]
Gestational Age (weeks)	34 (32, 37)
Number of Children	
0	31 (63%)
1	11 (22%)
2	7 (14%)
Race	
White	41 (84%)
Black	1 (2.0%)
Asian or Pacific Islander	4 (8.2%)
American Indian/Alaskan Native	1 (2.0%)
Other	2 (4.1%)
Hispanic	4 (8.2%)
Married	48 (98%)
Income	
$26,000-$50,000	1 (2.0%)
51,000-$100,000	17 (35%)
101,000-$250,000	28 (57%)
$250,000+	3 (6.1%)
Employed	44 (90%)
PASS Score >= 21 at intake	20 (41%)
Active Anxiety Disorder at Intake	16 (33%)
Prior Anxiety Disorder	19 (39%)
Prior Depressive Disorder	22 (45%)

[1] Mean (Range); n (%) , [2] BMI unknown = 1

Results Continued

Sleep, Perceived Stress, Trait Anxiety, Perceived Worry, and RMSSD

Higher scores on the scales below were significantly associated with lower RMSSD at all time-points.

- PSQI (indicating worse sleep) (p = 0.0164)
- STAI-Trait (indicating higher trait anxiety) (p = 0.0485)
- PSS (indicating higher perceived stress) (p = 0.04553)

Table 2

Scales at Third Trimester Visit	N = 49[1]
Perinatal Anxiety Screen Scale (PASS)	13 (2, 42)
Pittsburgh Sleep Quality Scale (PSQI)	8 (1, 18)
Perceived Stress Scale (PSS)	13 (2, 27)
Penn State Worry Questionnaire	46 (26, 78)
Spielberg State-Trait Anxiety Inventory - State (STAI-State)	30 (20, 510
Spielberg State-Trait Anxiety Inventory - Trait (STAI-Trait)	33 (21, 52)
Childhood Traumatic Events	1.16 (0,4)
Childhood Traumatic Severity Sum	4.9 (0, 19)
Obsessive Compulsive Inventory-Revised (OCI-R)	5.8 (0, 27)
Edinburgh Postnatal Depression Scale (EPDS)	4.3 (0, 14)

[1] Mean (Range); n (%)

Other Measures

Heart rate was also significantly positively associated with PSQI score (p = 0.0182). On the 5-point Stroop Likert Scales following task completion, participants rated the stressfulness of the experience on average at 1.7, which is between "not at all stressful" and "a little stressful". Difficulty was rated on average at 2.4, which is between "mostly easy" and "neutral".

Conclusion

- This is the first study to evaluate HRV in a cohort of pregnant women with and without anxiety diagnoses without comorbid affective illness
- The perception of stress, anxiety, and poor sleep were associated with lower RMSSD at all time points, but not associated with stress responsiveness
- Further investigation of autonomic system alterations during antenatal anxiety is warranted
- Future considerations: Intervention such as yoga and meditation to improve HRV in pregnancy, particularly for those that no not wish to take medications

Limitations

- Our stressor (Stroop) was likely not evocative enough based on participant responses
- Although we evaluated anxiety diagnoses at baseline, we did not have a measurement of active diagnoses at the time of the HRV measurement

Acknowledgements & References

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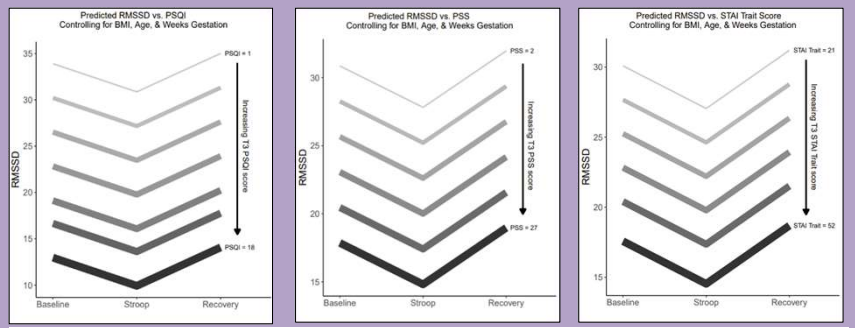

Figure 1: Modeled RMSSD with increasing PSQI, PSS, and STAI-Trait scores controlled for BMI, Age, and Weeks Gestation.