CARDIAC RESPONSES TO AFFECTIVE AUDITORY AND VISUAL STIMULI IN ADULTS WITH AUTISM SPECTRUM DISORDER (ASD)

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Background

Parasympathetic control of heart rate reflects capacity for autonomic regulation1 and behavioural control.2

ASD has been characterized by autonomic hyperarousal3,4 and reduced cardiac responsiveness to social stressors.5 Hyperarousal is consistent with inefficient parasympathetic cardiac control. However, few studies have examined parasympathetic functioning with respect to emotional challenges in ASD.

Purpose

To examine autonomic functioning in high-functioning adults with ASD at rest and in response to the presentation of visual and auditory affective stimuli.

We expected adults with ASD to show higher baseline arousal and reduced autonomic responsiveness to affective stimuli.

Method

Emotion recognition and autonomic regulation were examined at baseline and in response to visual and auditory emotional challenges in ASD and control participants.

Participants:

15 high-functioning adults with confirmed DSM-IV diagnosis of autism or ASD (12 male, 3 female; 19 - 52 yrs, M = 35.5 (7.8); IQtotal M =101(19).

Matched group of 16 non-clinical adults (12 male, 4 female; 23 - 48 yrs, M = 35.7(10.6), IQtotal M = 107(12).

Procedure:

Stanford-Binet IQ, Autism-Spectrum Quotient, Beck Anxiety Inventory, and Benton Face Recognition Test were administered individually.

Prior to the Emotion Recognition Test, continuous electrocardiogram (ECG) was recorded from each participant at rest and during performance of two tasks.

Affective Tasks:

Modified emotional Stroop task with faces as distractors.

Passive listening to contrasting classical music excerpts.

Physiological Measures:

Heart Period

Respiratory Sinus Arrhythmia (parasympathetic measure)

RSA change

Salivary Cortisol

Results

Do arousal levels differ by group?

Fig. 1

Anxiety, Endocrine, Autonomic Measures by Group:

Self-reported trait anxiety, (t28) = 2.44, p < .03, cortisol, F(1, 22) = 6.17 p < .03, and heart rate (~inverse of HP) were higher in ASD, F(1, 29) = 8.25, p < .01. (Fig. 1, A-C).

RSA was lower in ASD, F(1, 28) = 7.81, p < .01, (Fig. 1D).

Baseline cortisol was positively correlated with anxiety in controls (p < .05), but baseline HP, RSA, and cortisol were unrelated to anxiety in ASD (p > .35).

Do participants with ASD recognize negative emotions or faces poorly?

Fig. 2

ASD erred more than controls on negative versus positive emotions, (interaction, F(1, 29) = 10.42, p < .01), though ASD face recognition, M = 44.5 (4.1), was within normal range (> 41).

Error rates within the ASD group were higher than surprise for fear, anger, disgust, and sadness (p < .01).

Groups differed on anger and disgust (Fig. 2).

Do groups differ in behavioural or autonomic responses to the Stroop and music tasks?

Fig. 3

Stroop Response Times by Group: Colour-naming was slower in ASD, F(1, 27) = 7.94, p < .01, even when differences in face- and emotion-recognition were controlled (Fig. 3).

Autonomic Responses: There were significant reductions in HP and RSA for Stroop performance (p < .01), but these did not interact with group (p > .13).

Heart Period by Music Intensity and Group:

For controls (p < .01), HP was reduced with increased music intensity, but for adults with ASD (p > .70), HP response did not change (interaction: F(1, 29) = 6.58, p < .02; Fig. 4).

Fig. 4

Autonomic Relations

Fig. 5

Relations between RSA change and Stroop Response Times by Group: For controls, greater RSA reduction predicted faster colour-naming, ns > .60, ps < .02. (Fig. 5).

There was no relation in ASD, ns < .14, ps > .60, though RSA reduction for task performance was the same in both groups, (p > .13).

Summary

Compared with matched controls, participants with ASD reported higher anxiety and showed greater physiological arousal overall. Trait anxiety was independent of baseline cortisol in ASD but not controls, suggesting physiological arousal in ASD may not relate to anxiety per se.

Autonomic responsiveness to stimulus change was reduced in ASD, and unlike controls, did not predict performance.

Conclusions

Autonomic inflexibility may contribute to the maintenance of social deficits in ASD, via undifferentiated autonomic representations of emotion.6

Although poor recognition of negative emotions in ASD is consistent with an amygdalar hypoactivation hypothesis, 7 high arousal and reduced autonomic responsivity with poor emotion recognition suggests amygdalar hyperactivity, consistent with an allostatic load model of autism.8

References