Positive rewarding effects of experimenter-administered cocaine is suppressed by cocaine infusion predictability

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Abstract

The positive reinforcing effects of cocaine are directly controlled by its ability to mediate voluntary self-administration. Cocaine is known to produce aversive effects, such as irritability, that can be exacerbated by certain conditions of cocaine administration. Our laboratory previously reported that the effect of a drug on voluntary self-administration can be modulated by the predictability of the drug’s delivery. We examined the hypothesis that predictability could influence the rewarding properties of cocaine when self-administration is not possible. To test this hypothesis, we exposed rats to weeks of cocaine self-administration followed by weeks in which they were exposed to cocaine infusions delivered via an intravenous catheter. The group was divided into two: a self-administration group and a control group. The self-administration group underwent a cocaine infusion protocol and was exposed to cocaine infusions at predictable and unpredictable intervals. The control group did not receive any exposure to cocaine infusions. The results indicated that exposure to predictable cocaine infusions significantly decreased the preference for cocaine, as measured by the number of infusions self-administered. These findings support the idea that predictability can modulate the rewarding properties of cocaine even when self-administration is not possible.

Introduction

Animal models of drug abuse have contributed immensely to advances in our understanding of drug seeking and taking behavior. When attempting to model the human experience of drug abuse, it is important to consider the context in which drug administration occurs. In our laboratory, we have examined the effects of predictability on cocaine self-administration.

Materials and Methods

Animals, Groups, Operant Training, and Surgery

Male Sprague-Dawley rats were housed under a 12-hour light-dark cycle and fed ad libitum. All animals were surgically implanted with a catheter under isoflurane anesthesia.

Cocaine Sessions

Both self-administration and experimenter-administered rats were exposed to a single cocaine administration session. The experimenter-administered rats were exposed to a single session of experimenter-administered cocaine infusions. The self-administration group was exposed to a series of self-administered cocaine infusions.

Data Collection

USV and locomotor activity data were collected throughout the experiment. Locomotor activity was recorded by linear tracking software and USV data were recorded using the NGS software. Data were analyzed using MATLAB software.

USV Analysis

A MATLAB program was written to automate the USV analysis process. Frequency-amplitude bins were created, and the number of USVs in each bin was calculated. The data were then analyzed using a repeated measures ANOVA.

Conclusions

Cocaine self-administration can be suppressed by the presentation of cocaine infusions delivered via an intravenous catheter. These findings suggest that predictability can influence the rewarding properties of cocaine even when self-administration is not possible.

References


Heatmaps of Log_{10}(USV + 1)