A Cocaine Experiment: Time-of-Day and Hangover Effects

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ABSTRACT

Cocaine use often is part of night time social activities. To examine the drug’s effects in combination with time-of-day variables, 24 male Ss were given cocaine and tested between 1830 and 2400. After 8 hrs sleep in the laboratory, Ss were tested the following morning. Treatments were 5 mg (placebo), 96 mg, and 126 mg cocaine taken intranasally in 3 equal amounts at 1/2 hr intervals. The first test battery began 25 mins after the third dose and the second battery began 3 hrs later. Day 2 testing began 1/2 hr after Ss arose.

Although subjectively-experienced stimulation by cocaine is relatively short-lived, Divided Attention (D-A) and Vigilance (VIG) data appear to demonstrate longer-duration performance effects. Performance was poorer near midnight than at the early test time, but the difference was significant for overall D-A performance only in the placebo condition. At the second test time, scores were better with cocaine than with placebo. VIG RTs were significantly slowed at the second test time with 5 mg or 96 mg cocaine; with 126 mg there was no significant difference between test times. A trend toward poorer performance was observed on the morning after cocaine in comparison to the morning after placebo.

INTRODUCTION

Cocaine effects on performance have been examined in a series of studies at SCRI. An initial experiment with cocaine (96 mg) and alcohol 0.58 g/Kg b.w.) found no impairment of driving-related laboratory tasks by cocaine (Moskowitz & Burns, 1989).

In a second experiment with 96 mg cocaine, subjects (Ss) performed better with cocaine than with placebo with the greatest difference observed during a test battery beginning three hours after dosing. Since that second test time coincided with the “afternoon slump”, the findings raised questions about the drug’s effects in interaction with circadian rhythm (Burns, 1993). Time-of-day differences associated with cocaine’s effects were further studied in a nighttime experiment.

EXPERIMENT DESIGN

Twenty-four healthy male Ss, ages 21-40 years, who were self-reported moderate users of cocaine, participated in three two-day treatment sessions. They were examined three times
per session with a battery of laboratory tests, which included Divided Attention (D-A) and Vigilance (VIG). Day 1 began between 1800 and 1930. Ss slept overnight in the laboratory, and were awakened at 0800 to begin day 2.

The placebo treatment was 5 mg cocaine. Active treatments were 96 mg and 126 mg cocaine. Each treatment was mixed with an inert powder to yield visually equivalent doses, which were given at half hour intervals in three equal amounts. Ss took the cocaine intranasally and began the first test battery immediately after the third dose. They began the second battery three hours after the first dose, and they began a third battery at 0900 on day 2.

At an initial session with no performance testing, Ss took 126 mg cocaine as three 42 mg doses at times 0, +30 minutes and +60 minutes. One S was dismissed from the experiment by the study physician after he developed elevated, unstable blood pressure following the second dose. Blood specimens were obtained 10 minutes after each dose.

RESULTS

Figure 1 graphs the blood concentrations of cocaine and benzoylecgonine (BE). Measured blood pressure and pulse rate peaks occurred within 10 to 15 minutes of the third cocaine dose and had returned to baseline levels four hours after the first dose.

D-A requires concurrent performance of a compensatory tracking task, located in the central visual field and a visual search task, located in the peripheral visual field. D-A was the first test in the battery and was performed immediately after dosing. Figure 2 displays the D-A data. Although tracking error scores decreased with cocaine in comparison to placebo, the differences were not statistically significant. The treatment main
effect for reaction times (RTs) to peripheral signals was significant ($F=5.35$, $2$ df, $p=0.008$). Paired comparisons identified the speeding of RTs by 96 mg at the second test time as the source of the effect. Contrary to what might be expected, the highest cocaine dose did not yield the best D-A performance.

**Figure 2**

**Divided Attention Test**

Overall D-A performance, quantified as a combined tracking and RT score, was significantly affected by test time ($F=10.81$, $2$ df, $p=0.0003$). Note that Ss were better able to maintain late night performance with either amount of cocaine than with placebo. Some residual effect from the earlier acute stimulation appears to have counteracted fatigue and drowsiness.
Data from the Vigilance test, which is a sensitive measures of arousal level, is uniquely useful in the examination of potentially alerting drugs. Again, as with D-A RTs, VIG RTs demonstrate that cocaine effects on performance persist much longer than the shorter-lived subjective stimulation (Figure 3).

The second Vigilance test began almost three hours after the last intake of cocaine. Given the elapsed time since dosing, together with fatigue and drowsiness at the late hour, VIG RTs were expected to be slow in comparison to the earlier test time. The slowing occurred when Ss received 5 mg or 96 mg cocaine, but with 126 mg there was no significant difference between RTs at the two test times. The number of correct responses decreased significantly on the second test only if Ss received placebo.

For all treatment conditions, D-A RTs increased on the “morning after” in comparison to the previous late night testing. VIG RTs also increased after cocaine but decreased if Ss had received placebo. Overall, there was a non-significant trend toward day 2 performance being worse after cocaine than after placebo.

SUMMARY AND CONCLUSIONS

D-A and VIG data agree with previously-reported data (Burns, 1993) in demonstrating that the effects of cocaine on performance persist past the period of acute stimulation. When Ss were tested near midnight, scores were better with cocaine than with placebo. It was only in the placebo condition that overall D-A performance was significantly worse at the late night hour. D-A RTs were faster with 96 mg cocaine whereas 126 mg cocaine prevented slowing of VIG RTs. These data suggest that cocaine effects may be task dependent as well as dose dependent.
REFERENCES
