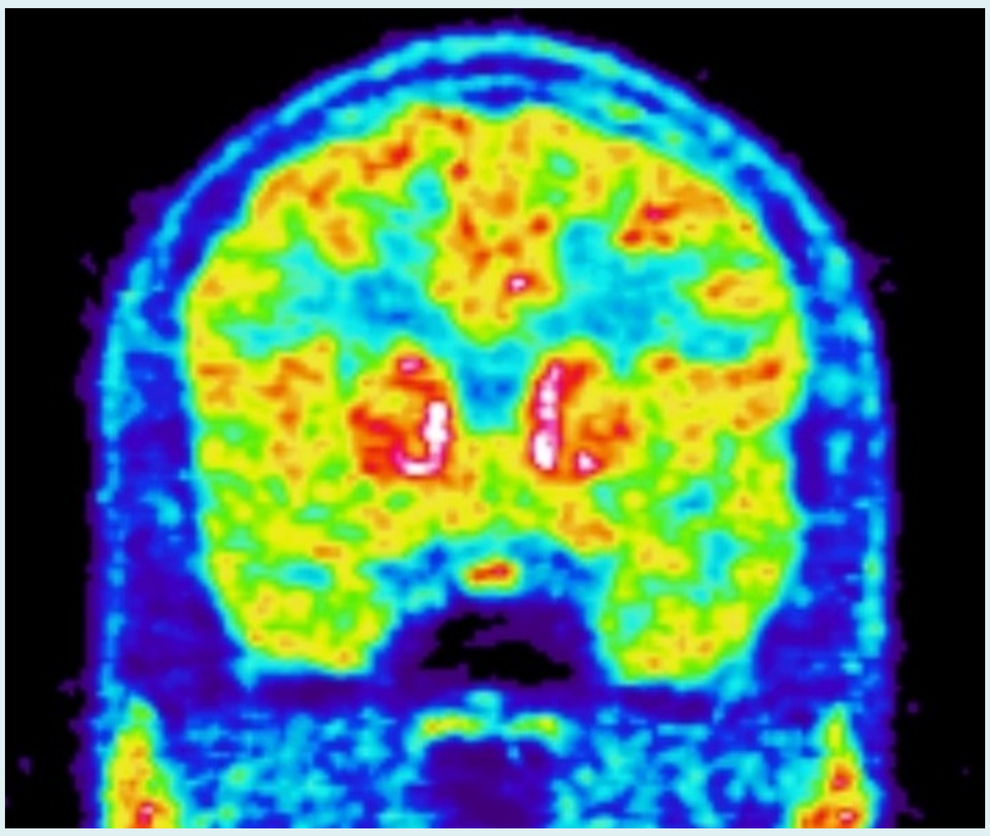
Amphetamine-opioid interactions in the human brain reward system - a PET study using [^{11}C]carfentanil

Joar Guterstam, Nitya Jayaram-Lindström, Simon Cervenka, Lars Farde, Christer Halldin, James Frost & Johan Franck



Coronal [^{11}C]carfentanil HRRT PET image

An intravenous dose of amphetamine does not cause an endogenous opioid release in healthy human subjects.

10 healthy young men were investigated with [^{11}C]carfentanil PET in three sessions: at baseline, after placebo and after an intravenous amphetamine dose. The order of amphetamine and placebo was double-blind and randomized.

There were no significant differences in [^{11}C]carfentanil binding potential between amphetamine and placebo conditions in any of the investigated brain regions.

Introduction

There is ample evidence for the involvement of the brain opioid system in stimulant dependence. However, the opioid effects of an acute dose of amphetamine have not previously been studied in the living human brain.

Hypothesis

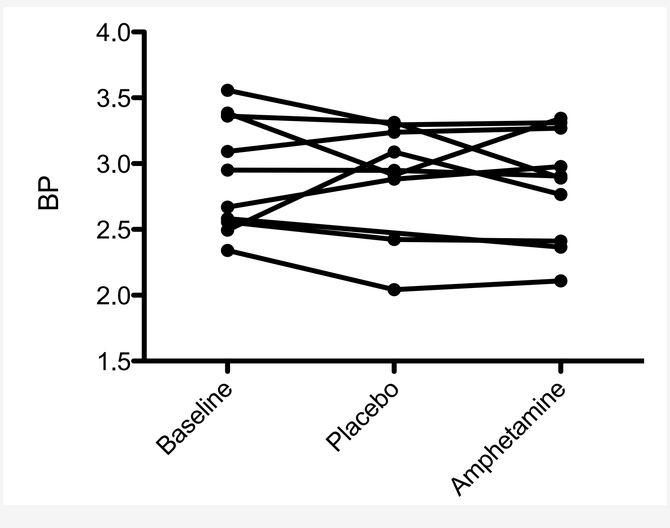
That an intravenous dose of amphetamine as compared to placebo would cause an endogenous opioid release in the human brain reward system, measurable as a reduction of the binding potential (BP) for the μ-opioid receptor radioligand [^{11}C]carfentanil.

Methods

10 healthy young men were investigated with [^{11}C] carfentanil PET in three sessions: at baseline, after placebo and after an intravenous dexamphetamine dose of 0.3 mg/kg bodyweight.

The order of amphetamine and placebo was double-blind and randomized. PET was performed with a Siemens HRRT system and analyzed according to SRTM with striatum, prefrontal cortex, amygdala and hippocampus as regions of interest.

Treatment	Mean BP (Ventral striatum)	SD
Baseline	2.899	.431
Placebo	2.905	.424
Amphetamine	2.835	.426



Individual [^{11}C]carfentanil BP values for the ventral striatum

Results

Amphetamine caused strong subjective effects in all participants. However, repeated-measures ANOVA revealed no significant differences in [^{11}C]carfentanil BP between treatment conditions in any of the investigated brain regions.

Conclusions

An acute, intravenous dose of amphetamine does not cause any significant opioid release in healthy human subjects.

This finding is in contrast with earlier animal experiments and points to the need for further investigations of the role of the opioid system in stimulant dependence.

This work was done in the Karolinska Institutet group for translational addiction research (PI Johan Franck). Further neuroimaging studies of the opioid system in amphetamine dependence are ongoing.

Karolinska Institutet
Joar Guterstam
MD • Division of Psychiatry
Karolinska University Hospital Solna R5:01
171 76 Stockholm

E-mail: joar.guterstam@.ki.se
Telephone: +46 73 600 35 51
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Karolinska Institutet