STASH, Vol. 4(10): Let's try something new: Vaccines to treat addiction

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Conventional treatments for substance abuse can have limited success for some and be ineffective for others. In an attempt to expand the available treatment options, researchers are developing vaccines for addiction. Orson et al. review the current status of vaccines to treat nicotine, cocaine, phenylcyclidine (PCP), methamphetamine, heroin, and morphine for which conventional inpatient and outpatient treatment programs have shown limited success(Orson et al., 2008). In this review, we discuss only the status of vaccines currently undergoing clinical trials with humans.

Methods

- The authors provide a critical review of current clinical vaccines and animal studies that focus on reactions to vaccinations intended to block the effects of various illicit drugs.

Results

- There are currently three nicotine vaccines undergoing clinical trials (see the first, third, and fourth rows of Table 1 below):
    - After 12 weeks, TA-NIC trial participants who were encouraged to quit smoking had a 38% quit rate; this is significantly higher than the 8% placebo group quit rate (LeSage, Keyler, & Pentel, 2006).
    - Elevated doses of NicVax resulted in participants' quitting smoking without being asked to do so (Hatsukami et al., 2005).
    - Participants in NicQb trials had quit rates twice those of the placebo group (57% vs 31%) (Maurer et al., 2005).

Vaccine	Drug-Carrier	Human Studies
TA-NIC	Nicotine – cholera toxin b	Phase I, Phase II

Nic-Vax	Nicotine – Pseudomonas exoprotein A.	Phase I, Phase II
NicQb	Nicotine – virus like particle	Phase I, Phase II, Phase IIb
TA-CD	Cocaine – cholera toxin b	Phase I, Phase IIa, Phase IIb

Figure. Current Status of Drug Vaccines in Clinical Trials (Orson et al., 2008).

- There is currently one cocaine vaccine in clinical trials: TA-DC (see the second row of Table 1 above).

    - Phase I and early Phase II TA-CD vaccine trials demonstrated reduction in cocaine effects in laboratory settings and reduced cocaine use in outpatient settings. (Kosten et al., 2002; Martell, Mitchell, Poling, Gonsai, & Kosten, 2005)
    - Higher doses of the TA-DC vaccine led to a periods of reduced cocaine use, as evidenced by researcher monitoring during urine testing (Martell, 2008 submitted).
    - Some trial participants overrode the vaccine by increasing their cocaine intake (Orson et al., 2008).

Limitations

- The reviewed trials are in the early research stages (i.e., Phases III and IV are yet to commence); the number of participants is small and the effect sizes are not comparable to large scale studies of conventional treatment options.
- It is difficult to compare the differences in quitting rates across nicotine vaccine studies. Researchers used different methods and different non-medical influences were present in each study. Consequently, placebo quit rates in one study were comparable to vaccine quit rates in another study. These observations suggest the need for additional research with more rigorous research methods.
- The efficacy of the vaccines in human trials has not yet been compared against conventional addiction treatments.

Discussion

The development of substance use vaccines will lead to increased knowledge about drugs, their pharmacokinetics, and the possibility of new treatments for substance addiction. The differences that result from placebo effects could also be further researched as more substance abuse treatments are developed. The complexities of the human body and of addiction science make this research difficult. It takes time to isolate the effects of a drug and the counter-effects of a vaccine, and it is also difficult to resolve the mental and physical aspects of a substance addiction. Despite these hurdles, current advances in addiction and substance use vaccines look promising.

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