Patterns of Variation in the Behavioral Responses of Rats to Irritants After Neonatal Capsaicin Treatment

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Introduction

Administration of capsaicin to neonatal rat pups has been shown to result in desensitization to irritating chemical stimuli (Bargallo et al., 1998). Neonatal capsaicin treatment does not necessarily result in the production of desensitization in all individuals, presumably occurring through the specific elimination of the vanilloid receptor-expressive (VR1) cell population of the trigeminal ganglion (Hessamedin Alimohammadi & Wayne L. Silver, 2000). The extent or degree of desensitization to irritating chemical stimuli does not seem to be correlated to the behavioral response to non-irritating stimuli. The current study examines the patterns of behavioral variation in individual neonatal capsaicin-injected rats and control-injected rats (Litter 1: pup 1/7, pup 4/7, pup 5/7, pup 2/7, pup 6/7, pup 5/7, pup 6/7, pup 5/7). It is hypothesized that neonatal capsaicin treatment in producing a desensitized adult state.

Methods

One-day old pups were subcutaneously injected in the dorsal aspect of the neck with 0.1 ml of either a 1% capsaicin solution (14 pups) or the vehicle (5 pups). Control pups were marked with a cut in their tail-tips. Capsaicin solution was prepared by dissolving synthetic capsaicin in a mixture of ethanol, Tween 80, and 0.9% saline (1:1:8). Before the injection, the pups were wrapped in gauze and placed on ice for approximately one minute in order to minimize the pain produced by the injections. Capsaicin injected pups were observed for 15-30 minutes post-injection, and in some cases for up to one hour. For behavioral testing, adult rats were placed in a sterilized clear polypropylene cage and allowed approximately 2 minutes to acclimate. Following this initial acclimation period, the cotton tip of an applicator stick was placed approximately 2 cm from an opening in the cage wall and the rat was allowed to acclimate to its presence for an additional 1-2 minutes. Using different applicators, rats were presented with a series of stimuli. The stimuli were presented randomly, with three repetitions per stimulus. Each rat's response within the first few seconds of encountering the stimuli was scored using a scale ranging from -2 to +2 as described above. Stimuli were presented randomly, with three repetitions per stimulus.

Results

Figure 1. Neonatal Capsaicin Treatment

Figure 2. Stimulus Presentation During Behavioral Study

Behavioral Response Scale

-2 Trigeminal Reflex: Reflexive Withdrawal Movement
-1 Aversive Response: Head Turn or Rejection Movement
0 Neutral Response: No Response or Lack of Interest
+1 Favorable Response: Inspiratory Sniffing & Investigation
+2 Highly Favorable Response: Attempted Feeding Behavior

Figure 3. Behavioral Response in Individual Rats

Figure 4. Mean Behavioral Response Scores

Conclusions

Neonatal capsaicin treatment does not necessarily result in the production of uniformly desensitized adult rats. Approximately 20% of neonatally capsaicin-injected rats were found to be more overall sensitive than the least sensitive control animal in this experiment. The extent or degree of desensitization to irritating chemical stimuli does not seem to be correlated to the behavioral response to non-irritants. On average, neonatally capsaicin-injected rats – including those found to be more sensitive than the least sensitive control animal – displayed significantly diminished aversion responses to acetic acid, nicotine, cyclohexanone, and ethanol. No differences were found between control and capsaicin-injected rats in their mean behavioral response to non-irritants. Final Conclusion: Neonatal administration of synthetic capsaicin does not guarantee a desensitized adult state, but instead may result in varying degrees of desensitization.

Literature List