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BRIEF COMMUNICATION

Shock-Elicited Flight Response in Chickens as an Index of Morphine Analgesia

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BARDO, M. T. AND R. A. HUGHES. *Shock-elicited flight response in chickens as an index of morphine analgesia.* PHARMAC. BIOCHEM. BEHAV. 9(1) 147–149, 1978.—Morphine influence on a flight response elicited by wing shock was examined in 17-day-old chickens. The chickens received either morphine (30 mg/kg) or saline on two days and were tested for responsivity to wing shock 30 min after each injection. On a third day all chickens received saline injections and were tested again. Tests consisted of delivering wing shock at increasing intensity to determine the threshold of a species-typical flight response. Morphine significantly increased the flight response threshold on the first test (analgesia), but not on the second test. Shock intensity values required to elicit the flight response in morphine and saline groups did not differ significantly on the third test when all birds received saline. In contrast to previous evidence, these results demonstrate morphine analgesia in chickens using a dose that approximates the analgesic dose range reported for other species.

Shock-elicited response Flight response Wing shock method Chicken Morphine Analgesia

ALTHOUGH acute administration of 5–30 mg/kg morphine produces analgesia in a variety of species including humans [2, 8, 11], the chicken appears to be an exception. Morphine produces some behavioral effects in chickens [6, 12] but Schneider [12], using a foot-shake response elicited by a pressure stimulus (multiple toe-pinch method), failed to obtain morphine analgesia in this species with doses below 200 mg/kg. This evidence suggests either that morphine has an unusually low analgesic potency in chickens or that the foot-shake response may be insensitive to morphine analgesic effects in this species. In support of the latter possibility we have informally observed a foot-shake response in chickens when a small strip of masking tape was attached to their toes. Thus, a chicken's foot-shake response may be elicited by stimuli that are not necessarily noxious. This possibility is especially relevant when assessing morphine analgesic effects because morphine may have a greater influence on emotional reactivity to noxious stimuli than on perception of noxious stimuli [8].

If the chicken's foot-shake response is more indicative of perceptual than of emotional reactivity, then morphine might be expected to have less effect on that response. A response more specifically related to emotional reactivity may be required to detect morphine analgesia. Responses elicited by electric shock are often used to assess morphine analgesia. Shock delivered through a grid floor, for example, elicits a reliable jump response in rats, and the threshold for this response is raised by morphine [1, 3, 4]. The present experiment examined the influence of 30 mg/kg morphine on a shock-elicited flight response in chickens.

METHOD

Animals

The animals were twenty-four 17-day-old White Leghorn cockerels *(Gallus gallus)* obtained from a local hatchery one day after hatching and maintained on a 12 hr light-dark cycle in a commercial brooder with food (Wayne pullet starter) and water freely available. These animals served as control subjects in an unrelated experiment. Their treatment in that experiment consisted of brief handling and weighing at 10 days posthatch.

Apparatus

Shock (BRS shock generator, Model SG–901) was administered in a 25×65×32 cm wooden chamber with a hinged top and hardware cloth front wall. The floor of the chamber consisted of 3 mm metal grids spaced 1 cm apart. The chamber interior was illuminated by a 7 W white light mounted 25 cm above the floor on the back wall. Shock electrodes consisted of two small flattened metal alligator clips that were attached to wires connected to a switch-activated shock relay located outside the chamber. An AC milliammeter was placed in series with the animal and could be used to measure shock intensity delivered to the chicken.

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Procedure

Each chicken was randomly assigned to one of two treatment groups (N=12 per group). Animals in one group were injected IM with 2 cc/kg of 30 mg/kg morphine sulfate (Morphine Group) and tested for responsivity to shock 30 min later (Test Day 1). Animals in the second group were treated similarly except that injections were 0.9% saline (Saline Group). This injection-test procedure was repeated 48 hr later (Test Day 2). Forty-eight hours after Test Day 2, all animals were injected with saline and tested again (Test Day 3). Injections and tests, randomly ordered on each test day, were administered in a darkened experimental room adjacent to the home brooder. During the 30 min injection-test interval animals were individually caged in the experimental room without food and water.

Responsivity to shock was assessed by measuring the threshold for observing a flight response to wing shock. A flight response was defined as a quick outward movement of both wings from the body in response to shock and was sometimes, but not always, accompanied by vocalization, jumping, and pecking at the shock electrodes. Shock electrodes were attached to the relatively featherless skin located on the underside of each wing near the body. Thirty seconds after the electrodes were attached and starting at 0 mA, continuous shock was delivered by manually increasing the shock intensity control dial at a rate of approximately 2 mA/min. Shock intensity was increased until the chicken performed a flight response or until shock intensity reached 2 mA. If a flight response was observed, the shock was terminated, and, 5 sec later, reinstated at the same intensity. If shock reinstatement failed to elicit a flight response within 1 sec the previous flight response was discounted and shock delivery continued from the same intensity at which it terminated. The flight response threshold was defined as the intensity at which shock reinstatement elicited a flight response. If shock intensity reached 2 mA before the flight response threshold was determined, the test was terminated and threshold was recorded as 2 mA.

RESULTS

The data summarized in Fig. 1 clearly show morphine analgesia. Analgesia is evident on Test Day 1 in the significantly higher flight response threshold of the Morphine Group relative to the Saline Group, $t=2.87$, $p<0.01$. Morphine analgesia is not evident on Test Day 2 as the flight response thresholds of Morphine and Saline Groups did not differ significantly. There was no significant difference in the flight response thresholds on Test Day 3 when both groups received saline injections.

DISCUSSION

Schneider [12] failed to demonstrate analgesia in chickens with morphine doses below 200 mg/kg. In contrast, the experiment reported here clearly demonstrates analgesia in chickens with a morphine dose which, although relatively high (30 mg/kg), more closely approximates the analgesic dose range reported for other species [2, 8, 11]. This large discrepancy in analgesic morphine dose could reflect methodological differences (multiple toe-pinch method in Schneider's research vs. wing-shock method reported here) or animal age differences (1- to 3-day-old chickens in Schneider's research vs. 17-day-old chickens reported here).

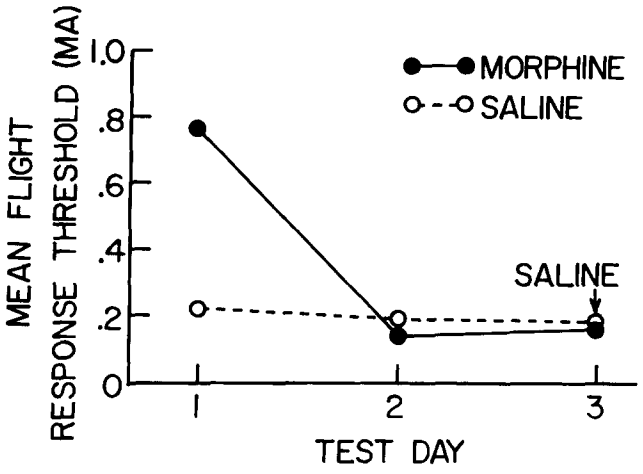

FIG. 1. Mean flight response thresholds obtained 30 min after chickens received either 30 mg/kg morphine or saline on Test Days 1 and 2. Both Morphine and Saline Groups received saline on Test Day 3. Standard error scores for Morphine and Saline Groups are: Morphine, 0.18, 0.04, 0.05 and Saline 0.03, 0.05, 0.06 on Test Days 1, 2, and 3, respectively.

Our informal observation, described earlier, indicated that the foot-shake response may be elicited by any perceived stimulus applied to the chicken's foot and might therefore be insensitive to the analgesic effect of morphine. Since this possibility was not assessed in the present research it is also possible that mechanisms underlying morphine analgesia are relatively undeveloped in 1- to 3-day-old chickens. Regardless of the source of difference between Schneider's report and the present report, the results we present for one morphine dose using a shock-elicited response in 17-day-old chickens are consistent with previous research showing morphine analgesia using a shock-elicited response in rats [1, 3, 4].

The morphine analgesia inferred from increased flight response threshold on Test Day 1 was not obtained on Test Day 2. This decrease in drug effect across repeated administrations is termed tolerance and in the present research occurred after a single morphine injection. Although this result is consistent with previous research showing single-dose morphine analgesic tolerance in rats and mice [7,9], it is not clear whether or not the data presented here reflect morphine analgesic tolerance, learning due to response contingent termination of shock, behavioral tolerance, or a combination of drug-test interactions that may influence analgesia response measures (e.g., [5]).

Test 3, where both morphine and saline groups were tested following saline injection, was conducted to assess potential influence of previous morphine exposure on subsequent response threshold. More specifically, recent evidence suggests that morphine tolerant rats may display a hyperalgesic response following saline injection [13]. The present results did not reveal a hyperalgesic response. However, response values lower than those reported here may not be possible (i.e., values around 0.2 mA may represent a floor effect).

Finally, morphine effects are characterized as opiate-specific if reversed by opiate antagonists [10]. While the present research describes a shock-elicited flight response in

chickens that is demonstrably sensitive to morphine in a manner that is descriptively characteristic of analgesia, whether or not this effect is opiate specific remains to be determined.

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