

Significance of Procaine Residues in Postrace Urine Samples

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Sequestration of horses treated with procaine HCL or procaine penicillin for a period of 4 h before post would effectively ensure that procaine had no effect on the horse's performance. However, the addition of epinephrine significantly increased the duration of local anesthesia, which could create complications for the sequestration strategy. Authors' addresses: Maxwell H. Gluck Equine Research Center and the Dept. of Veterinary Science, University of Kentucky, Lexington, KY 40506 (Harkins, Woods, and Tobin); The Kentucky Racing Commission, Lexington, KY 40511 (Mundy); Truesdail Laboratories, Tustin, CA, 92680 (Stanley); and Arthur, Valla, and Associates, Sierra Madre, CA, 91024 (Arthur).

1. Introduction

Procaine is one of the most commonly detected drugs in postrace urine samples,¹ with 73 positive calls in the U.S. during a 3.5-year period (January 1990–July 1993).² Many of these positives are apparently inadvertent, resulting from the administration of procaine as procaine penicillin or other legal therapeutic agents. Because procaine penicillin is a legitimate therapeutic agent widely used by veterinarians and because procaine is extremely persistent in urine, inadvertent procaine positives are a major problem for equine veterinarians, horsemen, and regulatory officials. Less likely sources of procaine in equine urine are illegal administrations of this drug as nerve or joint blocks; these are the uses of procaine that are of regulatory concern.^{2,3}

There are two practical approaches to the problem of procaine detection in postrace urine samples. One is to determine the minimum effective dose of procaine to cause a significant pharmacologic effect and thereby set a plasma or urinary threshold based

on this dose. A second approach is to sequester procaine-treated horses for a period of time prior to a race. Because the pharmacologic effects of procaine are short-lived, a reasonable period of sequestration should effectively prevent the improper use of procaine for its local anesthetic (LA) effects. In this communication, we report the plasma and urinary concentrations of procaine associated with threshold doses of the agent in horses and the duration of the pharmacologic effects of procaine with and without epinephrine after its use as a LA.

2. Materials and Methods

Six mature Thoroughbred mares were injected with 80 mg of procaine HCl^b subcutaneously into the posterior fetlock to measure the procaine concentration in plasma. In a second experiment, procaine HCl (40, 80, 160, and 320 mg) with and without epinephrine (1:100,000) was injected subcutaneously to assess duration of local anesthesia, by the use of a heat projection lamp that measured hoof withdrawal

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reflex latency (HWRL⁴). In a third experiment, the highest no-effect dose of procaine HCl (5.0 mg) was injected subcutaneously to measure the procaine concentration in urine.

Analysis of variance with repeated measures was used to compare saline and treatment HWRL values for the different doses of procaine with and without epinephrine. Significance was set at $p < 0.05$.

3. Results

Procaine was detected in plasma at the first sampling point (10 min). Plasma procaine reached a peak (13.88 ng/ml) at 30 min and persisted through 360 min after injection. Procaine was detected in the urine at the first sampling point (1 h) and reached a peak (23.7 ng/ml) 4 h after injection. Urine procaine concentration returned to control values 24 h after injection.

Following all injections, there was a significant LA effect at the first measurement (7.5 min). For the 40-mg dose, the significant LA effect persisted through 30 min; for the 80- and 160-mg doses, the significant LA effects persisted through 45 min; and for the 320-mg dose, the LA effect was extended through 60 min. There was a significant LA effect following procaine injection with epinephrine through 180 and 420 min, respectively.

4. Discussion

In a concurrent study,⁴ we determined that the highest no-effect dose (i.e., the highest dose of a drug at which there is no possibility of a pharmacological effect during a race) of procaine was 5.0 mg, which is a surprisingly small amount of agent. We also determined that any LA effect from 80 mg of procaine disappeared by 60 min after treatment. By extrapolating from the plasma procaine concentration curve, we concluded that the plasma concentration of procaine 1 h after a 5.0-mg injection would be ~500 pg/ml, a concentration well below the routine quantification ability of most analytical laboratories. Beyond this, the logistic and technical difficulties involved in stabilizing low concentrations of procaine in the presence of plasma esterases make the collection and handling of these samples difficult.

Because the measurement of procaine concentration in plasma was not practical and because procaine is present in urine at higher concentrations and for longer durations than in plasma,¹ we focused our research on the measurement of procaine concentra-

tion in urine. In our study, peak procaine concentration (23.7 ng/ml) was measured in urine with a mean pH of 8.5. Because strenuous exercise causes acidosis and urinary acidification in horses⁵ and because urinary concentrations of basic drugs such as procaine may be concentrated up to 1,000 fold in acidic urines,⁶ 25 ng/ml would be a very conservative threshold in postrace urine until further research determines urinary procaine thresholds associated with acidic urine.

As the LA effect of a large dose of procaine HCl (320 mg) returned to control values 60–90 min after injection, the sequestration of horses treated with procaine HCl or procaine penicillin for a period of 4 h before post would effectively ensure that procaine had no effect on the horse's performance. However, the addition of epinephrine significantly increased the duration of local anesthesia, which could create complications for the sequestration strategy.

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References and Footnotes

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⁴Dr. Robert Gowen, Racing Commissioners International, Lexington, KY 40511 (personal communication), 1995.

⁵Abbott Laboratories, North Chicago, IL 60064.