A Comparison of N-Butylscopolammonium and Lidocaine for Control of Rectal Pressure in Horses*

Tong Luo, BS a
Joseph J. Bertone, DVM, MS, DACVIM b
Holly M. Greene, MS a
Steven J. Wickler, PhD, DVM a

*Funding for this study was provided by Boehringer Ingelheim Vetmedica, Inc., St. Joseph, Missouri.

aEquine Research Center
Department of Animal and Veterinary Sciences
California State Polytechnic University, Pomona
3801 West Temple Avenue
Pomona, CA 91768

bCollege of Veterinary Medicine
Western University of Health Sciences
309 East Second Street
Pomona, CA 91766

CLINICAL RELEVANCE

In its FDA approved formulation, N–butylscopolammonium bromide (Buscopan Injectable Solution, Boehringer Ingelheim Vetmedica) is an anticholinergic spasmolytic agent indicated for management of abdominal pain associated with spasmodic colic, flatulent colic, and simple impactions in horses. Use of this drug abates gastrointestinal peristalsis and rectal pressure. It has been suggested that N–butylscopolammonium bromide could be used to facilitate rectal examinations in horses. This study compared the effects of N–butylscopolammonium bromide versus lidocaine and a saline control on rectal pressure and the number of rectal strains during rectal examination. The results of this study indicate that this drug increases the quality, and presumably the safety, of rectal examinations in horses.

INTRODUCTION

Equine rectal trauma associated with rectal examination, an essential diagnostic procedure in horses, has always been a risk to patients, clients, and veterinarians. It has been reported that 50% to 80% of rectal tears are fatal, and full-thickness (grade IV) tears are usually catastrophic even with prompt aggressive therapy. Rectal tears are the most frequent single reason for equine veterinary malpractice litigation. Case studies in Texas and California indicate that most rectal tears occur during rectal examination, and tears can happen in all breeds of horses. It has been suggested that primary factors causing rectal tears include failure of the rectal wall to relax, rectal straining, and patient resistance. It follows that the safest way to prevent rectal tears is to perform the procedure when the bowel is relaxed and the horse is not straining.

Practitioners have used lidocaine administered per rectum for years to facilitate rectal examination. Lidocaine administered per rectum has been shown to decrease rectal pressure in the equine rectum. However, the drug has not yet been evaluated for the purpose of facilitating rectal examinations. The purpose of this study was to compare the effects of N–butylscopolammonium bromide and lidocaine per rectum on rectal pressure and the number of rectal strains during rectal examination in horses. The results of this study indicate that this drug increases the quality, and presumably the safety, of rectal examinations in horses.
$N$–butylscopolammonium bromide in its FDA approved formulation demonstrated that it is highly effective in relieving abdominal pain.\textsuperscript{7,9} Reported adverse effects of $N$–butylscopolammonium bromide include temporarily dilated pupils, increased heart rate, dryness of the oral mucous membranes, and reduced intestinal sounds.\textsuperscript{10} Practitioners in Europe have indicated that the use of $N$–butylscopolammonium bromide, which is available only in a combination injectable solution with dipyprone, is not only useful in the management of abdominal pain but also enhances rectal examination by reducing peristalsis and rectal straining.\textsuperscript{b}

The objective of this study was to evaluate whether the use of $N$–butylscopolammonium bromide in its FDA approved formulation, administered according to label dosage, or 2\% lidocaine administered per rectum can improve the ease and safety of rectal examination performed on horses. Our hypothesis is that $N$–butylscopolammonium bromide in its FDA approved formulation can relax the rectum more predictably than lidocaine by reducing rectal pressure and straining through smooth muscle relaxation.

### MATERIALS AND METHODS

#### Animals

All animal procedures were approved by the California State Polytechnic University Institutional Animal Care and Use Committee. Six adult horses (four mares and two geldings; three Arabians, two Thoroughbreds, and one Hackney) were used in this study. Their mean age was 10 years.\textsuperscript{6,7}

Rectal tears are the most frequent single reason for equine veterinary malpractice litigation.
age (±SD) was 10.8 (±6.2) years and mean weight (±SD) was 477 (±45) kg. The horses are research animals at the Equine Research Center, California State Polytechnic University, Pomona, and were naive to rectal palpation before the study.

Experimental Design
There were three experimental groups:

- **Buscopan group**—N–butylscopolammonium bromide in its FDA approved injectable formulation (20 mg/ml; Buscopan) was administered IV at the FDA approved dosage (0.3 mg/kg, equivalent to 1.5 ml/100 kg body weight, once) and 50 ml of normal saline was administered per rectum.

- **Lidocaine group**—50 ml of 2% lidocaine (Lidocaine HCl Injectable 2%, Vetus Animal Health) was administered per rectum and saline was administered IV (1.5 ml/100 kg body weight once).

- **Control group**—0.9% NaCl solution (0.9% NaCl injection USP, Braun Medical) was administered IV (1.5 ml/100 kg body weight once) and per rectum (50 ml).

The subjective measure of efficacy, performed by the rectal palpation investigator (RPI; Bertone) made it essential to maintain masking of treatment. A three-way random crossover design was used. Each horse received all three treatments in a serial fashion; treatments were limited to one/day with a 2-day washout period between treatments. Before the study, an order of treatment was developed. On day 1, horses were randomly assigned to the order, so that there were two horses in each treatment group/experimental day, and each day, each horse received a different treatment. The RPI was masked to treatment; this was accomplished by random assignment of treatment and with delivery of an intravenous and a per rectum test article to all horses on each experimental day.

As each horse entered the study, it was placed in restraining stocks and the rectum was manually evacuated of feces. A 1-m length of Silastic tubing (3.4 mm inner diameter × 4.6 mm outer diameter; Cole-Parmer Instrument, Vernon Hills, IL) was used to deliver the per rectum test article. The RPI grasped one end of the tubing and inserted it into the horses’ rectum to the length of his mid-biceps (approximately 50 cm). The other end of the tubing was left outside the rectum and acted as a portal for drug delivery. Per rectum saline and lidocaine were then dispersed into the tubing by injection with a subsequent air flush from outside the rectum with the use of a 60-ml disposable syringe and further dispersed manually in the locale of the RPI’s gloved hand. Both solutions were clear and kept at ambient temperature to further facilitate investigator masking. In all three groups, N–butylscopolammonium bromide, saline IV, lidocaine, and saline per rectum were all administered in route–volume matched fashion.

Rectal Pressure Measuring System
Rectal pressure and sensitivity were tested by an intrarectal latex condom balloon device connected to a physiograph (EEG & Polygraph Data Recording System, model 79D, Grass Medical Instruments, Quincy, MA). Plungers were removed from 60-ml Luer-lock disposable syringes and the barrels cross-sectioned at the 30-ml mark. The end with the Luer-lock needle attachment was used, and rubber cement was placed around the outside of the barrel body approximately 1 cm below the cut end. A nonlubricated male condom (Trojan, Church & Dwight, Princeton, NJ) was cross-sectioned in half, and the cut end of the reservoir section was placed over the cut end of the syringe barrel onto the rubber cement. Two wraps of umbilical tape were placed...
around the condom and syringe at the level where the rubber cement had been applied and tied tightly to increase adherence and security of the seal. This closed the system, except at the Luer-lock end of the barrel. The Luer-lock end was connected to a 2-m long polyvinyl tube by firm insertion of the male needle adapter of the syringe barrel into the tubing, which created an airtight seal. The other end of the tubing was attached to a double-lumen connector with a diverter; one lumen connected to the transducer (low-level DC Pre-Amplifier, model 7P1G, Grass Medical Instruments) and the other to a 60-ml syringe as the air injector. The transducer was connected to the amplifier (Digital Pressure Indicator, Omega Model HHP701, Omega Engineering, Stamford, CT) of the physiograph. The intrarectal balloon pressure changes, which represent the rectal pressure, were recorded as graphic tracings on the chart paper. The speed of the paper was set at 50 mm/min. Pen sensitivity was set at 0.5 mV/cm and 1.0 mV/cm.

**Procedures**

Horses were weighed and drug doses calculated before the experiment. The measuring system was calibrated at 10 and 20 mm Hg by the digital pressure indicator. The RPI placed his arm with the latex balloon device and the per rectum drug delivery tube grasped in his hand into the rectum of the subject horse. The balloon device was held via the syringe barrel and directed cranially to minimize RPI effect on the balloon device. Pressure shifts from the RPI were minimized. This was also facilitated by the masking of the RPI to treatment. The RPI left his arm in place until all recordings were made. The condom was inflated with air to a pressure of 20 mm Hg. Balloon pressure data were recorded for 3 minutes as pretreatment data, and then test articles were administered. Data were recorded for another 3 minutes as the posttreatment data. Discovery studies in this laboratory indicated that the 3-minute period would be sufficient for the rectal relaxation effects of N–butylscopolammonium bromide. Clinical experience indicated the same was true for lidocaine. In addition, the needs of field veterinary practice would make much longer periods to efficacy impractical for common use. After the RPI withdrew the balloon, the device was checked to ensure that there was no leakage in the system and the balloon pressure was recorded as baseline data. The recording chart paper was photocopied, and the copied tracings were then cut along the baseline. The tracings were cut free from the paper above the tracing, and the paper was weighed on an analytical balance (Model XA, Fisher Scientific, Pittsburgh, PA) to obtain the numeric data. The weight of the paper between the upper tracing and the baseline was assumed to be related to the area under the pressure–time curve. A single strain was measured and defined as any spike in pressure that increased 20 mm Hg above baseline and then returned below 20 mm Hg.

**Statistics**

The repeated measurement ANOVA (SuperANOVA, Abacus Concepts, Berkeley, CA)
blocked for treatments was used to analyze the data. Treatments were the independent variable; pre- and posttreatment balloon pressures were dependent variables. P values ≤ .05 were considered significant. Means comparison was used to compare the differences between treatment groups.

**RESULTS**

The mean rectal pressure before and after injection of the drug and saline are shown in Figure 1. The total rectal pressure for the 3 minutes after administration of Buscopan was 68% of the pressure in the 3 minutes before administration. There were no significant changes between preand posttreatment values for the lidocaine or control groups. In addition, the numbers of rectal strains during 3 minutes before and after treatment were counted. After administration of N–butylscopolammonium bromide, strains decreased from 10.1 (±4.1)/3 minutes before treatment to 1.2 (±0.7)/3 minutes after treatment. There was no reduction on strain count after injecting lidocaine (pretreatment, 9.7 [±5.0]; posttreatment, 8.0 [±4.2]) and placebo (pretreatment, 13.5 [±2.5]; posttreatment, 13.7 [±3.2]).

**DISCUSSION**

The data in this study support the hypothesis that N–butylscopolammonium bromide can relax the rectum far better than lidocaine administered rectally by reducing rectal pressure and strain in horses. Lidocaine per rectum was no better than the normal saline control within the time defined by the study protocol.

N–Butylscopolammonium bromide is already being used to enhance the safety and quality of rectal examination in equine practice, but its effects for this purpose have not been evaluated. To our knowledge, the present study is the first to evaluate the use of N–butylscopolammonium bromide during rectal examination. A similar intrarectal balloon device made from condoms and used in this study is a traditional method used to diagnose and study the sensitivity and compliance of the rectum in humans. Other studies of N–butylscopolammonium bromide evaluated the effect of N–butylscopolammonium bromide combined with dipyrone on abdominal pain. That product has been marketed in Europe for a number of years as Buscopan Compositum (Boehringer Ingelheim Vetmedica.). Other studies investigat-
ed the effect of \(N\)-butylscopolammonium bromide alone on abdominal pain.\textsuperscript{7,8} It has been demonstrated that \(N\)-butylscopolammonium bromide, alone or in combination with dipyrone, appears to have a spasmylytic effect that is successful in treating some abdominal abnormalities in horses and abomasal disorders in cattle.\textsuperscript{15}

There are no untoward adverse effects reported from studies of \(N\)-butylscopolammonium bromide used in horses at the manufacturer’s suggested dosage. In a safety study, 10 times the recommended dose of \(N\)-butylscopolammonium bromide was administered; horses showed symptoms including dilated pupils, increased heart rate, dryness of the oral mucous membranes, and reduced intestinal sounds.\textsuperscript{7}

In the present study, the pressure tracings indicate that \(N\)-butylscopolammonium bromide was associated with reduction in intraluminal rectal pressure within 1 minute after administration, which is similar to the previous observation that the drug was associated with a reduction in abdominal discomfort within 30 seconds after injection in association with gastrointestinal relaxation.

**CONCLUSION**

The data of the balloon-pressure changes indicate that the use of \(N\)-butylscopolammonium bromide during rectal examination stopped rectal muscular contractions and reduced rectal pressure as compared with lidocaine or a saline control over the first 3 minutes of administration.

**REFERENCES**