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# Comparison of Transrectal and Abdominal Transducers in Abdominal Ultrasonography of Horses: A Mini-Review

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Mini Review

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## ABSTRACT

Colic, a prevalent condition in horses, poses a significant threat with a high incidence rate and is a leading cause of equine mortality. Abdominal ultrasonography is vital for evaluating gastrointestinal health, traditionally performed with an abdominal transducer. However, limited access to this equipment prompts the common use of trans rectal transducers, traditionally reserved for reproductive examinations. This study compares the two transducers in organ identification and abnormality detection during transcutaneous abdominal ultrasonography. The pilot project assesses organ identification in clinically healthy horses, revealing comparable results with a depth limitation affecting certain organs. Subsequently, the study examines horses with colic, employing a fast localized abdominal ultrasonography protocol. Results indicate no significant differences in detecting free fluid, small intestinal abnormalities, or colon wall pathology. However, the transrectal transducer is less effective in identifying the left kidney and stomach. These findings suggest that the readily available trans rectal transducer is a viable option for abdominal ultrasonography in horses, offering crucial insights for equine colic diagnosis and decision-making in the field. Colic is a prevalent condition in horses, ranking as a leading cause of equine mortality. Abdominal ultrasonography is crucial for assessing gastrointestinal health, yet the availability of suitable transducers in primary care equine practice is limited. This study aims to compare the efficacy of trans rectal and abdominal transducers in organ identification and abnormality detection during transcutaneous abdominal ultrasonography.

**Keywords:** Colic; Equine health; Abdominal ultrasonography; Trans rectal transducer; Abdominal transducer; Organ identification; Abnormality detection; Gastrointestinal tract; Horse mortality; Fast localized abdominal ultrasonography; Flash protocol; Equine colic diagnosis

## INTRODUCTION

Colic is a common condition in the horse, with an incidence of 4.2 events/100 horses per year and it is a leading cause of death among horses, second only to old age [1]. Abdominal ultrasonography is useful in evaluating the gastrointestinal tract and has a role in distinguishing lesions of the small and large intestine [2]. The equine abdomen is traditionally scanned with a 2-5 MHz curvilinear array or sector transducer, colloquially known as the "abdominal probe" (and referred hereinafter as "abdominal transducer,") yet few primary care equine veterinary practitioners have access to this transducer. In fact, only 8% of ultrasound machines purchased for use in equine practice in Canada from 2016 to 2021 included an abdominal transducer [3]. Meanwhile, practitioners commonly use 5-10 MHz linear array ultrasound transducers for reproductive examinations (colloquially known as the "rectal probe" and referred hereinafter as "trans rectal transducer"). One conference proceeding described that the spleen, liver, kidneys, duodenum, large colon, small intestine, bladder, and diaphragm could be imaged transutaneously using the transrectal transducer [4]. Evidence-based information comparing the use of the transrectal transducer and abdominal transducer in transcutaneous abdominal ultrasonography would facilitate critical decisions for equine colic patients in the field.

## LITERATURE REVIEW

With a series of studies, our group set out to answer the questions of how a transrectal transducer compares with an abdominal transducer for organ identification during transcutaneous abdominal ultrasonography of clinically healthy horses (pilot project) and how they compare in ultra-sonographic detection of abnormalities in horses presenting for colic. These are the first-published studies to compare the transducers in organ identification and detection of abnormalities in equine abdominal ultrasonography.

In the pilot study four veterinarians with variable skill level performed abdominal ultrasonography on twelve clinically normal horses [5]. Two horses were examined independently on both sides simultaneously by two randomly assigned veterinarians. Both recorded whether ten organs expected to be visualized on abdominal ultrasonography were "identified" or "not identified" *via* ultrasonography in six standardized sextants to designate location along each side of the horse. This protocol followed methodology described by Williams et al. [6]. The transducer used was randomly allocated and then the pair would switch to the next horse and scan the other respective side of that horse with the opposite transducer. Fishers Exact Tests were used to determine if there was a difference in abdominal organ identification and a Chi squared test was used to determine differences between transducers in identifying target abdominal organs.

There was no significant difference in organ identification on the right side of the abdomen and on the left side, the stomach, liver, and kidney ($p=0.014$, $p=0.036$, $p=0.0146$, respectively) were less likely to be detected with the transrectal transducer. There were no significant differences between the transducers in detection of the spleen, colon, small intestine, and urinary bladder on the left side. With the maximum depth of 10 cm for the transrectal transducer, the depth of organs was thought to be a factor in decreased organ identification on the left side. The left kidney is located medial to the 5-8 cm spleen and the stomach is also located deeper within the abdomen,

deep to the spleen [7]. It is less clear why the left liver was less likely to be identified using the transrectal transducer, but one hypothesis is that the narrow field of this transducer makes it more difficult to use surrounding structures such as the spleen and stomach to definitively identify the left liver lobe. Overall, the transrectal transducer produces ultrasonographic images of sufficient quality to allow organ identification similar to the abdominal transducer with the exception of a depth limitation that affects visualization of the left kidney, left liver, and stomach. Limitations to the study were the lack of blinding to the transducer being used, the variable expertise of the ultrasonographers, and the relatively low number of horses used.

Following the pilot study, we decided to compare the detection of abnormalities in horses presenting with colic using transrectal and abdominal transducers and fast localized abdominal ultrasonography of horses (FLASH) [8]. The FLASH protocol is simple to use for clinicians without extensive ultrasound experience and can be used in emergency settings to detect major abnormalities in horses with colic making it the ideal protocol for use of rectal transducers by general practitioners evaluating horses for colic in the field [9]. Our hypothesis was that both the transrectal and abdominal transducers could detect free abdominal fluid and abnormalities of the small intestine. We hypothesized that there would be significant differences in their ability to detect gastric conditions and left dorsal displacement of the colon.

Horses over one year of age who presented to a referral clinic for colic and transcutaneous abdominal ultrasonography were recruited over the study period of 2 months. Due to the emergent nature of the situation, horses were not clipped and the hair coat was instead soaked with alcohol. Horses were evaluated as usual by the attending clinician using an abdominal transducer for abdominal ultrasonography. Enrolled horses were simultaneously examined using the transrectal probe on the opposite side and the exam was concluded whenever the attending clinician completed their exam, to not delay diagnostics and treatment. Each ultra-sonographer (all veterinary interns with equivalent ultrasound experience) completed a FLASH score sheet and recorded cine-loops. Redacted and randomized cine-loops were retrospectively analyzed by board-certified equine specialists, who completed FLASH score sheets. These data were analyzed using Chi square testing, paired-t-testing, Wilcoxon matched-pairs signed rank testing, and Mann Whitney testing depending on normality determined by Shapiro-Wilk testing.

There were no significant differences in detection of free abdominal and thoracic fluid, small intestinal pathology (distention, wall thickness, motility), or colon wall thickness using the transrectal and abdominal transducers. In fact, the transrectal transducer detected colon wall thickening in 5.6% of images compared to 1.4% of images using the abdominal transducer. As predicted based on the pilot study, the transrectal transducer was less likely to detect the left kidney (and therefore nephrosplenic entrapment and left dorsal displacement) and stomach (and therefore detection of gastric dilation).

Detection of abnormal small intestine using FLASH is the best predictor for surgical intervention therefore rapid diagnosis of small intestinal distention, abnormal wall thickness, and abnormal motility using the readily available transrectal probe by general equine practitioners could lead to faster referral and improved survival rates [9]. Further, although not statistically significant, there was higher incidence of detection of thickened colonic wall with the transrectal transducer, which corresponded to diagnoses of left dorsal displacement, colon impaction, colitis, and impaction with right dorsal displacement. The low-depth penetration and high near-field resolution of the transrectal probe may explain this difference. Limitations of the study include lack of hair clipping, which may have disproportionately impacted the transrectal transducer due to its low depth penetration, severely painful horses

were excluded from the study to not impact their prompt treatment, and limited numbers of patients (24 horses) were evaluated during the 2-month study.

## CONCLUSION

This study shows that the readily accessible transrectal transducer can be used in abdominal ultrasonography of normal horses to detect all organs, with decreased visualization of the left kidney, stomach, and left liver lobe. In horses presenting with colic, it can be used with the FLASH protocol to successfully detect abnormalities in abdominal fluid, small intestine, and large intestine, which could make a significant impact on critical decisions regarding referral and surgical intervention. It is less useful for conditions that require detection of the left kidney and stomach, including nephrosplenic entrapment, left dorsal displacement, and gastric dilation. Overall, both studies were the first to prospectively explore the use of transrectal transducer in transcutaneous abdominal ultrasonography. These research findings have significant ramifications for ultra-sonographic diagnosis of colic in the field.

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