

The impact of ultrasound during emergency after-hour admissions of horses

A Viljoen^a, M N Saulez^a, A Carstens^b and B Gummow^c

ABSTRACT

Clinical use of diagnostic ultrasound at point-of-care or emergency situations, although common, has not been well documented in veterinary medicine. Medical records of after-hour emergency equine admissions during a 10-year period were reviewed and horses that received ultrasound scans were identified. Data sheets for each ultrasound scan performed during emergency clinical evaluation were collected and reviewed. Data extracted included anatomical region imaged, body system affected, documented ultrasonographic diagnosis and final diagnosis. Six hundred and nine records were available of which 108 horses had an ultrasound diagnostic procedure performed. The most common reason for emergency ultrasonography was to investigate gastrointestinal abnormalities, the largest proportion of these being large intestinal disorders. A complete ultrasound report was documented in 57 % of evaluations, of which 79 % correlated with a final diagnosis. Incomplete reporting made accurate interpretation of records difficult. Results indicate that the use of ultrasound in the emergency setting may be of diagnostic benefit and impact on patient management. Ultrasound training should be provided to residents in order to gain proficiency, especially with regard to the gastrointestinal system.

Keywords: diagnostic imaging, equine, gastrointestinal, training.

Viljoen A, Saulez M N, Carstens A, Gummow B **The impact of ultrasound during emergency after-hour admissions of horses.** *Journal of the South African Veterinary Association* (2010) 81(4): 216–218 (En.). Section of Equine Medicine, Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Private Bag X05, Onderstepoort, 0110 South Africa.

INTRODUCTION

Ultrasound use in the critically ill patient has become essential for improving outcome in human patients.⁶ Since the early 1970s, technological advances such as multifrequency probes and colour Doppler as well as the introduction of new clinical applications of ultrasonography in trauma patients have allowed greater use of point-of-care ultrasound in emergency situations.^{5,6,8} Emergency and critical care medicine is constantly evolving and the demand for ultrasound studies after regular working hours has increased. Board-certified ultrasonographers are in short supply, especially after hours, resulting in internists and residents performing many ultrasound studies. Therefore the American College of Emergency Physicians has stated that training in performing and interpreting ultrasound imaging studies should be included in residency curricula.¹²

In veterinary medicine, ultrasound has

proven to be a safe, non-invasive and useful diagnostic imaging modality with an increasingly wide application.³ Originally introduced into equine medicine for diagnostic purposes in the early 1980s, it is now also being used for evaluation of treatment and patient monitoring, while simultaneously aiding prognostication.^{2,3,13}

Since the use of ultrasound in an emergency and critical care setting is becoming more popular amongst non-radiologist clinicians, we sought to quantify both the use of ultrasound as a diagnostic tool as well as the reporting of ultrasonographic data during emergency after-hour equine admissions at the Onderstepoort Veterinary Academic Hospital (OVAH) over a 10-year period.

MATERIALS AND METHODS

Medical records of all after-hours emergency equine admissions to the OVAH between 1998 and 2007 were reviewed. Horses that received ultrasound scans immediately following admission were identified and data sheets for each ultrasound scan performed during emergency clinical evaluation were collected and reviewed. Data extracted included anatomical region imaged, body system affected, ultrasonographic diagnosis and final

diagnosis. After-hours cases were defined as horses admitted at any time other than 08:00–16:30, Monday to Friday inclusive.

Admissions were classified and grouped into different body systems affected according to the final diagnosis made at the end of the hospitalisation period. This included gastrointestinal, musculoskeletal, respiratory, reproductive, urinary, cardiovascular and nervous systems. Ultrasound evaluation was grouped into anatomical region imaged (abdominal, thoracic, musculoskeletal and urinary). If more than one body system was affected the horse was classified according to the most significant body system affected based on ultrasound results and the clinician's interpretation. The gastrointestinal system was further classified into small and large intestinal disorders. Data were extracted on intestinal wall thickness, degree of motility, lumen diameter and peritoneal fluid characteristics as recorded in the patient files. The number of reported ultrasonographic diagnoses and subsequent correlation with the final diagnosis in hospital were also recorded.

RESULTS

Medical records of 609 after-hours equine emergency admissions during the 10-year period were reviewed. Ultrasound was performed on 18 % of horses ($n = 108$) of which 81 % ($n = 87$) occurred between 2003 and 2007. Most horses were diagnosed with gastrointestinal disorders (76 %, $n = 82$) and abdominal ultrasound was therefore performed most frequently during emergency admissions (72 %, $n = 78$) (Fig. 1). Abdominal ultrasound was performed on 90 % (74/82) of equine admissions diagnosed with gastrointestinal disorders, of which 51 horses (69 %) had large intestinal disorders, while small intestinal disorders were recorded in 23 horses (31 %). Impaction and nephrosplenic entrapment of the large colon was recorded in 13 (25 %) and 11 (22 %) of the 51 horses respectively.

Within the group of horses that received abdominal ultrasound scans as a result of gastrointestinal disorders, motility was recorded of the large intestine (18 %, $n = 13$) and small intestine (31 %, $n = 23$), wall thickness was recorded of the large

^aSection of Equine Medicine, ^bSection of Diagnostic Imaging, Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Private Bag X05, Onderstepoort, 0110 South Africa.

^cSchool of Veterinary and Biomedical Sciences, James Cook University, Townsville, Australia.

*Author for correspondence.
E-mail: adrienne.viljoen@up.ac.za

Received: May 2010. Accepted: October 2010.

intestine (19 %, $n = 14$) (within normal limits [WNL]: $n = 10$; increased [>3 mm]: $n = 4$) and small intestine (35 %, $n = 26$) (WNL: $n = 14$; increased [>3 mm]: $n = 12$) while small intestinal diameter was recorded in only 32 horses (43 %). The echogenicity of peritoneal fluid was recorded in 33 horses (increased: $n = 5$, normal: $n = 28$), while the amount of peritoneal fluid was subjectively recorded in 34 horses (increased: $n = 7$, normal: $n = 27$). Gastrointestinal rupture was subsequently diagnosed in all 5 horses with increased peritoneal fluid echogenicity and volume, including a ruptured liver with resultant haemoperitoneum. An exploratory laparotomy was performed on 22 of 74 horses. In 9 of 22 horses a sonographic diagnosis was not documented, while in 12 of 22 horses, ultrasonographic findings provided sufficient information to support surgical exploration.

Twelve horses had ultrasound performed for musculoskeletal-related disorders. Disorders included soft tissue trauma ($n = 6$), abscessation ($n = 3$), superficial digital flexor tendinitis and *interosseus medius* muscle injuries ($n = 2$ each) and suspected septic arthritis ($n = 1$). Thoracic ultrasound was performed on 5 horses and revealed evidence of pulmonary abscessation, pleural effusion and pulmonary consolidation. Umbilical ultrasound was performed on 3 foals. An echocardiogram was performed on 1 horse that had a thrombophlebitis of the jugular vein and bacterial endocarditis. The reproductive tract was evaluated in 3 horses. Foetal viability was assessed in 2 horses by percutaneous abdominal ultrasound while 1 horse was transrectally evaluated for retained foetal membranes.

A complete ultrasound report containing a diagnosis based on ultrasonographic findings was documented in 61 of 108 ultrasound evaluations (57%). Seventy-nine per cent (48/61) of documented ultrasonographic diagnoses correlated with a final diagnosis. Seventy-six per cent of documented gastrointestinal ultrasonographic diagnoses (Fig. 2) correlated with the final diagnosis, of which small intestinal disorders and nephrosplenic entrapment of the large colon were most accurately diagnosed (100 % and 92 % respectively). Fifty-two per cent (25/48) of ultrasonographic diagnoses were definitively confirmed either during surgery or on *post mortem* examination. The remaining 48 % (23/48) responded to medical intervention although no definitive diagnosis was possible.

DISCUSSION

Results of diagnostic ultrasound performed on emergency after-hour equine

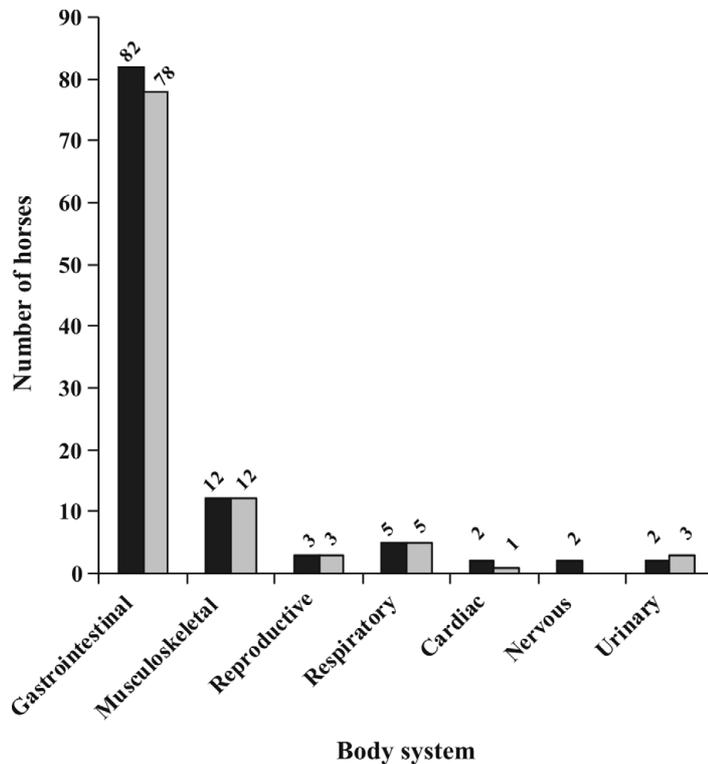


Fig. 1: After-hours equine emergency admissions to the OVAH (1998–2007): number of ultrasound examinations performed per affected body system. ■, Body system affected; ■, body system imaged.

admissions indicate that abdominal ultrasound was most commonly performed. Of these the most frequently affected system was the gastrointestinal tract. This is consistent with results reported by Viljoen *et al.*¹⁵ who analysed after-hours equine emergency admissions at the same institution. Ultrasound is often per-

formed on horses presenting with acute abdominal pain, a true medical emergency in equine medicine often requiring rapid decision-making. It is particularly valuable with regard to treatment decisions such as differentiating surgical from non-surgical conditions. This can be done by measuring parameters such as small

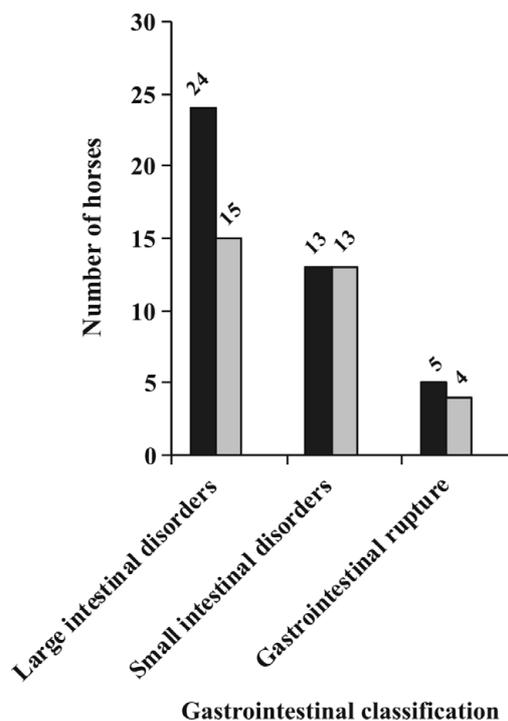


Fig. 2: After-hours equine emergency admissions to the OVAH (1998–2007): documented gastrointestinal ultrasonographic diagnoses which correlated with a final diagnosis. ■, Documented ultrasonographic diagnoses; ■, correlation with final diagnosis.

intestinal distension, intestinal wall thickness, peristalsis and peritoneal fluid abnormalities.² Previous authors reported that they were able to diagnose small intestinal obstruction more accurately after abdominal sonographic examination compared with rectal palpation, which helped differentiate medical from surgical treatment.^{7,13} This study supports these findings as all small intestinal associated ultrasonographic diagnoses recorded correlated with the final diagnoses. Small intestinal parameters (motility, wall thickness and diameter) were recorded in less than 50 % of all abdominal ultrasonographic evaluations and might have proven more valuable if measurements were recorded more often.

Horses with gastrointestinal disorders were predominantly diagnosed with large intestinal abnormalities. This is similar to a previous report indicating that large colon impactions represented the majority of large intestinal disorders at the same institution¹⁶. Owing to the gas-filled nature of its contents, large intestinal ultrasonography is more difficult. Although not routinely used in diagnosing large intestinal impactions, ultrasonographic changes, including loss of sacculations of the ventral colon and hyper-echoic intestinal contents, may aid in localising and diagnosing them³. Ultrasonographic evaluation of the large colon does, however, remain useful in the diagnosis of intestinal displacements such as nephrosplenic entrapment, as demonstrated by this study. In recent years, ultrasonographic colonic wall thickness has proven valuable in prognosticating and diagnosing large intestinal volvulus.^{9,14} A thickened colonic wall lacking peristaltic activity reflects the degree of oedema and haemorrhage, and therefore the prognosis.¹³ As was the case with small intestinal measurements, large intestinal measurements were infrequently recorded.

In addition to gastrointestinal organ pathology, foetal viability and distress can also be determined by percutaneous abdominal ultrasound, minimising risks involved with rectal palpation.¹⁰ In this study, transcutaneous abdominal ultrasonography was performed to evaluate foetal viability during obstructive dystocia and possible uterine torsion. Information such as foetal heart rate and rhythm, foetal activity as well as placental fluid echogenicity can provide valuable information regarding foetal distress in such emergency situations. This can aid the decision whether to perform an emergency caesarean section.

Thoracic ultrasonography was performed on 5 horses presented with

suspected pneumonia. Even though thoracic ultrasonography is limited to the lung periphery, most horses presenting with pneumonia or pulmonary abscesses have a degree of pleural or peripheral pulmonary involvement, making ultrasonography a useful tool for diagnosis of such pulmonary disorders.¹¹

This study had several limitations. Accurate interpretation of medical records was difficult due to the retrospective nature and lack of completed data sheets for each ultrasound scan. This affected attempts to correlate the ultrasound diagnosis, surgical intervention and survival. Furthermore, confirmation of ultrasound findings was not always possible either due to response to medical therapy, inability to conduct a *post mortem* examination or surgical exploration. The study proved useful, however, in defining routine data capture for future epidemiological evaluation.

Results obtained in this study suggest that the use of ultrasound in the emergency and critical care setting has increased significantly. Since non-radiologist clinicians (internists and residents-in-training) are mostly responsible for emergency after-hour care, we believe that basic ultrasound knowledge should be part of emergency after-hours training. Emergency and critical care ultrasound is currently regarded as an integral part of human emergency residency programmes and proved that greater operator confidence and experience correlates with improved accuracy.¹⁴ In order to provide a wider clinical application in equine emergency ultrasonography, a similar approach to that used in human medicine ultimately leading to an ultrasound curriculum for critical care medicine may be worthwhile and will be a significant quality-improvement activity.

In conclusion, we suggest that ultrasound may be a useful modality when evaluating horses with gastrointestinal disease. Results indicate that the use of ultrasound in the emergency setting may be of diagnostic benefit and impact on patient management, especially when considering surgical intervention for gastrointestinal-related disorders. Furthermore, accurate record keeping together with a systematic diagnostic approach and evaluation could lead to improved utilisation of ultrasound. Ultrasound training should be provided for residents in order to gain proficiency, especially in diagnosing gastrointestinal disorders.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge Mrs Sarie Lotter for her assistance in

retrieving medical records, and the students and staff of the Onderstepoort Veterinary Academic Hospital for their supportive care of patients.

REFERENCES

1. Akhtat S, Theodoro D, Gaspari R, Tayal V, Sierzenski P, Lamantia J, Stahmer S, Raio C 2009 Resident training in emergency ultrasound: consensus recommendations from the 2008 council of emergency medicine residency directors conference. *Academic Emergency Medicine* 16: 32–36
2. Freeman S L 2002 Ultrasonography of the equine abdomen: findings in the colic patient. *In Practice* 24: 262–273
3. Freeman S L 2003 Diagnostic ultrasonography of the mature equine abdomen. *Equine Veterinary Education* 15: 319–330
4. Jang T, Naunheim R, Sineff S, Aubin C 2007 Operator confidence correlates with more accurate abdominal ultrasounds by emergency residents. *Journal of Emergency Medicine* 33: 175–179
5. Kendall J L, Hoffenberg S R, Smith R S 2007 History of emergency and critical care ultrasound: the evolution of a new imaging paradigm. *Critical Care Medicine* 35: 126–130
6. Kirkpatrick A W, Sustic A, Blaivas M 2007 Introduction to the use of ultrasound in critical care medicine. *Critical Care Medicine* 35: 123–125
7. Klohn A, Vachon A M, Fischer A T 1996 Use of diagnostic ultrasound in horses with acute abdominal pain. *Journal of the American Veterinary Medical Association* 209: 1597–1601
8. Neri L, Storti E, Lichtenstein D 2007 Toward an ultrasound curriculum for critical care medicine. *Critical Care Medicine* 35: 290–304
9. Pease A P, Scrivani P V, Erb H N, Cook V L 2004 Accuracy of increased large-intestine wall thickness during ultrasonography for diagnosing large colon torsion in 42 horses. *Veterinary Radiology and Ultrasound* 45: 220–224
10. Reef V B 1998 Fetal ultrasonography. In Reef V B (ed.) *Equine Diagnostic Ultrasound* Saunders Co, Philadelphia: 425–445
11. Reef V B, Whittier M, Allam L G 2004 Thoracic ultrasonography. *Clinical Techniques in Equine Practice* 3: 284–293
12. Sankoff J 1999 Emergency medicine resident education: making a case for training residents to perform and interpret bedside sonographic examinations. *Annals of Emergency Medicine* 34: 105–108
13. Scharner D, Rorring A, Gerlach K, Rasch K, Freeman D E 2002 Ultrasonography of the abdomen in the horse with colic. *Clinical Techniques in Equine Practice* 1: 118–124
14. Sheats M K, Cook V L, Jones S L, Pease A P 2010 Use of ultrasound to evaluate outcome following colic surgery for equine large colon volvulus. *Equine Veterinary Journal* 42: 47–52
15. Viljoen A, Saulez M N, Donnellan C M, Bester L, Gummow B 2009 After-hours equine emergency admissions at a university referral hospital (1998–2007): causes and interventions. *Journal of the South African Veterinary Association* 80: 169–173
16. Voigt A, Saulez M N, Donnellan C M, Gummow B 2009 Causes of gastrointestinal colic at an equine referral hospital in South Africa (1998–2007). *Journal of the South African Veterinary Association* 80: 192–198