Concurrent fracture of the radius and ulna is a common injury in dogs, accounting for approximately 18% of all fractures in this species. The incidence of this type of fracture is even higher in small- or toy-breed dogs and has been attributed to biomechanical factors such as low failure loads of the distal aspect of the radius. A minor trauma such as a small jump or fall is often the only reported cause for radius-ulna fractures in small dogs.

Although treatment options for radius-ulna fractures include surgical or conservative approaches, surgery is usually preferred because external coaptation devices alone are notoriously associated with a high failure rate, with malalignment or nonunion of bone reported for > 80% of cases. Surgical options are numerous and include open or minimally invasive bone plate fixation, circular or linear external fixation, radial dowel pining, or a combination of these procedures. However, even when treated surgically, smaller dog breeds are reportedly more susceptible to complications, such as nonunion, delayed union, recurrent lameness, or refracture, than are medium- or large-breed dogs. Anatomic and mechanical differences are most likely responsible for a greater complication rate for fractures involving the DRU than for fractures involving other locations in smaller dog breeds. Instability due to small distal fragment size and limited soft tissue and blood supply surrounding the fracture site are all reported factors that could potentially hinder fracture healing.
For most surgeons, open reduction and bone plate fixation has long been the gold standard for the treatment of fractures of the DRU in miniature- or toy-breed dogs. Nonetheless, the recent literature on this topic is sparse and most often pertains to small cohorts of patients not necessarily limited to miniature- and toy-breed dogs. A retrospective study involving 22 radius-ulna fractures treated with a bone plate fixation technique revealed postoperative complications for 54% of these fractures, and 18% were considered major complications. These results would appear extreme to many surgeons, but they are cited in a current textbook and consequently commonly used by veterinarians when advising dog owners about the risks of surgically treating DRU fractures in small-breed dogs. It is the authors’ clinical impression that open reduction and bone plate fixation for the treatment of these injuries is not associated with such a high complication rate. Therefore, the purpose of the study reported here was to determine outcomes and complication rates of open reduction and cranial bone plate fixation of DRU fractures in a large cohort of exclusively toy- and miniature-breed dogs evaluated at a referral hospital.

Materials and Methods

Case selection criteria

Miniature- and toy-breed dogs admitted to the Centre Vétérinaire DMV with a DRU fracture from 2008 through 2015 were eligible for inclusion in the study. Additional inclusion criteria were body weight < 7 kg (15.4 lb), fracture located in the distal half of the antebrachium, treatment consisting of ORIF, use of a bone plate positioned on the cranial aspect of the radius as the sole mode of internal fixation, and availability of follow-up physical and radiographic examination data.

Medical records review

Medical records of included dogs were reviewed to extract information regarding signalment, fracture etiology, fracture type, interval between injury and surgical procedure, plate type, plate size, screw configuration, cancellous bone graft use, prophylactic antimicrobial administration, type and duration of postoperative external coaptation, and complications. Duration of surgery and anesthesia could not be assessed because this information was not consistently reported in the medical records. Three of the authors (RDAP, JB, and MG) each evaluated a portion of the immediate and subsequent follow-up radiographs for distal fragment size, implant placement, apposition, alignment, and fracture healing stage. In the medical records, lameness was described as absent, minor, moderate, severe, or non-weight bearing at each follow-up examination. Recorded complications were classified by the authors as major (ie, requiring a second procedure) or minor (ie, able to be managed successfully with medical or conservative treatment). Radiographic findings such as decrease in bone opacity were not listed as complications if they were not associated with clinical signs at any stage of the follow-up period.

Surgical procedure

All dogs had undergone ORIF of fractures with a bone plate, which had been performed by 1 of the 3 board-certified surgeons of the Centre Vétérinaire DMV or by a surgical resident under their direct supervision. For the procedure, all dogs had been anesthetized with isoflurane in oxygen, and in most situations (surgeries performed after 2010), regional anesthesia had been provided via a brachial plexus block with bupivacaine hydrochloride (2.2 mg/kg [1 mg/lb]). A constant rate IV injection of fentanyl (2 to 5 µg/kg/h [0.9 to 2.3 µg/lb/h]) or remifentanil (2 to 5 µg/kg/h) had been administered intraoperatively and during the first 12 to 24 hours after surgery. Cefazolin (22 mg/kg [10 mg/lb]) or ticarcillin-clavulanate (40 mg/kg [18.2 mg/lb]) had been administered IV at the time of anesthetic induction and again every 8 hours after surgery until the dog was observed to eat. Antimicrobial administration had been continued orally at the surgeon’s discretion for 7 to 14 days. Orally administered tramadol, NSAIDs, or both had been prescribed for 5 to 21 days on the basis of circumstances and surgeon preference.

Preoperative radiography of the antebrachium, consisting of mediolateral and craniocaudal projections, had been performed for all dogs. Lengths of the distal radial fragment, proximal radial fragment, and total radius were retrospectively measured, and a distal-to-total radial length ratio was recorded for each fracture. The level of the fracture was retrospectively expressed as the percentage of the total radial length.

During surgery, all dogs had been positioned in lateral or dorsal recumbency, depending on surgeon preference, and all fracture sites had been accessed via a craniomedial approach to the distal aspect of the radius. Care had been taken to preserve the cephalic vein and the tendon of the abductor pollicis longus muscle. When the size of the distal radial fragment allowed placement of bone-reduction forceps, fracture reduction had been performed and a neutralization plate applied on the cranial surface of the radius, with a minimum of 2 screws applied distally and 3 screws applied proximally. When the distal fragment size was limited, the plate had been first positioned on this distal fragment with 1 or 2 screws, and reduction and positioning of the proximal screws had been performed subsequently. Afterward, the surgical site had been thoroughly flushed with saline (0.9% NaCl) solution and closed routinely.

Postoperative radiography had been performed immediately after the procedure. A soft bandage, splinted bandage, or a synthetic resin cast had been applied on the affected limb, depending on fracture repair configuration and surgeon preference. Exercise restriction to short walks on a leash for at least 4 to 6 weeks had been recommended to owners of all
dogs. Following removal of the external coaptation device, a progressive return to usual activity level over a 2- to 4-week period had been advised for all dogs as well as a rehabilitation program consisting of passive range of motion exercises of the ipsilateral elbow joint and carpus.

**Follow-up data**

Each dog had been reevaluated 2, 4, and 6 weeks after surgery, and subsequent follow-up evaluations had been performed, depending on the age of the patient, presence of any type of external coaptation, stage of bone healing, or development of any complication. All bandages had been reevaluated every 2 weeks or sooner if judged necessary by the owner. Management of external coaptation depended on surgeon preference or repair configuration. The first follow-up radiographic examination was performed between 3 and 4 weeks after surgery and then every 2 to 4 weeks until bone healing had been achieved. Bone union was defined as the point when the original radial fracture line was no longer visible. In each situation, the surgeon who had performed the initial surgical procedure had also performed a complete orthopedic examination at least 2 weeks after removal of any external coaptation device or bandage. Lameness, limb alignment, and carpal range of motion had been subjectively assessed at that stage.

Finally, a long-term follow-up questionnaire was completed with the owners by telephone interview at least 6 months after the procedure (Supplemental Appendix S1, available at http://avmajournals.avma.org/doi/suppl/10.2460/javma.250.12.1419). Long-term outcome for affected limbs was considered excellent if there was no lameness or visible angular deviation, good if there was minimal stiffness or angular deviation, fair if there was some intermittent lameness, and poor if lameness was permanent or deviation was severe. When dogs had 2 affected limbs and when limb function differed between limbs, long-term outcome for the worst affected limb was considered.

**Statistical analysis**

Descriptive statistics were computed. No additional statistical analysis was performed.

**Results**

**Animals**

A total of 102 miniature- and toy-breed dogs and 105 fractures met the inclusion criteria and were included in the study. Twenty-six (25%) dogs were neutered males, 24 (24%) were sexually intact males, 32 (31%) were spayed females, and 20 (20%) were sexually intact females. Breeds included Toy Poodle (n = 33 [32%]), Chihuahua (24 [24%]), Italian Greyhound (17 [17%]), Yorkshire Terrier (8 [8%]), Pinscher breeds (8 [8%]), Pomeranian (4 [4%]), mixed (4 [4%]), and Chinese Crested, Bichon Frisé, Miniature Schnauzer, and Pug (1 [1%] each). Mean body weight was 3.1 kg (6.8 lb; range, 1 to 7 kg [2.2 to 15.4 lb]). Mean age at first evaluation was 13.5 months (range, 2 to 69 months).

**Fractures**

For 92 (90%) dogs, the DRU fracture had been caused by minor trauma, such as a fall from a low height or playing with other pets; fracture etiology for the other 10 (10%) dogs was unknown. All fractures were simple and closed. Sixty-six of the 105 (63%) fractures were transverse, and 39 (37%) were short oblique. Fifty-five (52%) involved the right forelimb, and 50 (48%) involved the left forelimb.

Three (3%) dogs had bilateral fractures, and both forelimbs had been surgically treated concurrently. Six (6%) fractures had been initially stabilized by external coaptation for a period ranging from 11 to 97 days; 4 of these fractures had been considered non-union fractures by the time the ORIF procedure was performed. None of these dogs had undergone previous surgery for their fractures.

Mean and median intervals between injury and surgical treatment were 3.9 days and 1 day, respectively (range, 0 to 97 days). Mean lengths of the distal and proximal segments were 19.2 mm and 70.7 mm, respectively, with a mean distal-to-total radial length ratio of 0.21.

**Surgical procedures**

Three plate types had been used for the ORIF procedure on the basis of surgeon preference, fracture configuration, or patient size: compression plates (1.5 mm [n = 58] and 2.0 mm [31]), cuttable plates (1.5 to 2.0 mm [10] and 2.0 to 2.7 mm [1]), and T plates (1.5 mm [2] and 2.0 mm [3]), all of which had been purchased from the same manufacturer.

Mean body weight for dogs that received the 1.5-mm and 2.0-mm plates was 2.32 kg (5.1 lb; range, 1.9 to 4.8 kg [4.2 to 10.6 lb]) and 4.52 kg (9.9 lb; range, 2.2 to 7 kg [4.8 to 15.4 lb]), respectively.

A median of 6 holes/plate (plate length), 6 total screws, 3 proximal screws, and 2 distal screws were used to stabilize the radius-ulna fractures. In 10 fractures, 1 hole had been left empty because of proximity to the fracture line. None of the compression or T plates had been modified intraoperatively by the removal of any plate hole. No contouring of the plates was necessary for any fracture.

Autogenous cancellous bone graft harvested from the proximal aspect of the ipsilateral humerus had been used for 2 fractures in which a previous attempt of external coaptation had failed. Postoperative external coaptation had been applied to 103 (98%) fractures to protect the surgical repair. Specific coaptation devices included splinted bandages (n = 79 [75% of all fractures]), soft bandages (18 [17%]), and synthetic resin casts (6 [6%]), depending on surgeon preference, and had been left in place for a median duration of 4 weeks. Oral antimicrobial administration had been continued for 7 to 14 days for 71 (70%) dogs, and SC administration of a long-acting antiimi-
crobiotically had been performed for 3 dogs. Twenty-eight dogs had received no antimicrobial after discharge from the hospital.

Follow-up data
Mean and median intervals between surgery and bone healing were 5.6 and 6 weeks, respectively. Immediate postoperative alignment and apposition of the repaired bones were considered excellent in all situations (Figure 1). During the last follow-up appointment, no lameness was recorded for 97 (95%) dogs and minor lameness was recorded for 5 (5%) dogs. Results of clinical and radiographic examination of limb alignment were considered excellent for 100 (95%) fractures and good for 5 (5%) fractures for which a mild valgus deviation was identified. For one 7-month-old neutered male Miniature Poodle weighing 5.3 kg (11.7 lb), severe valgus deviation was identified 3 weeks after the initial surgery had been performed on a chronic DRU fracture previously stabilized with a synthetic resin cast for 10 weeks. The alignment was considered excellent after the revision procedure (Figure 2).

Complications developed in 26 (25%) fractures; 23 (22%) were considered minor complications, and 3 (3%) were considered major complications. Of the 3 major complications, 2 fractures (2 dogs) required implant removal 2 and 8 months after surgery because of surgical site infection. These 2 dogs received no postoperative antimicrobials. The other major complication involved the same dog in which severe distal valgus of the antebrachium was identified 3 weeks after surgery, suggesting a refracture had occurred and requiring subsequent angular deformity correction.

Figure 1—Representative mediolateral (A through C) and craniocaudal (D through F) radiographic views of a 13-month-old sexually intact male Miniature Poodle with a DRU before (A and D), immediately after (B and E), and 8 weeks (C and F) after surgical repair by open reduction and bone plate fixation to the cranial aspect of the bone. DR = Right.

Figure 2—Craniocaudal radiographic views of a chronic DRU fracture in a 7-month-old neutered male Miniature Poodle initially repaired by means of open reduction and bone plate fixation to the cranial aspect of the bone. A—Image obtained 3 weeks after the initial surgery, in which a severe valgus deformity is visible that required subsequent angular deformity correction 8 weeks after the initial surgery. B—Image obtained immediately after revision surgery. C—Image obtained 4 weeks after revision surgery. This dog had originally been admitted for repair of bilateral DRU fractures, consisting of a recent fracture on 1 side and a 10-week-old nonunion fracture initially managed with a cast (and in which the subsequent valgus deformity was identified). The dog recovered from the revision surgery with no complications and good limb alignment.
Of the 23 minor complications, 18 were bandage-associated superficial skin irritations or wounds and 5 were minor valgus deviations. Implant failure was identified 3 weeks after surgery. Relative stability of the fracture and acceptable alignment of the limb permitted successful management without further surgical procedures (Figure 3). Osteopenia involving the radius, ulna, or carpal bones was radiographically detected in 22 fractures (Figure 4) and was not considered a minor complication because it was never associated with lameness or refracture in any affected dog.

Owners of 71 of the 102 (70%) dogs were contacted by telephone to obtain long-term follow-up information (median follow-up interval, 41 months; range, 8 to 83 months). Sixty-eight (96%) of these dogs had no residual lameness, and 3 (4%) dogs had signs of mild lameness at extremely cold temperatures. Sixty-eight (96%) owners rated the overall outcome as excellent, and 3 (4%) rated it as good because of a minimal valgus deviation with no apparent decrease in limb function. None of the contacted owners rated the outcome as fair or poor. The owner of 1 (1%) dog with bilateral fractures reported that its level of activity was slightly decreased relative to before the traumatic event. According to their owners, all other dogs (99%) returned to typical activity after the recovery period.

**Discussion**

The present retrospective study was conducted to determine outcomes of DRU fracture repair by means of open reduction and cranial bone plate fixation in a large group of miniature- and toy-breed dogs. Findings suggested that ORIF with bone plating for this type of fracture yielded an excellent outcome and low complication rate, and outcomes compared favorably with or were similar to those of other or the same reported techniques.2,5,7,8,13,17 Most of the recent research has focused on closed reduction and less invasive procedures of fracture repair in dogs2,5,13,17,20 or has failed to discriminate dog breeds on the basis of size.13,16,18 As previously suggested, DRU fracture in miniature- and toy-breed dogs represents a particular condition.2–6,17 More specifically, when proportionally loaded, the antebrachii of toy-breed dogs are more susceptible to fracture than those of large-breed dogs because of differences in cross-sectional properties of bone.4 Although medium-sized and larger breeds of dogs are most often evaluated for more complex and high-velocity fractures,18 toy breeds usually sustain low-velocity, simple fractures. In the present study, 90% of dogs had sustained a DRU fracture as a result of minor trauma, and all fractures were simple and closed. In recent studies12,13,22 involving DRU fracture, emphasis has been placed on preservation of fracture

![Figure 3](https://www.jvma.org/article-figures/figure_3.png)

Figure 3—Cranio-caudal radiographic views of a DRU fracture in a 7-month-old sexually intact male Miniature Poodle 3 (A), 8 (B), and 12 (C) weeks after surgical repair by means of open reduction and bone plate fixation to the cranial aspect of the bone. Implant failure was identified 3 weeks after surgery. Relative stability of the fracture and acceptable alignment of the limb permitted successful management with 6 weeks of external coaptation. By 12 weeks after surgery, complete healing of the fracture with clinically important bone remodelling was achieved.

![Figure 4](https://www.jvma.org/article-figures/figure_4.png)

Figure 4—Mediolateral radiographic views of a repaired DRU fracture in a 5-month-old spayed female Miniature Poodle immediately (A) and 5 (B) and 8 (C) weeks after surgery showing transient osteopenia of the carpus, radius, and ulna. Bone structure opacity considerably decreased after 5 weeks of external coaptation. Three weeks after removal of the coaptation device, bone structure opacity was comparable to the opacity immediately after surgery.
hematoma and blood supply at the fracture site, at the expense of anatomic reduction. Although the MIPO technique has been successful in humans and veterinary species for various and usually complex fracture configurations, it may not be the most suitable option for miniature- or toy-breed dogs with a simple fracture in the distal portion of the bone. In our clinical experience, most of these fractures in miniature breeds are located distally, leaving only a small distal fragment size for implant placement.

In the present study, the mean distal fragment length was 19.2 mm, and most fractures were located below the distal fourth of the antebrachium, as indicated by a mean distal-to-total radial length ratio of 0.21. The MIPO technique for repair of DRU fractures requires the use of a temporary external skeletal fixator to distract the bone fragments and achieve limb alignment. For such distal fractures, use of external skeletal fixator pins would considerably reduce the already limited available bone length for screw placement and may compromise the distal fragment. Accurate reduction of these simple fractures is more difficult to achieve with MIPO, which has been shown to result in translational malalignment more frequently than ORIF.

Interference between the plate and extensor tendons in fractures of the distal aspect of the radius is also a risk factor for persistent lameness and plate removal in miniature- and toy-breed dogs. Although not clearly defined as a problem secondary to soft tissue interference, plate removal because of persistent lameness nonresponsive to anti-inflammatory and antimicrobial treatment was identified in 23% (7/30) of dogs of all sizes that received larger (vs smaller) plates in a previous study. As the present study revealed, DRU fractures in miniature- and toy-breed dogs are typically simple and therefore suitable for anatomic reduction. Restoration of the radial bony column via ORIF generates load sharing between the bone and the implanted plate, allowing the surgeon to choose a thinner plate, therefore decreasing the risk of interference with the extensor tendons and subsequent implant removal procedure. Of the 105 fractures described in the present report, only 2 required implant removal and were associated with infection rather than mechanical discomfort. Because the mean size of the implants used was smaller than that previously reported, choice of a thinner plate could be presumed to reduce the need for subsequent implant removal caused by tendon interference.

In the present study, most of the 71 dog owners contacted by telephone at least 6 months after surgery rated their overall satisfaction with the postoperative result as excellent. Ninety-nine percent of dogs reportededly returned to their previous level of activity after the recovery period. Seventeen of 22 (77%) dogs with radiographic signs of osteopenia at the time of last follow-up were included in this owner-contacted group, and no subsequent adverse event was mentioned by owners involving the ipsilateral limb to suggest re-fracture. Although a decrease in radiographic bone opacity has long been considered a postoperative complication, these results suggested that osteopenia is not necessarily associated with a greater risk of re-fracture. The osteopenia could be presumed to have been transient and mainly related to the use of postoperative external coaptation devices given that the use of smaller, thinner plates may result in less stress shielding. Although long-term radiographic follow-up would have been necessary to confirm this presumption, it is the authors’ experience that a return to normal function allows bony remodeling around the implanted plate and a long-term increase in the thickness of radial and ulnar cortices.

The overall postoperative complication rate in the present study was 25%, with major complications identified for only 3% of fractures. These results compare favorably with those of a similar study, in which the postoperative complication rate was 54% and the catastrophic complication rate was 18%. Several factors may help explain these differences. First, 55% of the fractures in the other study were chronic in nature and previous attempts at surgical repair had been made, which may have resulted in less potential for bone healing and a greater failure rate. In the present study, < 4% of DRU fractures were considered nonunion fractures and the surgery performed at our institution had been the first attempt at surgical repair. In the other study, osteopenia was also considered a complication, therefore increasing the minor complication rate from 44% to 54%. Furthermore, it is unclear whether the repaired radius in that study had been protected by the use of postoperative external coaptation devices.

In the present study, postoperative valgus deformity was identified in 6 (6%) fractured forelimbs; 5 had minor lateral deviation, compared with the contralateral forelimb, and 1 had severe valgus deformity that required subsequent angular deformity correction. This finding is similar to other findings reported for ORIF, external fixation, or MIPO for radius-ulna fractures. Interestingly, valgus is the only angular deformity identified in the frontal plane after repair of DRU fractures. Some investigators support the role of the carpal extensor muscles and digital flexor muscles in displacing the distal fragment caudolaterally during surgical retraction. The normal conformation of the distal aspect of the antebrachium and carpus in dogs also may explain further postoperative valgus deviation during weight bearing. Nonetheless, perfect anatomic reduction should limit this risk and is theoretically not feasible with minimally invasive or closed procedures.

All fractures healed a median of 6 weeks after surgery in the study reported here, which is similar to findings of a study involving MIPO and ORIF repair of radius-ulna fractures and brief than those in a study involving placement of an intramedullary pin in the ulna to assist reduction with MIPO techniques. On the basis of these findings, and within the confines of the present retrospective study, bone healing does not appear to be adversely influenced by...
an open surgical approach to the fracture site, compared with when minimally invasive procedures are used.\textsuperscript{13,18} Furthermore, fracture healing in miniature- and toy-breed dogs in the present study did not appear to take longer than has been reported for larger breeds.\textsuperscript{11,13} Bone healing is more difficult to assess radiographically when ORIF approaches to fracture repair are used because ORIF relies on primary bone healing and radiographic disappearance of the fracture line, rather than on callus formation. The time required before radiographic evidence of bone healing is detected is often overestimated with primary bone healing,\textsuperscript{13} which may have led to a false increase in the median healing time of 6 weeks reported here.

Bandages (17%), splinted bandages (75%), or casts (6%) were used in almost all dogs of the present study to protect the surgical repair in the early stage of bone healing. A large proportion of the minor complications reported were associated with use of such coaptation devices. Therefore, postoperative monitoring for such complications is strongly recommended thorough client communication and diligent follow-up. In a study\textsuperscript{11,25} involving dogs and cats, 63% of orthopedic conditions of the distal portion of the limb for which casts were used were associated with soft tissue injury. In the light of the bandage-associated skin irritation and wounds, one could question the use of external coaptation devices in the postoperative management of such fractures. However, it is the authors’ opinion that providing initial and additional stability to the repair should allow the surgeon to select smaller implants, which may alleviate the need for subsequent implant removal.

Of the 105 fractures evaluated in the present study, only 1 implant failure was identified 3 weeks after the initial surgery. For the affected 3.6-kg Miniature Poodle, original plating consisted of an 8-hole, 1.5- to 2.0-mm cuttable plate with 4 screws placed proximally and 4 screws placed distally. Relative stability of the fracture callus and acceptable alignment of the limb permitted successful management with 6 weeks of external coaptation. Because the dog had no clinical signs after complete bone healing, the owner elected not have the implants removed (Figure 3). Cuttable plates were used for only 11 (10%) DRU fractures, reflecting the authors’ preference for the use of compression plates in such fractures.

The retrospective nature of the present study represents an inherent limitation mainly because of the lack of standardization of surgical technique, postoperative management, and follow-up data collection. Nonetheless, the included cases pertained to an inclusion period (8 years) during which surgeons and surgical staff remained the same and techniques were consistent. Follow-up appointments are also included in the initial surgery price at our institution, facilitating owner reporting of complications, even when long term. Not all owners of dogs in the present study could be contacted for a follow-up telephone interview; however, we considered the achieved 70% response rate to be sufficiently representative for study purposes. We concluded that open reduction and cranial bone plate fixation with a temporary bandage or splinted bandage for the treatment of DRU fractures in miniature- and toy-breed dogs provided an excellent outcome with a fairly low complication rate.

**Footnotes**

- a. Hospira Healthcare Corp, Montreal, QC, Canada.
- b. Sandoz Canada, Boucherville, QC, Canada.
- c. Novopharm, Toronto, ON, Canada.
- d. Timentin, GlaxoSmithKline, Mississauga, ON, Canada.
- e. Veterinary Orthopedic Implants, St Augustine, Fl.
- f. Convenia, Zoetis, Kirkland, QC, Canada.

**References**


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**From this month’s AJVR**

**Assessment of agreement among diplomates of the American College of Veterinary Anesthesia and Analgesia for scoring the recovery of horses from anesthesia by use of subjective grading scales and development of a system for evaluation of the recovery of horses from anesthesia by use of accelerometry**

Stuart C. Clark-Price et al

**OBJECTIVE**

To evaluate agreement among diplomates of the American College of Veterinary Anesthesia and Analgesia for scores determined by use of a simple descriptive scale (SDS) or a composite grading scale (CGS) for quality of recovery of horses from anesthesia and to investigate use of 3-axis accelerometerometry (3AA) for objective evaluation of recovery.

**ANIMALS**

12 healthy adult horses.

**PROCEDURES**

Horses were fitted with a 3AA device and then were anesthetized. Eight diplomates evaluated recovery by use of an SDS, and 7 other diplomates evaluated recovery by use of a CGS. Agreement was tested with $\kappa$ and AC1 statistics for the SDS and an ANOVA for the CGS. A library of mathematical models was used to map 3AA data against CGS scores.

**RESULTS**

Agreement among diplomates using the SDS was slight ($\kappa = 0.19$; AC1 = 0.22). The CGS scores differed significantly among diplomates. Best fit of 3AA data against CGS scores yielded the following equation: $RS = 9.998 \times SG^{0.633} \times \Sigma UG^{0.174}$, where $RS$ is a horse’s recovery score determined with 3AA, $SG$ is acceleration of the successful attempt to stand, and $\Sigma UG$ is the sum of accelerations of unsuccessful attempts to stand.

**CONCLUSIONS AND CLINICAL RELEVANCE**

Subjective scoring of recovery of horses from anesthesia resulted in poor agreement among diplomates. Subjective scoring may lead to differences in conclusions about recovery quality; thus, there is a need for an objective scoring method. The 3AA system removed subjective bias in evaluations of recovery of horses and warrants further study. (*Am J Vet Res* 2017;78:668–676)