Journal of the American Association for Laboratory Animal Science
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Vol 46, No 3
May 2007
Pages 32–36

Teaching a New Method of Rabbit Intubation

Thamus J Morgan[1,*] and Maria M Glowaski[2]

Veterinary technology students were asked to participate in a study comparing 2 methods of teaching endotracheal intubation of rabbits. The first group of students was taught to intubate rabbits by the classic 'blind' method. This method entailed holding a sternally recumbent rabbit by its head while the intubator listened to breath sounds through a partially passed endotracheal tube inserted through the rabbit's oral cavity. When the rabbit inhaled, the intubator introduced the endotracheal tube to the lower respiratory tract, timing the movement of the endotracheal tube with the opening of the laryngeal inlet. A second technique, based on the blind method of intubation of horses, was taught to a second set of students. In this method, the operator visualizes the condensation of exhalation from the respiratory tract in the transparent silicon endotracheal tube positioned at the rostral larynx. The operator uses this information to advance the endotracheal tube into the airway. All students were successful with both techniques. Although students intubated the rabbits more quickly with the classic blind technique, they expressed unanimous preference for the lateral recumbency method.

Rabbits (*Oryctolagus cuniculus*) are a common anesthetic patient, whether in biomedical research or companion animal practice. For fiscal year 2004, the United States Department of Agriculture accounted for 261,573 rabbits in research facilities,[29] whereas the American Veterinary Medical Association census (1998) reported 4.8 million pet rabbits in the United States.[13] The rabbit is an animal model for myocardial infarction[5,9,11,27] and development of orthopedic techniques,[7,16,23] to name only 2 of numerous biomedical study uses. Successful intubation of these animals is necessary for optimal anesthesia of the animal and protection of the surgical staff from exposure to waste-gas quantities of inhaled anesthetics.[24] Spaying, neutering, and other surgical procedures of these pet animals are part of routine companion animal practice.

Rabbits are considered a difficult species to intubate, compared with other commonly intubated animals (that is, dogs, cats, and pigs). Many different techniques have been described for the rabbit, with a visually guided method being the most published.[6,8,26,31] Rabbits are at risk for laryngeal trauma, secondary swelling, and vagal stimulation due to repeated misguided intubation attempts. In humans, fatal laryngeal swelling due to trauma from repeated attempts of intubation is a potential sequela of an inexperienced or incompetent intubator.[26] Tracheal lesions in rabbits due to repeated intubation attempts have been documented.[21] Rabbits may die of suffocation due to traumatic laryngeal obstruction or require euthanasia after tracheal rupture due to excessively forceful intubation technique.[22] With sufficiently traumatic intubation, subglottic stenosis may result, further narrowing an already small airway (5.81 mm ventrodorsally by 5.41 mm laterally at the level of the cricoid in a 2.3- to 5.1-kg rabbit) and making subsequent intubation even more difficult.[4,17] Education and clinical experience will provide confidence to anesthetists while facilitating their ability to be humane and gentle.[2,25]

Laboratory animal health technicians and research technicians generally learn about lagomorphs on the job, with little or no formal training in anatomy, neurology, and physiology. Students in veterinary technology programs are instructed in anesthetics on a limited range of species, that is, dogs and cats; rabbits are not typically part of most formal training programs.[12] The goal of many veterinary technology programs is to prepare technicians for a wide range of clinical experience encompassed in companion animal practice. Despite the great need for highly trained veterinary technicians in research, few programs offer additional skill training in laboratory animal methodologies.

This study was conducted to compare 2 methods of intubation and assess the feasibility of teaching technical students these techniques. Interdisciplinary collaboration resulted in the development of a novel, atraumatic intubation technique for rabbits. This new technique was taught in addition to the classic method described by Flecknell.[8] All participating students had completed their veterinary surgery and anesthesia course successfully and had never intubated a rabbit previously.

Methods and Materials

General procedures. This study was approved by the Institutional Animal Care and Use Committee of Becker College (Leicester, MA) and conducted in accordance with the *Guide for the Care and Use of Laboratory Animals*.[20] All rabbits were donated to Becker College from Millbrook Breeding Laboratories (Amherst, MA). These rabbits were negative for bacterial, viral, helminths, protozoan, and arthropod pathogens. Rabbits were individually housed in a stainless steel hanging-cage system under standard environmental conditions (18 to 21 °C, 30% to 70% humidity, 12:12-h light:dark, 15 to 18 air changes hourly). The rabbits were fed a commercial chow (5P25 Pro-Lab Hi-fiber Rabbit Chow, PMI Nutrition International, Richmond, VA) and had ad libitum access to water via 1-l water bottles with stainless steel ball-bearing sipper tubes (bottles were changed daily). Each rabbit had a 5 × 10 × 10-cm wooden block and some other type of environmental enrichment toy (nylon bone or barbell chew toy, stainless steel triangular rattle, 15-cm-diameter hard plastic ball, or a collection of stainless steel washers on a hanging chain) within its cage. Each rabbit received a handful (approximately 1/2 cup) of timothy-clover hay every other day, in addition to its daily ration.

Anesthesia. At 24 h prior to study initiation, 5 (3 female and 2 male) New Zealand White rabbits weighing 2.4 ± 0.46 kg received complete physical examinations. The animals were not

Received: 13 Nov 2006. Revision requested: 7 Dec 2006. Accepted: 7 Dec 2006.
[1]Division of Veterinary & Animal Health, Becker College, Leicester, MA; [2]Department of Anesthesiology, Tufts University School of Veterinary Medicine, North Grafton, MA.
[*]Corresponding author. Veterinary Medical Unit, Veteran Affairs Medical Center, Durham, NC. Email: thamus.j.morgan@us.army.mil

fasted prior to anesthesia. Immediately preceding preanesthetic administration, baseline parameters (heart rate, respiratory rate, temperature) were recorded. The rabbits were given glycopyrrolate (0.1 mg/kg; Fort Dodge Laboratories, Fort Dodge, IA), acepromazine (0.5 mg/kg; Butler Company, Columbus, OH), and butorphanol (0.5 mg/kg; Fort Dodge Laboratories) intramuscularly as preanesthetics. The oropharynx and larynx was lavaged with 0.5 ml of 0.2% lidocaine solution (Butler Company, Columbus, OH) delivered in a 1-ml syringe. To enhance the anxiolytic and pharmacologic effects of the preanesthetics, the rabbits were covered for 10 min while in their transport cages. Anesthesia was induced by administration of medetomidine (0.25 mg/kg; Pfizer Animal Health, Exton, PA) subcutaneously after preanesthetic parameters were recorded. Stage 3, Plane I anesthesia[19] was achieved within 6 ± 2 min. Clinical signs of stage 3, plane I anesthesia are lack of muscle and jaw tone, sluggish to absent palpebral response, decreased respiratory and heart rate, and loss of gag and pedal reflexes. Each rabbit was intubated by 3 students during 1 study session; oxygen-volatilized isoflurane (1% to 3%; Abbott Laboratories, Chicago, IL) delivered via a precision vaporizer (Fluotec MK III, Cyprane, Keighley, UK) was administered to the rabbits between students, to maintain anesthetic depth. Each rabbit was only used for 1 study session. A study technician monitored anesthesia in accordance with standards of the American Society of Anesthesiologists.[19] These standards are taught within the context of the veterinary surgery and anesthesia course and are the standards of this facility. Silicon, clear, noncuffed, wire-embedded endotracheal tubes (inner diameter, 3.5 mm; Bivona, Portex, Keene, NH) were used throughout the study; the outer diameter of the endotracheal tube used for each rabbit was determined by palpation of the trachea distal to cricothyrodieius apparatus, and the tube length was determined from the distance of the thoracic inlet from the tip of the animal's nose. Sterile, water-based lubricant (K-Y Lubricating Jelly, Johnson and Johnson, Arlington, TX) was applied sparingly to the outer surface of the tube for ease of placement.

Event timing. A short presentation was given to each group of students about the purpose and expectations of the study, and the technique was demonstrated before the students were invited to try. The elapsed time required to teach the technique—from the point the instructor picked up the endotracheal tube to the end (successful intubation)— was recorded. The time for each student to perform the taught task and correctly place the ET tube was timed similarly. Students were given a maximum of 3 attempts to place the tube.

Study groups. Students were assigned randomly to 1 of 2 study groups. The 'classic' group (n = 9) was the set of students that were taught the classic blind intubation technique described by Flecknell.[8] The 'novel' group (n = 6) was the set of students that were taught the new method. The 2 groups of students were taught the same techniques in a different order to test the comparative ease of assimilation. Once the students completed the task of the initial study, the exercise was repeated with students learning and performing the second technique of intubation. After both techniques were completed, the students were asked which method they preferred and why.

All participating students had completed their veterinary surgery and anesthesia course. Students who had intubated rabbits previously were not included in this study.

Techniques. ***Classic blind technique.*** Flecknell described the classic blind technique.[8] The rabbit's head was held by the operator, in the handler's subordinate hand, so that the index finger and thumb grasped the maxillary arches of the rabbit's dentition. The last finger was placed on the saggital crest of the skull to give the hand and wrist the leverage to suspend the animal by its head. The goal was to dorsoflex the head so that the nose was pointed toward the ceiling and the front feet just touched the table. The operator's dominant hand introduced the endotracheal tube behind the incisors and guided it gently forward to the larynx. The sound of the rabbit swallowing, amplified through the tube, cued the handler to put an ear over the endotracheal tube adapter and listen for respiratory sounds. If the rabbit's head was held in the left hand, the operator used the right ear to listen while the operator's head was turned counterclockwise to watch the animal's thorax. If the endotracheal tube was advanced too far, too early, and without proper placement, the tube partially obstructed the airway causing possible tissue damage and local hypoxia.[21] The endotracheal tube was advanced only as the animal reached the maximal inspiration. The larynx is widest (approximately 5 mm in diameter) at this point and accepts the endotracheal tube most easily. If undue resistance was felt, the operator pulled the tube back slightly to permit normal breathing. On occasion, a slight twist of the tube was needed in order for the Murphy's eye of the endotracheal tube to move off the epiglottis or arytenoid fold and enter into the larynx. Coughing by the animal was an early sign of successful placement of the ET tube.

Figure 1. Technique 2: Dorsoflexion of rabbit's head. The rabbit's head is held so the ears rest upon the dorsum of the rabbit. The endotracheal tube is in the handler's dominant hand. The head and jaw are manipulated by the handler's submissive hand.

Novel intubation method. The rabbit was placed in lateral recumbency, typically with the feet of the animal towards the handler and the nose pointed towards the dominant hand. This hand introduced the endotracheal tube. The key to successful intubation was to have the rabbit's head maximally dorsoflexed; the head actually extended past the vertical line drawn from the neck to the shoulders with the ears resting on the dorsum of the rabbit. With the subordinate hand lightly holding the head in this dorsoflexed position on the table (thumb on the mandible, exerting upward pressure), the operator's dominant hand introduced the endotracheal tube behind the incisors (through the diastema; Figure 1). The endotracheal tube followed the hard palate to the back of the oropharynx. Condensation within the lumen of the endotracheal tube was evidence of exhalation (Figure 2). The operator slowly advanced the tube, watching the tube clear of condensate on inhalation (Figure 3) and then fog on exhalation. When the tube reached a point of slight resistance (arytenoids), the operator paused to let the animal exhale once. This step ensured that the tube was in the proper position (by fogging the tube). During the next period of clearing, the opera-

Figure 2. The endotracheal tube is fogged with condensation when the animal expires. This fogging indicates that the tube is in the region of the larynx.

Figure 3. Once in the region of the larynx, the endotracheal tube clears when the animal inhales. Using the visual alteration of condensation and clearing allows the tube to be placed into the larynx when the tube is clear. The airway is the widest at the depth of inhalation.

tor advanced the tube so that the tube adaptor was positioned in front of the incisors; the tube should enter the trachea easily at the point of maximal inspiration. Coughing was an early indication of successful intubation.

The operator always checked the endotracheal tube placement, regardless of intubation method. Proof of proper positioning was evidenced by 3 findings: unassisted respiration, condensation upon on a metallic object (for example, laryngoscope handle), and proper movement of the thorax.

After-study care. At the termination of the study, oxygen-volatized isoflurane was discontinued, and rabbits received 100% oxygen for 3 min. Once the gag (or swallow) reflex returned, the endotracheal tube was removed. The rabbit was given atipamazole (0.25 mg/kg; Pfizer Animal Health, Exton, PA) intramuscularly as a reversal agent for medetomidine. The rabbits received flunixin meglumine (2.2 mg/kg, Schering Plough Animal Health, Union, NJ) subcutaneously for inflammation prevention and analgesia. The rabbits were recovered in the surgical suite in their transport boxes under close supervision. Once the rabbits were sternal (or standing, in most cases), they were placed in the recovery unit (stainless-steel bank of 4 large cages; Shor-line, Kansas City, KS) for 1 h. The rabbits were monitored visually for mentation and respiration every 15 min. On return of the rabbits to their usual housing, they were given a handful of timothy-clover hay to stimulate appetite. The rabbits were examined 3 times daily for 3 d after the study. No post-study morbidity or illness was documented. Each rabbit was used only once during the study. The rabbits finished the semester as teaching animals and then were adopted out to students as pets.

Statistics. The Student's 2 sample t test was used to compare the times required for instructors or students to master each intubation method. Statistics (Stata 9.2, StataCorp LP, College Station, TX) also were applied to the difference in time between instructor and student performing or mastering the same technique as well as if differences existed between which technique was performed or mastered first. The threshold for significance was set at $P = 0.05$. The results are presented as mean ± standard error.

Results

Regardless of which intubation technique was used first, mastering the second technique took less time than did the first technique ($P < 0.007$) (Table 1). This may have been due to anatomic familiarity and self-confidence gained by the operator after having been successful with the first technique mastered. In addition, the students placed endotracheal tubes in rabbits as quickly did the instructor regardless of the order in which the techniques were taught (Table 1 and Table 2) (overall population mean ± SE: 153 ± 30 s for instructor and 156 ± 21 s for students). This could be a reflection of the education level of personnel involved (technical students versus on-the-job trained research technicians).

Preliminary findings suggested that the new recumbent technique would be easier to master. This study refuted that hypothesis: Table 2 indicates that the novel lateral recumbency technique required significantly longer time to demonstrate and master than did the classic blind technique. This result was surprising in light of anecdotal reports and the author's experience that the classical blind technique was difficult to learn and master.[10] In addition, the novel technique may be intrinsically more time-consuming because the operator was not directing the endotracheal tube into proper placement but rather waiting for the animal to respire to facilitate placement.

The animals did not exhibit any laryngeal spasm or bleeding due to laryngeal trauma from either technique used. Any such bleeding would have been evident on the endotracheal tube at withdrawal. All animals resumed normal behavior within hours of study completion.

After completion of the study session, the students were asked "Which technique would you use if the opportunity arose?" and "Why?" The students unanimously replied that the lateral recumbency technique was their preference. Their answers were based on the perceived ease of placement in a noisy clinic or emergency room situation and the comfortable position (lateral recumbency) of the rabbit, which allowed successful placement of the endotracheal tube without force. The study rabbits continued in the curriculum as teaching animals without complication and later were adopted by students.

Discussion

Rabbits are one of the most difficult species to intubate due to their small oral opening and tendency to develop laryngospasms. Multiple unsuccessful attempts of intubation can lead to laryngeal trauma and edema. Death can be secondary to laryngeal and arytenoid swelling due to the described trauma and edema.[22] Several methods of rabbit intubation have been described, and involve a plethora of equipment. Yurevich[32] described a single-person technique using a frozen endotracheal

Table 1. Time (s) for successful intubation by the instructor and students

	Classic		Novel	
	First	Second	First	Second
Instructor	107 ± 31 (n = 3)	64 ± 9[a] (n = 2)	261 ± 44 (n = 2)	186 ± 66 (n = 3)
Student	135 ± 27 (n = 9)	45 ± 10[a] (n = 6)	252 ± 64 (n = 6)	188 ± 30 (n = 9)

'First' and 'second' refer to the order in which the techniques were taught.
[a]$P < 0.05$ (Student 2 sample t test) versus time as Second Method taught.

Table 2. Time (s) needed to demonstrate or master 2 techniques for intubating rabbits

	Classic	Novel
Instructor (n = 5)	89 ± 9	214 ± 19[a]
Students (n = 15)	84 ± 4	213 ± 8[a]

[a]$P < 0.05$ (Student t test) versus time for classic method.

tube and guide wire for intubation. Mansfield and colleagues[18] described intubating rabbits by using an acoustical delivery device, which would register obstructions and malposition of the endotracheal tube. Kersjes and colleagues[15] reported using fluoroscopic guidance to place a guide wire. Irazuta and colleagues[14] advocated placing the rabbit in a supine position (dorsal recumbency) and performing a needle cricothyroidotomy to place a guide wire. Weinstein and colleagues[30] described a 2-person technique using an otoscope as a speculum to introduce an endotracheal tube. Tran and colleagues[28] and Worthley and colleagues[31] both described 2-person techniques requiring an endoscope to visualize and properly place an endotracheal tube; this equipment likely could not be assembled sufficiently rapidly in an emergency situation to save a rabbit experiencing respiratory distress or arrest.

The need for an easy, effective, fast, and atraumatic method of intubation is evident, especially for paraprofessionals (such as veterinary technicians and veterinary anesthetists). In addition, a technique that could be done single-handedly would be valuable to teach to any person needing to intubate rabbits (investigative staff). This study demonstrated that students with surgical nursing background successfully intubated rabbits. All rabbits were intubated within 4.2 min of stage 3, plane II anesthesia. The time data refuted preliminary findings that the novel technique would be faster to master than the classic blind technique. Both authors have taught students the classical blind technique. Although those teaching sessions were untimed, the previous experience of both instructors led them to estimate that the instructing of this technique and its mastery by students took longer than 89 s (Table 2). Other preliminary findings involving introducing the new lateral recumbency technique to experienced veterinary technicians and veterinarians seemed to indicate that the time to demonstrate and master the technique was the same as in the current study (Table 2); however, the sessions again were untimed.

Respiratory depression or arrest is a common presenting event that requires immediate attention and the prevention of fatal, handler-induced trauma or complication.[3] A person's level of confidence in placing the endotracheal tube can be an important variable when that person is faced with an animal in a life-threatening situation. In a study environment where the animal represents an important model of human disease or key study time point, rapid, successful, and gentle intubation ensures compliance with the concept of using as few animals as possible in biomedical research.

The study demonstrated the feasibility of teaching veterinary technical students both intubation techniques. In doing so, the students learned 2 additional clinical techniques, thus strengthening their skill sets for presentation to potential employers. Regarding the techniques themselves, the novel lateral recumbency technique likely would be extremely useful when surrounding environmental noise (such as that of an extremely busy emergency room or intensive care unit) might complicate successful intubation with the classic blind technique. Although the time to place the endotracheal tube was significantly ($P < 0.001$) longer with the novel method (214 ± 12 s), the overall maximal time of 4.2 min is a reasonable amount of time in which to place an airway in an emergency situation, provided the animal is not obstructed. A limitation of the current study was the small number of participants (n = 15). In the future, these techniques might be taught earlier in the curricula in order to engage more students or in a biomedical environment or veterinary teaching hospital to utilize a student base that may have little to no formal veterinary technical training.

Rapid and competent placement of an intubation tube, especially during an emergency situation, decreases the risk of fatal laryngeal swelling, trauma, or death due to the lack of a patent airway. This novel lateral recumbency technique is an easily adopted, effective, expeditious, atraumatic, and reliable method of endotracheal intubation of rabbits that can be performed by a single operator.

Acknowledgments

We would like to thank Becker College for affording us the opportunity to do this study. Personal thanks goes to the study technician, Sharon McMahon CVT, and students for their enthusiasm, patience, willingness and the donation of time to participate in this study. A public thanks goes to Millbrook Breeding Laboratory (Amherst, MA) for the donation of the rabbits.

References

1. **Amiel D, Toyogchi T, Kobayashi K, Bowden K, Amiel ME, Healey RM.** 2003. Long-term effect of sodium hyaluronate (Hyalgan) on osteoarthritis progression in a rabbit model. Osteoarthr Cartil **11:**636–643.
2. **Beardshall RM.** 1996. Induction of anesthesia by veterinary nurses. Vet Rec **139:**452.
3. **Bonner B.** 2002. Personal communication (emergency clinic owner and practitioner).
4. **Cherukupally SR, Adams AB, Mankarious LA.** 2003. Age-related mechanisms of cicoid cartilage responses to injury in the developing rabbit. Laryngoscope **113:**1145–1148.
5. **Chiari PC, Bienengraeber MW, Pagel PS, Krolikowski JG, Kersten JR, Wariltier DC.** 2005. Isoflurane protects against myocardial infarction during early reperfusion by activation of phosphatidylinositol-3-kinase signal transduction: evidence for anesthetic-induced post-conditioning in rabbits. Anesthesiology **102:**102–109.
6. **Davies A, Dullack M, Moore C.** 1996. Oral endotracheal intubation of rabbits (*Oryctolagus cuniculus*). Lab Anim **30:**182–183.
7. **Fahlgren A, Messner K, Aspenberg P.** 2003. Meniscectomy leads to early increase in subchondral bone thickness in rabbit knee. Acta Orthop Scand **74:**437–441.
8. **Flecknell PA.** 2000. Anesthesia, p 110. In: Flecknell PA, editor. Manual of rabbit medicine and surgery. Gloucester (UK): British Small Animal Veterinary Association Publishing.
9. **Fujita M, Morimoto Y, Ishihara M, Shimizu M, Takase B, Machara T, Kikuchi M.** 2004. A new rabbit model of myocardial infarction without endotracheal intubation. Surg Res **116:**124–128.

10. **Glowaski, MM.** 2003. Personal communication.
11. **Gonzales GE, Palleiro J, Monroy S, Perez S, Rodriguez M, Masucci A, Gelpi RJ, Morales C.** 2005. Effects of the early administration of losartan on the functioning and morphological aspects of post-myocardial infarction ventricular remodeling in rabbits. Cardiovasc Pathol **14:**88–95.
12. **Hartman G.** 2003. Personal communication.
13. **Household Pet Survey.** 2002. US pet ownership and demographics source book. Schaumberg (IL): American Veterinary Medical Association.
14. **Irazuzta J, Hopkins J, Gunnroe J, Brittain E.** 1997. Simple method of multipurpose airway access through percutaneous tracheostomy in rabbits (*Oryctolagus cuniculus*). Lab Anim **47:**411–413.
15. **Kersjes W, Hildebrandt G, Schunk J, Konig J, Belis A, Schild H.** 1999. A new technique for oral endotracheal airway access in rabbits under fluoroscopic control: an easy way for drug administration in chronic experiments. Eur Surg Res **31:**216–220.
16. **Kumagai K, Saito T, Koshino T.** 2003. Articular cartilage repair of rabbit chondral defect: promoted by creation of periarticular bony defect. J Orthop Sci **8:**700–706.
17. **Loewen MS, Walner DL.** 2001. Dimensions of rabbit subglottis and trachea. Lab Anim **35:**253–256.
18. **Mansfield JP, Shannon DC, Wodicka GR.** 1998. Acoustic method to quantitatively assess position and patency of infant endotracheal tubes: preliminary results in rabbits. Pediatr Pulmonol **26:**354–361.
19. **Muir WW, Hubbell JAE, Skara RT, Bednarski RM.** 2000. Anesthetic procedures in exotic pets, p 372. In: Handbook of veterinary anesthesia, 3rd ed. New York: Mosby Publishing.
20. **National Research Council.** 1996. Guide for the care and use of laboratory animals. Wasgington (DC): National Academy Press.
21. **Nordin U, Lindholm CE.** 1977. The vessels of the rabbit trachea and ischemia caused by cuff pressure. Arch Otorhinolaryngol **215:**11–24.
22. **Phaneuf LR, Barker S, Groleau MA, Turner PV.** 2006. Tracheal injury after endotracheal intubation and anesthesia in rabbits. J Am Assoc Lab Anim Sci **45(6):**67–72.
23. **Reuter JD, Ovadia S, Howell P, Jaskwich DH.** 2002. Femoral fracture repair and postoperative management in New Zealand White rabbits. Contemp Top Lab Anim Sci **41(4):**49–52.
24. **Smith JC, Robinson LD, Auhll A, March TJ, Derring T, Bolon B.** 2004. Endotracheal tubes versus laryngeal mask airways in rabbit inhalation anesthesia: ease of use and waste gas emissions. Contemp Top Lab Anim Sci **43(4):**22–25.
25. **Stringer KR, Bjenov S, Yentis SM.** 2002. Training in airway management. Anaesthesia **57:**967-83.
26. **Tcherveniakov A, Tchalakov P, Tcherveniakov P.** 2001. Traumatic and iatrogenic lesions of the trachea and bronchi. Eur J Cardiothotac Surg **19:**19–24.
27. **Thompson RB, van den Bos EJ, Davis BH, Morimoto Y, Craig D, Sutton BS, Glower DD, Taylor DA.** 2005. Intra-cardiac transplantation of a mixed population of bone marrow cells improves both regional systolic contractility and diastolic relaxation. J Heart Lung Transplant **24:**205–214.
28. **Tran HS, Puc MM, Tran J-LV, Del Rossi AJ, Hewitt CW.** 2001. A method of endoscopic endotracheal intubation in rabbits. Lab Anim **35(3):**249–252.
29. **United States Department of Agriculture, Animal and Plant Health Inspection Service.** 2004. Fiscal year 2004 animal welfare act inspection report. Riverdale (MD): US Department of Agriculture.
30. **Weinstein CH, Fujimoto JL, Wishner RE, Newton PO.** 2000. Anesthesia of six-week-old New Zealand White rabbits for thoracotomy. Contemp Top Lab Anim Sci **39(3):**19–22.
31. **Worthley SG, Rogue M, Helft G, Soundarajan K, Siddiqui M, Reis ED.** 1999. Rapid oral endotracheal intubation with a fiberoptic scope in rabbits: a simple and reliable technique. Lab Anim **34(2):**199–201.
32. **Yurevich S.** 2002. Blind intubation in rabbits. Vet Tech **23:**291–293.