Control of Systemic Hypertension During Electro-Ejaculation of the Giant Panda (Ailuropoda melanoleuca) Using Intravenous Nicardipine Hydrochloride

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Citation

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Abstract

The giant panda (Ailuropoda melanoleuca) is a critically endangered species. Artificial insemination, using semen from underrepresented males, is a key factor in maintaining a robust and diverse gene pool. Semen is obtained from the giant panda by electro-ejaculation (EEJ), which causes significant systemic hypertension. While treatment of hypertension by increasing anesthetic depth or administering beta blockers may be successful, they are accompanied by significant unwanted side effects. We describe the successful use of bolus dose intravenous Nicardipine, a calcium channel blocker to control hypertension induced by electro-ejaculation in the male giant panda.

INTRODUCTION

The giant panda (Ailuropoda melanoleuca) is a critically endangered species, and its survival requires intensive management of captive and free-ranging populations. Artificial insemination, using semen from underrepresented males, is a key factor in maintaining a robust and diverse gene pool. Although translocating animals for natural breeding may occasionally be successful, artificial insemination confers less risk and is more cost effective [1]. At the San Diego Zoo, semen is obtained from the giant panda by electro-ejaculation (EEJ), during which, secondary to an electrical stimulus and catecholamine surge, the animal develops significant system hypertension [1]. These blood pressure elevations may reach potentially dangerous levels requiring administration of antihypertensive medications, additional anesthetic agents, or simply cessation of the procedure. Previously at our institution, treatment with propofol, isoflurane or labetalol has been met with limited success. Here we describe the use of bolus dose intravenous Nicardipine to control hypertension induced by electro-ejaculation in the male giant panda.

CASE REPORT

GG is a 17 year old, 74 kilogram wild-caught male giant panda, now residing at the San Diego Zoo. Other than the observation of severe systemic hypertension during previous EEJ procedures (Figure 1), he is in good health. During GG's 2007 annual examination semen was collected by EEJ and frozen for artificial insemination at another North American zoo.

In preparation for induction of anesthesia the animal was fasted and water was withheld overnight. After sedation with 800 mg of ketamine administered by short-range intramuscular dart, he was transported to the Zoo hospital OR for the procedure. After application of monitors, anesthesia was induced and deepened with 5% isoflurane via mask. Venous access was obtained, and the larynx was anesthetized with 4 ml of 2% lidocaine. The trachea was then intubated with a 12.0 ETT, and anesthesia was maintained with 2 % isoflurane in 100% oxygen (Figure 2). Blood pressure was taken on the forelimb by a non-invasive cuff. Using a Dinamap blood pressure monitor, baseline blood pressure was 163/83 with a baseline heart rate of 75. The method of EEJ uses an electro stimulator, in a protocol that has been described elsewhere [23] The panda was positioned in dorsal recumbancy and the electro-ejaculation rectal probe was inserted. With the first series of EEJ stimulations the blood pressure rose to 230 / 162 with a heart rate of 120 (Figure 3). Immediately prior to the second round

of EEJ, 200 mcg (2.7 mcg/kg) of intravenous Nicardipine was administered as bolus. The following BP of 200/112 prompted a second dose of 250 mcg (3.4 mcg/kg) of IV Nicardipine (6.1 mcg/kg total). The blood pressure then returned towards baseline at a value of 148/77. The EEJ procedure was allowed to resume, with blood pressure remaining stable. Before the 3rd round of EEJ, a preemptive bolus of 250 mcg of Nicardipine was given, and no further episodes of hypertension were noted (Figure 3). After the completion of the EEJ and examinations, the animal was allowed to emerge from anesthesia in a transportation crate, where he was extubated without complication.

{image:1}

{image:2}

{image:3}

DISCUSSION

The captive breeding program of the giant panda is necessary to maintain genetic diversity and to assist in the conservation of this species. After initial poor success, there is now a thriving captive-born population, with third generation captive animals now reaching breeding age. Chronic hypertension has been recorded by us and others as a concern in some captive giant pandas, with hypertension a common finding during EEJ [1]. The levels are frequently severe enough to warrant immediate treatment or cessation of the procedure for fear of catastrophic consequences. Hypertensive emergencies in humans are defined as severe hypertension with associated acute impairment of end organs [4]. The end organ damage may include stroke, hypertensive encephalopathy, aortic dissection, myocardial ischemia and infarction, acute pulmonary edema and hypertensive nephropathy [5]. With the giant pandas at the San Diego Zoo, we have found that treatment of hypertensive crisis with intravenous Propofol in 1-3 mg/kg boluses is somewhat effective, but may contribute to prolonged emergence from anesthesia. Intravenous beta blockers are an alternative therapy, and the injectable form of Labetelol has been utilized with some success. However, its use tends to decrease the volume of semen obtained during EEJ as Labetalol may require early termination of the procedure secondary to loss of erection.

Nicardipine, a water soluble calcium channel blocker that possesses predominantly vasodilator properties without a significant decrease in inotropy, has been used effectively and safely in humans as an intravenous antihypertensive [6]. Nicardipine has been shown to be as efficacious as sodium nitroprusside and nitroglycerin in the treatment of perioperative hypertension as an infusion dose [789]. However, it has also

been demonstrated to be effective as a bolus dose for acute hypertension secondary to direct laryngoscopy in humans [10].

At the San Diego Zoo and in other zoos, veterinary medical staff have been able to obtain non-invasive blood pressure measurements in unanesthetized pandas using operant conditioning [1]. We have also shown that non-invasive blood pressure measurements taken on the forelimb correlate well with intra-arterial blood pressure measurements [11]. Hypertension observed in giant pandas has been demonstrated to result in epistaxis, although other complications of hypertensive emergency have not been described. Previously documented treatments included beta blockers (oral propranalol), and amilodipine [12]. Thus, we believe that frequent measurement of systemic blood pressure and treatment of hypertension during EEJ is warranted and may prevent potentially serious and devastating complications.

In summary, we present the use of intravenous Nicardipine as a therapeutic option in a giant panda with acute systemic hypertension secondary to electro-ejaculation. We hope to gain more experience with this treatment during future giant panda EEJ procedures. Maintenance of normotension is an extremely difficult yet crucial part of the anesthesia for these procedures. Nicardipine, appears to be a significant advance in the treatment of hypertension in this critically endangered species.

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References

1. Janssen, D.L, Morris P, Sutherland Smith M, Greenberg M, Desheng L, Mauroo N, Spelman L. Medical Management of Captive Adult and Geriatric Giant Pandas. in Giant Pandas; Biology, Veterinary Medicine, and Management. Edited Wildt DE, Zhang A, Zhang H, Janssen DL, ellis S. Cambridge University Press 2006
2. Howard J.G. Semen collection and analysis in nondomestic carnivores. In zoo and wild animal Medicine: Current Therapy III. Ed Fowler ME. Philadelphia PA: W.B. Saunders Co. 1993 pp 390-9

3. Platz C,Wildt D.E., Howard J.G., Bush M. Electroejaculation and semen analysis
4. Journal of Reproduction and Fertility 1983, 67 9-12
5. Aggarwal, M. and I.A. Khan, Hypertensive crisis: hypertensive emergencies and urgencies. Cardiol Clin, 2006. 24(1): p. 135-46.
6. Blumenfeld, J.D. and J.H. Laragh, Management of hypertensive crises: the scientific basis for treatment decisions. Am J Hypertens, 2001. 14(11 Pt 1): p. 1154-67.
7. Efficacy and safety of intravenous nicardipine in the control of postoperative hypertension. IV Nicardipine Study Group. Chest, 1991. 99(2): p. 393-8.
8. Vecht, R.J., et al., Comparison of intravenous nicardipine and nitroglycerin to control systemic hypertension after coronary artery bypass grafting. Am J Cardiol, 1989. 64(15): p. 19H-21H.
9. Kwak, Y.L., et al., Comparison of the effects of nicardipine and sodium nitroprusside for control of increased blood pressure after coronary artery bypass graft surgery. J Int Med Res, 2004. 32(4): p. 342-50.
10. Halpern, N.A., et al., Postoperative hypertension: a multicenter, prospective, randomized comparison between intravenous nicardipine and sodium nitroprusside. Crit Care Med, 1992. 20(12): p. 1637-43.
11. Curran, M.P., D.M. Robinson, and G.M. Keating, Intravenous nicardipine: its use in the short-term treatment of hypertension and various other indications. Drugs, 2006. 66(13): p. 1755-82.
12. Greenberg M. 2003 Unpublished data
13. Mauroo N.F., Routh A., Hu. W. Diagnosis and management of systemic hypertension in a giant panda (Ailuropoda Melanoleuca). Proceedings of the american Association of Zoo Veterinarians, ed C.K. Baer. Minneapolis MN pp. 289-90

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