Immobilization of Japanese Black Bears (Ursus thibetanus japonicus) with Tiletamine Hydrochloride and Zolazepam Hydrochloride

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ABSTRACT. The effect of anesthetizing with a 1:1 combination of tiletamine hydrochloride and zolazepam hydrochloride (TZ) was evaluated in 75 Japanese black bears. TZ was administered to 43 captive and 11 wild, 8 captive and 13 hibernating captive bears at the doses of approximately 9.0 mg/kg (usual dosage), 18.0 mg/kg (high dosage) and 5.0 mg/kg (low dosage), respectively. Sufficient anesthetic effects were achieved in all bears, and rectal temperatures, heart rates and respiratory rates did not change significantly during an hour handling. Complete blood cell examinations showed no abnormal data. A combination of TZ would be an efficient and safe drug for chemical immobilization of Japanese black bears.

KEY WORDS: immobilization, Japanese black bear, tiletamine-zolazepam.

In many situations, such as attaching a radio-transmitter, medical examinations and sampling various biological materials, many drugs have been used for immobilization of free-ranging and captive wildlife. It is necessary to select anesthetic drugs with little adverse effects on the animal as much as possible. Anesthetics that have specific antagonists are generally preferable for wildlife. Moreover, in handling large animals such as bears, the safety of handlers should be considered. For example, etorphine [1, 11], ketamine-xylazine [7, 13], and medetomidine-ketamine [3, 5] have been used to immobilize bears. Recently a mixture of tiletamine-zolazepam has often been used as an anesthetic drug administered alone for brown bear (Ursus arctos) [12, 14] and polar bear (U. maritimus) [3, 6, 9, 10] or administered with a combination of medetomidine for polar bear [2, 3, 5], black bear (U. americanus) [4] and sun bear (Helarctos malayanus) [8]. In this study, we first applied tiletamine-zolazepam to Japanese black bear (U. thibetanus japonicus) to evaluate the anesthetic effect and its safety.

Healthy and sexually mature 64 bears (16 males and 48 females) kept in Ani Matagi-no-sato Bear Park, Akita and 11 wild bears (4 males and 7 females) captured by traps in the East Chugoku Mountain Range for the radio-tracking research were used between June 1996 and July 1997 in this study. Bears were immobilized with a 1:1 mixture of tiletamine-HCL and zolazepam-HCL (TZ, Zoletile® 100, Virbac Laboratories, France; mixture of 250 mg zolazepam-HCL and 250 mg tiletamine-HCL) prepared at 300 mg/ml.

Bears were divided into 3 groups (A, B and C). Group A (usual dosage) consisted of 54 bears (43 captives and 11 wild) administered approximately 9.0 mg/kg TZ intramuscularly by blowgun based on estimated body weight. Additional administration of TZ was needed in some captive bears of this group. Group B (high dosage) consisted of 8 captive bears and Group C (low dosage) was also 13 captive hibernating bears administered TZ intramuscularly based on estimated body weight at the doses of approximately 18.0 mg/kg and 5.0 mg/kg, respectively.

After judging induction, bears were weighed and measured, and blood samples were collected. Final dosages were calculated from actual body weights. Heart rates, respiratory rates, and rectal temperatures were recorded every 10 min after induction until final examinations at 60 min. Induction times (times from initial injection to induction) and recovery times (times until a bear sits up) were noted. Symptoms of anesthetizing, such as unconsciousness, analgesia, reflex inhibition and muscle relaxation, could not be obtained due to shortage of labor. When bears showed any sign of awakening during handling, additional TZ was properly hand-injected intramuscularly. All blood samples in EDTA tubes were placed on ice and analyzed for complete blood cell profiles as soon as possible. Statistical differences were determined by Mann-Whitney test or two-way analysis of variance. A significance level of p<0.05 was used in the analyses.

Sufficient anesthetic effects were safely achieved in all 75 bears in the 3 groups for 1 hr handling. No bear died or caused shock, but salivation was observed in several bears in the anesthetized phase. The dosages of drugs and anesthetic characteristics in each group were shown in Table 1. No differences in all data were detected between the sexes other than body weights. In Group A, there were 29 captive bears that could be handled by initial injection (initially-injected bears) and 14 captive bears that were given additional injections (additionally-injected bears) during handling. The 14 additionally-injected bears were administered a significantly lower dosage (6.9 ± 1.0 mg/kg) at initial injection than that (8.8 ± 1.5 mg/kg) of initially-injected bears (p<0.05) because of underestimation of actual body weights. But all additionally-injected bears could be han-
dled safely with a final dose at 9.6 ± 1.0 mg/kg. And there were no significant differences in total dosage, induction times, and recovery times between both initially-injected bears and additionally-injected bears. All 11 wild bears could be handled with only initial injection (9.8 ± 2.5 mg/kg). Total dosage, recovery times and induction times of wild bears were no different from those of captive initially-injected bears. These findings indicate that about 9.0 mg/kg is necessary at the dosage of TZ for an hour handling in both captive and wild Japanese black bears. All bears in Group B could be handled by initial injection at the high dosages of 18.0 ± 2.9 mg/kg without any problems, but recovery time was significantly (p<0.05) longer than in captive initially-injected bears of Group A. Immobilizations of hibernating bears in Group C at low dose (5.2 ± 0.9 mg/kg) did not cause any problems, though some bears needed additional administration. Induction times of hibernating bears in Group C prolonged more than that of initially-injected bears in Group A (p<0.05), partly due to their reduced metabolism.

TZ produced minimal adverse cardiopulmonary effects in bears [5]. In this research, rectal temperatures, heart rates and respiratory rates did not change significantly during handling in all groups (Fig. 1). Complete blood cell examinations showed no abnormal data (Table 2).

Immobilizations of captive, wild and hibernating Japanese black bears with a tiletamine-zolazepam combination were safe and had little adverse effect on TPR for an hour and complete blood cell profiles within an early anesthetized phase. However, the only problem is that the effects of TZ can not be reversed because no specific antagonist drug for TZ is available. Recently, medetomidine-tiletamine-zolazepam combinations (MTZ) have been used for handling of bears, and the use of atipamezole, the antagonist against medetomidine, reduced recovery times in bears [2–5, 8]. There are many situations that the effects of TZ in bears should be reversed immediately, as when handling unhealthy bears and relocating those with aversive conditioning. It would be necessary to conduct another study.

Table 1. Anesthetic characteristics of immobilization with a tiletamine-zolazepam combination to Japanese black bears (mean ± SD)

<table>
<thead>
<tr>
<th>Group*</th>
<th>n</th>
<th>BW (kg)</th>
<th>Zoletile (mg/kg)</th>
<th>Induction time</th>
<th>Recovery time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Initial</td>
<td>Additional</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Initial</td>
<td>Additional</td>
<td>Total</td>
</tr>
<tr>
<td>A</td>
<td>29</td>
<td>73 ± 25</td>
<td>8.8 ± 1.5</td>
<td>8.8 ± 1.5</td>
<td>9 ± 4</td>
</tr>
<tr>
<td>Initial</td>
<td>29</td>
<td>73 ± 25</td>
<td>8.8 ± 1.5</td>
<td>8.8 ± 1.5</td>
<td>9 ± 4</td>
</tr>
<tr>
<td>Captive</td>
<td>29</td>
<td>73 ± 25</td>
<td>8.8 ± 1.5</td>
<td>8.8 ± 1.5</td>
<td>9 ± 4</td>
</tr>
<tr>
<td>Wild</td>
<td>11</td>
<td>42 ± 15</td>
<td>9.8 ± 2.5</td>
<td>9.8 ± 2.5</td>
<td>5 ± 2</td>
</tr>
<tr>
<td>Additional</td>
<td>14</td>
<td>60 ± 14</td>
<td>6.9 ± 1.0</td>
<td>2.8 ± 0.6</td>
<td>8 ± 4</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>68 ± 12</td>
<td>18.0 ± 2.9</td>
<td>18.0 ± 2.9</td>
<td>8 ± 2</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>59 ± 10</td>
<td>4.5 ± 1.0</td>
<td>2.2 ± 0.8</td>
<td>5.2 ± 0.9</td>
</tr>
</tbody>
</table>

* Group A: administered at usual dosage to captive and wild bears.
* Group B: administered at high dosage to captive bears.
* Group C: administered at low dosage to hibernating bears.

Fig. 1. Rectal temperature, pulse rate and respiratory rate of 75 Japanese black bears during immobilization with TZ. Means and standard deviations are presented. Changes over time were not significant within each group: ● Group A (captive bears), ○ Group A (wild bears), ▲ Group B, ■ Group C.
about immobilizations with medetomidine-tiletamine-zolazepam in Japanese black bear to establish safer anesthesia for their research and proper management.

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REFERENCES


Table 2. Complete blood counts of Japanese black bears after immobilization with a tiletamine-zolazepam combination (mean ± SD)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Red blood cell (× 10⁴/µl)</th>
<th>White blood cell (/µl)</th>
<th>Hemoglobin (g/dl)</th>
<th>Hematocrit (%)</th>
<th>Total protein (g/100 ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Captive</td>
<td>43</td>
<td>614 ± 88</td>
<td>6,600 ± 2,900</td>
<td>11.8 ± 0.9</td>
<td>36 ± 4</td>
<td>7.8 ± 0.5</td>
</tr>
<tr>
<td>B Wild</td>
<td>11</td>
<td>662 ± 96</td>
<td>8,400 ± 4,200</td>
<td>14.2 ± 2.1</td>
<td>41 ± 5</td>
<td>8.5 ± 0.6</td>
</tr>
<tr>
<td>B Wild</td>
<td>8</td>
<td>696 ± 131</td>
<td>6,500 ± 1,700</td>
<td>13.0 ± 1.2</td>
<td>44 ± 5</td>
<td>7.7 ± 0.4</td>
</tr>
<tr>
<td>C Hibernating</td>
<td>13</td>
<td>621 ± 73</td>
<td>5,100 ± 2,000</td>
<td>13.0 ± 1.4</td>
<td>39 ± 5</td>
<td>9.1 ± 0.5</td>
</tr>
</tbody>
</table>

* Group A: administered at usual dosage to captive and wild bears.
* Group B: administered at high dosage to captive bears.
* Group C: administered at low dosage to hibernating bears.