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Original Article

Comparative Safety Evaluation of Boma and Chemical Immobilization Techniques Applied for Translocation of Spotted Deer (*Axis axis*)

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ABSTRACT

The translocation of wild ungulates poses significant stress to the animal species being transported, necessitating careful consideration. Chemical restraint helps to reduce the stress levels significantly by minimizing the mobility of the animals. Capture myopathy, a leading cause of mortality during chemical immobilization, is a critical concern. However, the Boma method offers a promising alternative to the conventionally used translocation methods. **Objective:** To compare the survival outcomes of the spotted deer captured and transported using both chemical restraint and the Boma method, therefore assessing their respective effectiveness. **Methods:** In the study, we used 22 spotted deer for chemical restraint method and 30 spotted deer were captured through Boma method and both of techniques were assessed, how capture methods influenced the fatality rate of the highly sensitive spotted deer which were being trans-located from Safari Zoo, Lahore to other captive sites of Punjab Pakistan. **Results:** The exceptional record of zero mortality in the Boma procedure was seen as compared to the chemical immobilization in which 31% of the total shifted animals were expired. The pathognomic white streaked/pale muscles in necropsy findings of dead animals later on confirmed the dead due to capture myopathy. **Conclusions:** The study established the finding that Boma technique is safer technique for trans-location of ungulates especially spotted deer as compared to the chemical immobilization.

INTRODUCTION

The distribution of the spotted deer (*Axis axis*), extends widely across the diverse habitats of the Sundarbans [1]. Certainly, the development of none or minimally invasive procedures allows obtaining information without the need to handle animals [2]. The translocation of any animal species, particularly ungulates, can be extremely stressful to the animals and it may strongly affect the success or outcome of the translocation [3]. Stress should be considered as a predictable factor in translocation and should be integrated into planning these operations [4]. Neuroleptics can undoubtedly be extremely useful in the management of wild and semi-domesticated deer [5, 6]. However, methods used for the capture of wild ungulates including the use of anesthesia have been reported to result in a marked alarmed reaction including physiological response indicative of stress and may be associated with a high incidence of mortality due to capture myopathy and other stress-related conditions [7]. Capture myopathy is a

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non-infectious disease of the muscle although; fear and excitement will always be associated with the handling of wild animals. However, it is possible to reduce the stress experienced by the animals subjected to transportation by investigating alternative methods [7]. The boma technique which was devised by Oelofse in1970 has been used for capturing a large number and variety of ungulates [8]. The Boma technique is a popular method used in Africa for transporting animals, including ungulates [9]. The Boma is typically constructed as a circular fence made of thorn bushes, creating a secure enclosure to facilitate the movement and transportation of animals [10]. While this technique focuses on the containment as a non-invasive method with minimum stress to the animal, anesthesia is used to immobilize deer for various medical interventions during transportation [11, 13].

In the current study, the two translocation techniques: Chemical restraint and the Boma technique have been subjected to a comparison. Moreover, no literature regarding the Boma's application in the translocation of the spotted deer is attainable, suggesting the lack of knowledge on the application of this method.

METHODS

A total number of 22 spotted deer were subjected to capturing employing anesthesia and a total of 30 spotted deer were captured by the use of the Boma during a routine inter-captive site transportation of the spotted deer from Safari Zoo, Lahore (31.385126782216176, 74.20938093862111). Chemical restraint involved administering xylazine at a dosage of 0.7 mg/kg of body weight and ketamine at a dosage of 2.5 mg/kg of body weight using dart guns and 5cc syringes. The dosages were calculated based on the estimated body weight, with the male deer assumed to have an adult weight of 70 kg and the average weight of the adult female deer considered to be 45 kg. The Boma method utilized a V-shaped boma, initially, 11-feet curtains were utilized to construct the Boma; supported by wooden and iron rods on either side of each curtain. Additionally, a specially designed ramp was built at the end of the enclosure between the loading truck and the end of the boma using a combination of wooden planks and road divider concrete blocks, enabling the deer to be lured into the loading truck Figure 1. The immobilization protocol involved the administration of the anesthesia, observed the induction time for the animals to reach a recumbent position, and shifting of animal in transportation cage and truck for timely immobilization of animals. On the other hand, in the boma technique, to minimize stress induced by human intervention, animals were enticed into the curtains with staff strategically positioned behind the blind curtains, preventing visual contact. A rear curtain as shown in the Figure 1 was gradually shifted to encourage forward movement, leading the animals toward the customized ramp positioned at the end of the V-shaped enclosure Boma. The deer responded remarkably well to being herded, provided they were not driven too hard and were permitted to proceed at their own characteristic trot as described by. This ramp ensured a gradual transition with no sudden raised platforms, facilitating smooth entry into the transport truck. The truck was strategically blocked on its sides and the top using blinds to prevent animal escape as demonstrated in the Figure 1. Although the animals generally detected the curtains at the entrance to the boma, the back was well concealed and they usually entered without hesitation. Upon safely loading all animals into the truck, the curtains were methodically rolled to avoid alarming the deer. To further enhance safety, the loaded truck was fully blocked with planks.

(A) **(B)**

Figure 1: (A) A top-down view demonstrating the Boma constructed inside the enclosure before driving the animals towards the ramp leading to the truck and in (B) rear moveable curtain used for the seamless movement of the spotted deer.

RESULTS

It was noted that the animals exhibited recumbency within 5 to 6 minutes after the administration of the immobilizing agents. Even after safe dosage of anesthesia, out of the 22 spotted deer immobilized utilizing anesthesia, it was observed that 7 of the subjects succumbed during their capturing after the administration of the anesthesia, resulting in a mortality rate of 31%. The capture myopathy was later confirmed as cause of death of these animals through necropsy reports received from Department of Pathology, University of Veterinary and Animal Sciences, Lahore. This signifies a non-negligible level of risk associated with the employed immobilization method. Therefore, it is crucial to recognize that this particular approach cannot be considered as entirely secure for the transportation of large populations of animals on a large scale due to the inherent susceptibility to potential errors especially in spotted deer considering that this particular deer species in very sensitive. Contrarily, out of the 30 spotted deer, it was observed that none of the deer succumbed during the transportation process by using the Boma technique.

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DISCUSSION

These findings contribute valuable insights into the immobilization process for spotted deer, emphasizing the importance of accurate dosage calculations in achieving effective and timely immobilization outcome. The identified mortality rate underscores the importance of continual evaluation and refinement of immobilization protocols to enhance safety and minimize adverse outcomes in large-scale capturing and transportation scenarios. The successful and uneventful transportation of all the individual animals underscores the inherent safety of the employed method, particularly when compared to the utilization of anesthesia for large-scale deer capture. Anesthesia plays a crucial role in the transportation of deer, ensuring both the safety of the animals and those involved in the capturing and translocation process [14]. Sedation, often considered in place of general anesthesia, is associated with decreased risk, particularly in situations like transportation [15]. Various pharmacological agents are employed for deer anesthesia, and attention must be paid to hunting seasons and individual responses within the species [16, 17]. However, the risk associated with the use of aesthetics for large-scale deer capture cannot be left unnoticed. The pathological findings on the post mortem examination in the current study were indicative of capture myopathy in the spotted deer. Stress-related catecholamine releases are strong vasoconstrictor agents that lower blood flow to muscles, resulting in hypoxic lesions [2]. Because of the increased permeability or injury to muscle cells during capture and handling procedures, muscle enzyme activity rises [18]. Numerous ungulates in the wild that are under stress or who have capture myopathy exhibit higher levels of these enzymes [2]. When an animal is afraid and not escaping, their muscles are usually in a condition of intense contraction, which prevents blood from flowing into them [18]. Although anesthetic has been shown to lessen the likelihood of capture myopathy in wild ungulates-particularly in more vulnerable species like spotted deer—it has not been shown to totally eliminate the condition's frequency. Although the exact cause of capture myopathy is unknown, it has been suggested that the muscular system is impacted by excessive catecholamine levels, a stress factor [18]. There have also been reports of capture myopathy, which has been linked to various capturing methods used for the transport and capture of wild ruminants, leading to acute stress [2]. Bacteria live in healthy carriers and act as secondary or opportunistic pathogens. Bacterial invasion has been known to be at least partly triggered by some other factor increasing the virulence of bacterial organisms or by affecting the immune system in the host [19]. There is growing evidence of the effects of stress on parts of the innate immune system [20]. The spread of novel pathogens may also lower host immunity and trigger activity in opportunistic bacteria [19]. When transporting the spotted deer, the Boma technique provides a controlled and efficient way to move these animals undulated. The enclosure helps manage the undulated movement within a confined space, ensuring a safer and more organized transportation process [21]. Additional research suggests the use of bamboo mats and sliding gates within the Boma, providing necessary provisions such as food, water, and salt to ensure the well-being of the transported animals [9]. The use of Boma, a well-established approach for capturing the spotted deer, has demonstrated exceptional efficacy with zero mortality observed in the current study. This technique involves the strategic use of enclosures, directing the animals through a controlled funnel-like fencing system [11]. The absence of mortality suggests that the Boma technique provides a secure and stress-free environment for deer during transportation [6]. The use of anesthesia introduces inherent risks and stress factors, contributing to a significant percentage of deer mortalities during the transport process [22, 23]. This striking difference highlights the superior safety profile of the Boma technique over the use of anesthesia for large-scale deer capturing and transportation.

CONCLUSIONS

In conclusion, the Boma technique emerges as a superior method for transporting the sensitive spotted deer, evidenced by its astounding record of zero mortality. The careful application of the Boma capturing technique involves gradually moving the spotted deer into an enclosure, and this systematic approach addresses the challenges encountered during deer transportation, emphasizing safety measures and minimizing stress on the animals. This contrasts distinctly with the use of anesthesia, which presents a substantial 31% mortality rate within 24 hours following capturing as highlighted in the current study.

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Authors Contribution

Conceptualization: BNK, MRK,
Methodology: BNK, MRK,
Formal analysis: MA
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All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

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