



Identification of Physical Trauma Injuries in Javan Langurs (*Trachypithecus* spp.) for Veterinary Forensic Examination

SARAH FAJRIANNISA¹, ACHADIYANI², SHAFIA KHAIRANI^{1,2*}

¹Veterinary Medicine Program; ²Department of Biomedical Sciences, Faculty of Medicine, Universitas Padjadjaran, Jl. Ir. Soekarno KM. 21, Jatinangor – Sumedang, West Java, 45363, Indonesia.

Abstract | The illegal wildlife trade constitutes exploitation and violates animal rights and welfare. The wildlife trade is a major threat of biodiversity loss in Indonesia, one of the most biodiverse countries in the world. The increase in illegal wildlife trade can be suppressed through law enforcement that involves the investigation process which has important aspects of veterinary forensic. Veterinary forensics aims to uncover crimes, including the illegal wildlife trade, as part of wildlife protection. All physical trauma wounds found during veterinary forensic examinations must be fully described to help analyze the conclusions of medical-legal and investigations. Data on various physical trauma injuries in endemic wildlife caused by animal crimes are difficult to find. This study aims to qualitatively descriptive physical trauma wounds in the necropsy report of Javan langurs (*Trachypithecus* spp.) (endemic wildlife in Indonesia) at Javan Primate Rehabilitation Center, to add references related to the description of physical trauma wounds for veterinary forensic examinations. The variables included description, etiology, instrument, and type of wounds. The identification results showed 11 types of wounds: abrasion, chop, gunshot, hematoma, therapeutic, and laceration wounds. The instruments responsible for these wounds included blunt-force objects, sharp-force instruments, and firearms. The most common physical trauma injuries were mechanical in nature, with gunshot wounds caused by air rifles (5/11) and hematoma abrasions from blunt objects (5/11). The most frequently abused parts of the body are the legs and head and the highest severity of injuries is on the leg and arm.

Keywords | Illegal wildlife trade, Javan langurs (*Trachypithecus* spp.), Necropsy reports, Physical trauma wounds, Veterinary forensics

Received | October 13, 2024; **Accepted** | December 22, 2024; **Published** | February 17, 2025

***Correspondence** | Shafia Khairani, Department of Basic Medical Sciences, Faculty of Medicine, Universitas Padjadjaran, Jl. Ir. Soekarno KM. 21, Jatinangor–Sumedang, West Java, Indonesia; **Email:** shafia@unpad.ac.id

Citation | Fajriannisa S, Achadiyani, Khairani S (2025). Identification of physical trauma injuries in javan langurs (*Trachypithecus* spp.) for veterinary forensic examination. *Adv. Anim. Vet. Sci.* 13(3): 658-667.

DOI | <https://dx.doi.org/10.17582/journal.aavs/2025/13.3.658.667>

ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331



Copyright © 2025 by the authors. Licensee ResearchersLinks Ltd, England, UK.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Wildlife trafficking is an illegal practice related to the violation of animal rights for the purpose of exploitation (Wyatt *et al.*, 2022). These violations include all

processes in the trade starting from hunting to receiving, importing and exporting, consumption, collecting (dead or alive) which are protected by national and international laws (Mozer and Prost, 2023; South and Wyatt, 2011). The illegal wildlife trade is recognized as a serious crime

by INTERPOL and the United Nations Office on Drugs and Crime (UNODC) (Nellemann *et al.*, 2014; UNODC, 2020). It is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to ensure that international trade does not threaten the survival of wild species comprising over 38,700 animal and plant species (CITES, 2024), including well-known iconic species, such as tigers, rhinos, elephants, and primates.

Wildlife trade occurs on a very large scale. The amount of wildlife legally traded through CITES is known to be on the rise. This can be seen from the number of transactions per year, which started at less than 5,000 in 1977 and peaked at more than 1.3 million in 2015. The amount of trade is also in line with the number of seizures of illegally traded species (Hughes, 2021). The global wildlife trade is valued at approximately \$16 billion, with \$3.5 billion attributed to illegal trade (Naiborhu, 2021). Illegal trade in wildlife contradicts the principles of animal welfare because in practice it often involves violence, torture and killing of the animals (Maher *et al.*, 2017). Overexploitation of wild trade has been shown might be an even bigger driver for the current biodiversity loss than climate change (Maxwell *et al.* 2016).

The illegal wildlife trade is also a major threat to Indonesia, as a one of mega biodiversity country in the world (Eryan, 2024). Biodiversity in the form of endemic wildlife richness in Indonesia can be threatened by the cases of illegal wildlife trade. The illegal trade in Indonesia alone has an estimated value of US\$1 billion per year, and has caused enormous economic, environmental and social losses, including the decline and local extinction of many species in Southeast Asia (UNDP, 2024). To address the highly dynamic and complicated problem of Illegal Wildlife Trade, research, knowledge, and collaborations are necessary (Mozer and Prost, 2023). The increase in illegal wildlife trade cases can be suppressed through law enforcement that involves the investigation process. Wildlife crime investigations have an important aspect in the form of a visum et repertum, which is part of the application of veterinary forensic science (McDonough and McEwen, 2016). A visum et repertum is an examination report in cases of violence or crime that serves as evidence in the law. In veterinary forensics, animal-related litigation can cover a wide range of cases, including violations of wildlife laws (Parry and Stoll, 2020).

Veterinary forensics aims to uncover cases of crime including illegal wildlife trade. The role of forensics relates to three main things: performing a medicolegal autopsy/necropsy (a specific examination of the body that has value in the law) to determine the cause of death, investigating acts of violence, and determining the time of death (Menezes and Monteiro, 2023). The forensic pathologists should document the type, size, shape, site, and location of injury (Shrestha *et al.*,

2023). Physical trauma wounds found during the examination become evidence of the crime that will greatly assist the investigation process. The type of physical trauma injuries sustained by an animal correlates with the type of violence and crime against the animal. The location and type of injuries on the animal's body in some cases of violence in illegal capture may show a pattern that can be further analyzed. Therefore, all physical trauma wounds found in animals during veterinary forensic examination must be described completely, both minor and major wounds. Injury descriptions are essential to help analyze the conclusions of medical-legal and criminal investigations (Denton *et al.*, 2006).

The most common case in forensic medicine is physical trauma wound, which is a type of wound caused by physical violence. Analysis in forensic examination requires a reference that can describe the condition of physical trauma wounds caused by various things such as shooting, stabbing, beating, and others. Lesion descriptions, both gross and microscopic, will greatly assist a forensic pathologist to determine the cause, duration, or postmortem interval since injury (Smith-Blackmore and Robinson, 2018). Data on the description of various physical trauma wounds caused by animal crimes is still difficult to find, especially in endemic and protected wildlife, whereas the description of these wounds is needed in the veterinary forensic conservation.

The description of these injuries can be obtained through medical records, made by veterinarians, at Javan Primate Rehabilitation Center when handling rescue and rehabilitation cases of endemic and protected animals in Indonesia. Medical records that can be used are necropsy reports in cases of animal deaths accompanied by physical trauma injuries. The data used in this study is a necropsy report on the Javan langurs (*Trachypithecus* spp.) which is one of the primate species with endemic status in Indonesia and vulnerable (IUCN, 2022). The distribution of Javan langurs (*Trachypithecus* spp.) is limited to Java, Bali and Lombok and has experienced a 30% population decline in the last 36 years. The population decline is caused by habitat fragmentation and illegal trade (Wahyu, 2021).

The vulnerable conservation status of the Javan langurs (*Trachypithecus* spp.) has caused it to be categorized as a protected primate species by the government of the Republic of Indonesia. The limited population of Javan langurs (*Trachypithecus* spp.) makes any information about Javan langurs (*Trachypithecus* spp.) very valuable. The identification of physical trauma wounds on Javan langurs (*Trachypithecus* spp.) is information that is very difficult to obtain because no research has discussed this matter. This limitation of information can be overcome through this study which aims to add references related to the description of physical trauma wounds for veterinary forensic examinations, especially in the scope of wildlife conservation.

ETHICAL APPROVAL

This research has obtained ethical permission from the The Research Ethics Committee Universitas Padjadjaran Bandung with Number: 156/UN6.KEP/EC/2023. This research used non-clinical materials (necropsy reports) and was conducted in accordance with ethical, legal, social, and other applicable regulations.

STUDY LOCATION

The research was conducted at Javan Primate Rehabilitation Center, West Java, Indonesia. The Javan Primate Rehabilitation Center is one of the wildlife conservation institutions in Indonesia that specifically handles various Javanese primate cases. The handling of these cases involves veterinarians who have a role in the field of wildlife conservation medicine, one of which is related to writing medical reports of animal death cases accompanied by physical trauma injuries. Not all wildlife rehabilitation centers have data related to these reports, especially for Javan primates. Therefore the authors chose the Javan Primate Rehabilitation Center as the research location.

DATA ANALYSIS

The research used a descriptive qualitative approach with purposive sampling method. The inclusion criteria for this study were necropsy reports documenting deaths with physical trauma wounds in Javan langurs (*Trachypithecus* spp.). Determination of inclusion criteria was based on the research objective, which was to obtain information on the description of physical trauma wounds on Javan langurs (*Trachypithecus* spp.) from necropsy reports. The variables of this study included wound description (region, coordinates, characteristics, size), wound etiology, instrument that caused the wound, and wound type.

A limitation of this study was the use of secondary data, which lacked complete information, resulting in a limited sample size. The sample size used in this study was three necropsy reports that met the inclusion criteria from all necropsy reports in the study location. All physical trauma wound findings in the three necropsy reports were expected to provide a variety of animal wound descriptions to achieve the objectives of this study.

PROCEDURES

The research procedure began with collecting all medical records that met the inclusion criteria and then analyzing the data. Data analysis was carried out by identifying physical trauma wounds in the documentation results in the form of photographs in the necropsy report. Wound findings were captured using a Fuji camera and personal phone. Identification was carried out by the authors based on the characteristics and condition of the wound along with in-

formation in the medical records written by veterinarians at the Javan Primate Rehabilitation Center. There is no standardized reference that explains in detail the standard classification or grading scale of wounds in veterinary forensic examinations. Therefore the determination of wound type was supported by various references related to wound criteria or classification. The identification results are presented in descriptive form.

RESULTS AND DISCUSSION

Data collection was carried out by researchers and a team of veterinarians at Javan Primate Rehabilitation Center and resulted in three necropsy reports. Three necropsy reports were selected because they met the inclusion criteria, namely necropsy reports of death cases accompanied by physical trauma wounds with the subject of Javan langurs (*Trachypithecus* spp.). The majority of necropsy reports recorded at the research site did not meet the inclusion criteria because it was rare to find cases of death accompanied by physical trauma wounds, especially in Javan langurs (*Trachypithecus* spp.). This limited the number of samples used in the study to three necropsy reports. However, the three necropsy reports can still be used for the purpose of this study. The identification results of the three necropsy reports can show a description of the various types of wounds on Javan langurs (*Trachypithecus* spp.) that have the same case history, experiencing violence, although the cause of death of each animal is different.

The identification and determination of wound was supported by various references related to wound criteria or classification. There is no standardized reference that explains in detail the standard classification or grading scale of wounds in veterinary forensic examinations. Therefore, the authors identified wounds using various references that discuss types of wounds in animals. The classification scheme for each wound finding in this study was carried out through wound observation based on the general wound description (regio, coordinate), etiology (mechanic, thermal), instrument that caused the wound (sharp-force, blunt-force, firearm), and wound type (abrasion, laceration, hematoma, stab, chop, gunshot, scratch, bite, therapeutic). Each wound was defined based on the characteristics and condition (shape, size, color) of the wound so that the type of wound could be distinguished.

The identification results of all necropsy reports showed that there were no thermal, stab, scratch, and bite wounds. The result also showed that there was one variable that could not be identified or Not Available (NA), namely wound description based on size. This is due to the absence of data related to wound size in the necropsy report (the length and width of the wound), therefore the estimated wound size calculation will be biased. The implication of

the unavailability of data regarding wound size is that the severity and cause of the wound cannot be known with certainty. The cause of the wound can be determined by the size of the wound, such as in knife stabbing cases where the size of the wound is needed to determine the approximate length of the knife used by the perpetrator. Therefore, the results of wound identification in this study cannot provide a detailed discussion of the relationship between wound size and severity and the exact cause of the wound. Assessing the size of the wound on the image or photograph using other methods can be considered to determine the approximate size of the wound. This could be done using scale calculations, but this was not done in this study as there was no data on the animal's body size in the necropsy report. The results of the identification of all physical trauma injuries can be seen in Table 1.

the loss of the epidermal layer of the skin with irregular shape, boundaries and uneven edges. The wound area on (Figure 1B) is without hemorrhage, while the wound on (Figure 1A) and (Figure 1C) is accompanied by hemorrhage. The condition of these wounds indicates a type of abrasion wound caused by blunt (mechanical) force with a rough surface and scraping off of the superficial epidermis (Simon *et al.*, 2023). Abrasion wounds accompanied by hemorrhage indicates damage to the deeper layers of the skin (dermis).



Figure 1: Abrasion in necropsy report 1 and 3. (a) Wound on the upper right side of the head (b) Several areas on the inner upper left leg (arrows). (c) Two adjacent wounds on the upper left face/forehead (arrows).

ABRASION WOUND

The identification of all physical trauma wounds were divided into several regions: head, thorax, abdomen, arm, and leg. The wound on the upper right side of the head (Figure 1A) along with several areas on the inner upper left leg in necropsy report 1 (Figure 1B), and two adjacent wounds on the upper left face/forehead in necropsy report 3 (Figure 1C) were abrasion-type wounds. These wounds have the typical characteristics of an abrasion wound, namely

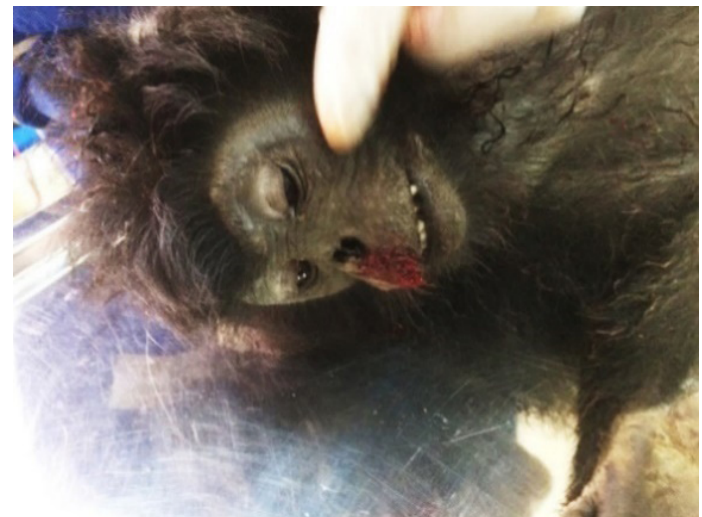


Figure 2: Chop in necropsy report 1. Wound on the lower part of the nose.

CHOP WOUND

The wound to the lower nose (Figure 2) shows a characteristic chopping/loss of fragments of the nasal bone. This leads to a type of cut wound that occurs as a result of sharp or blunt (mechanical) force and will result in a combination of chopping and crushing. The area around the wound is also accompanied by hemorrhage due to tissue damage and rupture of blood vessels. The characteristics of this lower nasal wound match the characteristics of a chop wound, which has bruised or chipped margins with bone fractures (Smith-Blackmore and Robinson, 2018).

GUNSHOT WOUND

The wound found in the abdominal region had coordinates at the lower right (Figure 3A). The wound in this area is a gunshot wound (mechanical) caused by an air rifle shot. The characteristics that can be observed in gunshot wound in the abdominal region are that there is a hole in the skin accompanied by a reddish color in the wound channel and surrounding area. Other gunshot wound morphologies mentioned in (Li *et al.*, 2015) including neat, mostly jagged, or star-like edges of the wound entry channel were not found in this gunshot wound. The depth and location of the air rifle bullet in the abdominal region can be observed through the X-Ray results in (Figure 3B). Radiography should be used to assist in locating projectiles (evidence)

may be present in the body (Touroo and Fitch, 2016). Radiography is the gold standard in examining gunshot wounds in the animal's body. The finding of gunshot wounds in this necropsy report was not accompanied by tissue sampling for laboratory analysis. The use of other imaging techniques or laboratory analysis can be performed to strengthen the indication of gunshot wounds. For example, histopathology examination to determine the tissue damage that occurred in the gunshot wound.

are allowed only for sporting purposes, not for hunting animals, especially protected animals (Simanungkalit and Lubis, 2024).

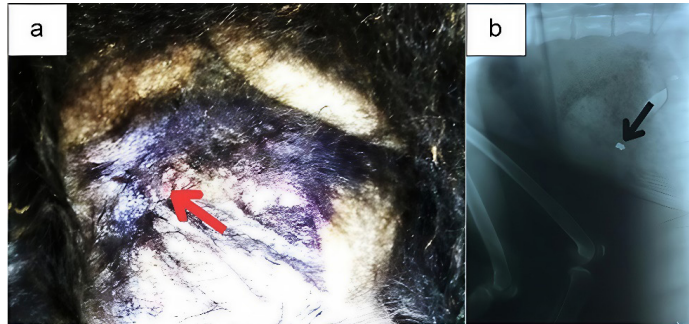


Figure 3: Gunshot in necropsy report 1. (a) Wound on the skin (arrow). (b) X-ray of the bullet location (arrow).



Figure 4: Dome point/round head air rifle bullet found in the animal's body.

The type of air rifle that caused the injury to the abdominal region was an air rifle with a dome point/round head bullet (Figure 4). General understanding of projectile weapons, ammunition, and ballistics is important for forensic cases (Bradley-Siemens *et al.*, 2018). The type of bullet found in an animal's body can indicate the purpose of shooting the animal. The results of (Kosasih *et al.*, 2017) stated that the 177 caliber (4.5 mm) dome point bullet is the type of bullet often used by people for hunting. This strengthens the assumption that people still use air rifles for hunting. Even though the use of air rifles has been regulated by law and there are specifications, one of which is not used for hunting. Regulations related to the use of air rifles in Indonesia have been regulated through Law Number 12 of 1951 and National Police Regulation Number 1 of 2022. Air rifles

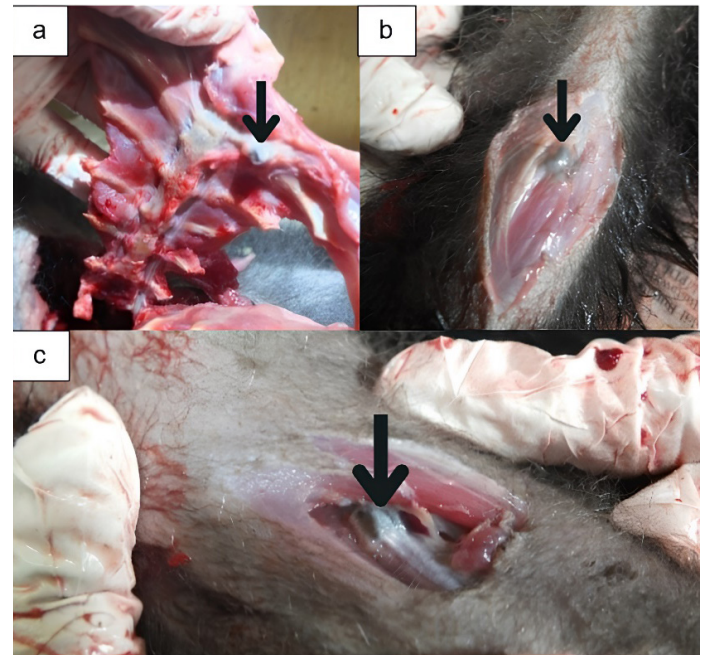


Figure 5: Gunshot in necropsy report 2. (a) Bullet location near the left sternum (arrow), (b) in the inner right arm muscle near the elbow joint (arrow), (c) in the inner upper right leg muscle (arrow).

Gunshot wounds were also found in necropsy report 2 (thorax, arm, and leg regions) (Figure 5). The bullet findings on the left sternum bone (Figure 5A), in the inner right arm, near the elbow joint (Figure 5B), and in the inner upper right leg (Figure 5C) indicates a gunshot (mechanical) wound suffered by the animal. The finding of these bullets were only recognized by the veterinary team during the necropsy procedure. Information from the veterinarian on duty stated that during the external examination there were no indication of a gunshot wound in these regions. The characteristics and conditions of gunshot wounds that can be observed in the thorax, arm, and leg regions are the presence of bullets attached to muscle tissue in the sternum area without hemorrhage or damage to surrounding tissues. The absence of damage to the tissue around the bullet can be an indication that the bullet findings have been in the muscle tissue for a long time, so that the tissue around the bullet has undergone a wound repair process characterized by the formation of connective tissue. The bullets found in the thorax, arm, and leg regions were air rifle bullets with a flat head type (flat/wadcutter pellet) (Figure 6). This bullet type is different from the bullet found in necropsy report 1 which had a round head type (Figure 4).

This difference in bullet type can indicate the distance shot by the shooter. Dome point/round head has an aerodynamic shape so it is more often used for hunting because it has

higher capabilities and accuracy at long distances. Whereas flat/wadcutter pellets are less aerodynamic so they are more suitable for close-range shots. The finding of flat/wadcutter pellets could mean that the animals experienced close-range shots, although it is not known exactly why close-range shots were chosen by the shooter. Another condition that allows the use of close-range shots other than hunting is in cases of animal abuse.

has the typical characteristics of hematoma and laceration wounds, namely there is severe hemorrhage in the tissue under the skin and damage to the epidermis and dermis tissue which causes tear the skin, open wound, and leaving strands of subcutaneous tissues bridging the wound (Gentile *et al.*, 2019). Excessive stretching of the skin also causes the skin tissue to lacerate with irregular borders (Ressel *et al.*, 2016). The finding of widespread tissue necrosis in the wound area indicates that the wound is chronic.



Figure 6: Air rifle bullet with a flat head type (flat/wadcutter pellet) found in the animal's body.



Figure 8: Hematoma and laceration wound on the arm region in necropsy report 3.



Figure 7: Wounds of the leg region in necropsy report 1. (a) Hematoma wound on the left hind upper leg. (b) X-ray examination of the leg region (arrow).



Figure 9: Wounds of the leg region in necropsy report 1. Therapeutic wounds in the form of chop and sutures (stitches) after amputation surgery.

HEMATOMA WOUND

The wound found in the left upper leg on the back (Figure 7) was a hematoma type wound. The widened wound area with a purple-black color indicates severe hemorrhage in the tissues under the skin with tissue necrosis in the blackish wound area. This is a typical characteristic of hematoma wounds, which are defined as more serious contusions with heavy hemorrhage (Lemone, 2017). The etiology of the hematoma wound has two possibilities, namely blunt force or bullet shot from an air rifle (mechanical). The possibility of blunt force in the area is based on the condition of the wound which leads to the typical characteristics of hematoma wounds that occur due to blunt force (Simon *et al.*, 2023). The possibility that the injury was caused by a bullet shot that penetrated the tissue under the skin was based on the finding of a bullet at the location of the hematoma echo in the X-Ray examination (Figure 7B).

THERAPEUTIC WOUND

Another type of wound found on the leg region in necropsy report 3 was a therapeutic wound that had coordinates in the lower left leg (Figure 9). The medical record stated that the animal had a bone fracture with a prognosis of infausta in the metatarsal and phalanx area, and amputation was performed by the veterinary team. The medical procedure resulted in a chop and suture wound, which is a type of therapeutic (mechanical) wound. Chop and suture wounds caused by therapeutic/surgical procedures have the

The other hematoma wound found in necropsy report 3, on the lower left outer arm (Figure 8). The wound was a hematoma-type that had undergone tissue necrosis accompanied by a laceration (tear) wound. The wound condition was caused by blunt force (mechanical), because the wound

same characteristics as chop and stab (needle) wounds with more organized and neat wound conditions. This condition is different from chop and stab wounds or other types of wounds caused by violence, where the resulting wound is irregular.

SCHEMATIC OVERVIEW OF THE WOUNDS

The identification results from the three necropsy reports above show a description of various types of mechanical injuries. All necropsy reports had the same case history (the animals were subjected to violence) although the cause of death was different for each animal. These findings suggest that all physical trauma wounds documented in the necropsy reports were the result of acts of violence. The acts of violence experienced by the animals resulted in physical trauma wounds on several areas of the animal's body that can form a pattern. These wound patterns can be used to identify areas of the animal's body that are often the object of violence. A schematic representation of the overall location of physical trauma wounds based on the necropsy report identification results can be seen in (Figure 10).

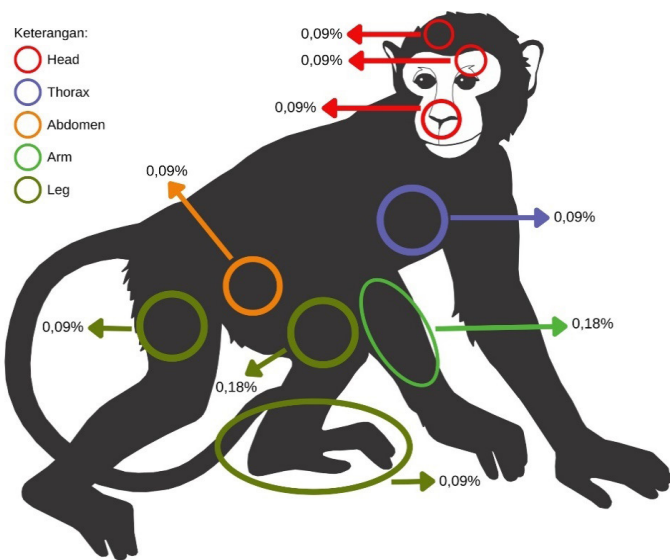


Figure 10: Schematic representation of the location of physical trauma injuries.

The schematic representation of physical trauma wounds in Figure 10 shows that the most common region of violence is the leg region. This is based on the percentage of physical trauma injuries found in all necropsy reports. The total number of physical trauma injuries in the necropsy report was eleven wounds divided into five regions. The total percentage of physical trauma injuries in the leg region was the highest (0.36%), followed by the head region (0.27%), arm region (0.18%), thorax region (0.09%), and abdominal region (0.09%).

The physical trauma wounds found in the leg and head regions can be attributed to the various possibilities that

occur when animals experience violence. This possibility can be related to the characteristics of Javan langurs (*Trachypithecus* spp.), both body and behavioral characteristics. The legs, essential for locomotion, are often targeted by abusers aiming to immobilize the animal without causing immediate death, as observed in shooting cases. The size of the animal's legs, which are longer than the arms, also causes the legs to have a greater chance of being hit by bullets during escape. The agonistic/vigilant nature of Javan langurs (*Trachypithecus* spp.) (Asyrofi *et al.*, 2022) may also be the reason that locomotor organs such as legs are often injured when animals fight or protect themselves (Touroo and Reisman, 2018).

The most common location of physical trauma injuries after the leg region was the head region, where the most common instrument causing injuries in this region was a hand or blunt object. This can be attributed to the purpose of the violence committed by the perpetrator, which is to cause a deterrent effect in the form of pain and fear so that animals will not fight back. The position of the head, which tends to be more accessible to the perpetrator, causes the region to be the object of violence.

A comparative analysis of all physical trauma wounds across the necropsy reports was conducted (Table 1). The analysis was conducted to determine the severity of wounds sustained by the animals. The severity of the wound was determined based on the region or location of the wound. Severity assessment was conducted based on the number of wounds, the level of damage or distribution of wounds, and the impact experienced by animals (pain and discomfort due to wounds). Based on the comparative analysis, it was found that wounds on the legs and arms had the highest severity. This strengthens the indication of violence in poaching practices, which often target the animal's locomotor organs with the aim of weakening the animal's movement.

The schematic representation and comparative analysis on all physical trauma wound findings in these necropsy reports shows an overview of conservation issues in Indonesia. This indicates that animal crimes continue to occur. For example, illegal hunting using air rifles. The finding of gunshot wounds on animals in this necropsy report is evidence that there are still irregularities in the use of air rifles by the community. This can be an evaluation of the implementation of regulations and supervision carried out by the authorities. Other wounds of high severity were also found. These wounds cause pain and suffering to the animals, violating animal welfare ethics and principles. Although physical trauma wounds rarely cause direct death, they can reduce the quality of life and impact population in the long term.

Table 1: Identification of all physical trauma injuries.

Data	Regio	Coordi- nates	Characteristic	Conditions	Size	Etiology	Instru- ment	Type	Total Injuries	Severity Assessment
Necropsy Report 1	Head	Upper right side of the head	Loss of the epidermal with irregular shape, border and une- ven edges	Hemorrhage occurs due to damage to the dermis	*NA	Mechanic	Blunt- force	Abrasion	2	Moderate
		Lower part of the nose	Loss of nasal bone fragments accompany- ing bruised or chipped margins	Hemorrhage occurs due to damage to tissues and blood vessels	*NA	Mechanic	Blunt- force, sharp- force	Chop		
	Ab- do- men	Lower right abdo- men	Irregular skin tears	Hemorrhage that is characterized by redness of the wound channel and surrounding area	*NA	Mechanic	Firearm (airrifle)	Gunshot	1	Low
Leg	Upper left leg of the back	There is hem- orrhage in the tissues under the skin with tissue necrosis	The wound area is purple-black in color, there are bul- let findings around the wound area.	*NA	Mechanic	Blunt- force/ firearm (airrifle)	Hemato- ma/ gunshot	3		Severe
	Lower left leg	Bone and muscle fractures, suture marks	The shape of the wound is organized and neat than other types of wounds	*NA	Mechanic	Sharp- force	Thera- peutic			
Necropsy Report 2	Thorax	Left side of sternal bone	There are bullet findings attached to the muscle tissue in the ster- num area	No hemorrhage or damage to sur- rounding tissue	*NA	Mechanic	Firearm (airrifle)	Gunshot	1	Low
	Arm	Inner right arm near the elbow joint	There were findings of bullets attached to mus- cle tissue in the arm area	No hemorrhage or damage to sur- rounding tissue	*NA	Mechanic	Firearm (airrifle)	Gunshot	1	Low
	Leg	Inner upper right leg	There were findings of bullets attached to mus- cle tissue in the leg area	No hemorrhage or damage to sur- rounding tissue	*NA	Mechanic	Firearm (airrifle)	Gunshot	1	Low
Necropsy Report 3	Head	Upper left side of the face	Epidermal missing, irregular shape, border and uneven edges	Hemorrhage (dam- age to the dermis layer of the skin)	*NA	Mechanic	Blunt- force	Abrasion	1	Low
	Arm	Lower left outer arm	Hemorrhage of tissues under the skin, open wounds with irregular borders	Necrosis tissue	*NA	Mechanic	Blunt- force	Hemat- oma, lacera- tion	2	Severe

Note: *NA: Not Available.

The identification results showed 11 types of wounds: abrasion, chop, gunshot, hematoma, therapeutic, and laceration wounds. The instruments that caused these wounds were blunt-force, sharp-force, and firearms. The most often types of physical trauma injuries are mechanical injuries, namely gunshot wounds caused by air rifles (5/11) and hematoma abrasions caused by blunt objects (5/11) in cases of animal abuse. The most frequently abused parts of the body are the legs and head and the highest severity of injuries is on the leg and arm. The animal's locomotor organs are frequently targeted by hunters to immobilize the animal rapidly without causing immediate death. The length of the animal's legs, compared to its arms, increases the likelihood of them being struck by bullets during escape attempts. The agonistic/vigilant nature of Javan langurs (*Trachypithecus* spp.) may also be the reason that locomotor organs such as legs are often injured when animals fight or protect themselves.

The process of identifying physical trauma injuries through the analysis of necropsy report data from one of the wildlife conservation institutions provides an overview of the application of veterinary forensics in the scope of wildlife conservation in Indonesia. The limitations and obstacles in this study were mostly influenced by the data completeness factor. This data completeness is related to the Standard Operating Procedure for handling cases of physical trauma injuries in wildlife, especially the writing of medical records. A good Standard Operating Procedure is expected to help the investigation process in wildlife crime cases, including illegal trade that threatens animal populations.

Although the application of veterinary forensics is not yet fully implemented in Indonesia, the completeness of data on animal crime cases will be very useful for the development of conservation efforts in the future. Conservation efforts through the application of Standard Operating Procedures for handling cases of physical trauma injuries to wildlife can continue to be developed through the addition of information in medical records. Data required in veterinary forensic investigations include complete general examination results (date, species, sex, age, body weight, body condition, case location, case history, total wound findings), external/physical examination, necropsy/postmortem examination, radiographic and laboratory examinations. All stages of examination must be carried out in detail and thoroughly with clear documentation that includes information on wound description (region, coordinates, characteristics, condition, size), etiology, type of wound, and the instrument that caused the wound.

The researcher would like to thank Ida Junyati Masnur, DVM. from the veterinary team of Javan Primate Rehabilitation Center who has been very helpful in the process of conducting this research.

NOVELTY STATEMENT

The author has researched the identification of physical trauma injuries in Javan langurs (*Trachypithecus* spp.). Comparative analysis in this research conducted on all physical trauma wound findings for the development of standard operational procedures for veterinary forensic examination in wildlife conservation. This study is published for the first time.

AUTHOR'S CONTRIBUTIONS

SF, A, and SK concept the research. SF conducted the research under supervision. All authors discussed the results and contributed to the final manuscript.

CONFLICT OF INTEREST

The author declares that he has no competing interests or belief could affect the objectives, aims and results of this study.

REFERENCES

- Asyofi M, Sulistiyowati H, Wimbaningrum R (2022). Preliminary Assessment of Population Structure and Habitat Characteristics of Javan Langurs (*Trachypithecus auratus* É. Geoffroy, 1812) in Watangan Puger Nature Reserve. *Jurnal Ilmu Dasar*, 23(1): 29–36. <https://doi.org/10.19184/jid.v23i1.26032>
- Bradley-Siemens N, Brower AI, Kagan R (2018). Firearm Injuries. In: Brooks, J. (eds) *Vet. Forensic Pathol.* Springer 1 https://doi.org/10.1007/978-3-319-67172-7_7.
- CITES The Convention on International Trade in Endangered Species of Wild Fauna and Flora (2024). <<https://cites.org>> (accessed 08 July 2024).
- Denton JS, Segovia A, Filkins JA (2006). Practical Pathology of Gunshot Wounds. *Arch. Pathol. Lab. Med.*, 130(9): 1283-9 <https://doi.org/10.5858/2006-130-1283-PPOGW>.
- Eryan A (2024). Review on Illegal Wildlife Trade Provisions in Indonesia: Cost-Benefit Analysis and Law Enforcement. *Indonesian Journal of International Law, Special Issue*, 21(5): 33-64. <https://doi.org/10.17304/ijil.vol21.5.1877>
- Gentile S, Kneubuehl BP, Barrera V, Dobay A, Thali MJ, Bolliger SA (2019). Fracture Energy Threshold in Parry Injuries Due to Sharp and Blunt Force. *Int. J. Legal Med.*, 133(5): 1429-1435. <https://doi.org/10.1007/s00414-019-02022-3>
- Hughes AC (2021). Wildlife Trade. *Curr. Biol.*, 31(19): 141-224 <https://doi.org/10.1016/j.cub.2021.08.056>.
- IUCN (2022). The IUCN Red List of the Threatened Species.
- Kosasih DP, Juheri J, Zaenudin A (2017). Ballistic Testing of Local

- Air Rifle Bullets and Imported Air Rifle Bullets Caliber. 177/4.5 mm. MESA (Teknik Mesin, Teknik Elektro, Teknik Sipil, Arsitektur), 2(1): 8-17.
- Lemone PD (2017). Handbook of Medical-Surgical Nursing: Musculoskeletal Disorders. 5th edition. EGC, Jakarta.
- Li Q, Deng D, Tao J, Wu X, Yi F, Wang G, Yang F (2015). Ultrasonic Imaging of Gunshot Wounds in Pig Limb. *Genet. Mol. Res.*, 14(2): 4291–4302. <https://doi.org/10.4238/2015.April.30.1>
- Maher J, Pierpoint H, Beirne P (2017). The Palgrave International Handbook of Animal Abuse Studies. Routledge. <https://doi.org/10.1057/978-1-137-43183-7>
- Maxwell SL, Fuller RA, Brooks TM, Watson JEM (2016). Biodiversity: The Ravages of Guns, Nets and Bulldozers. *Nature*, 536: 143–145. <https://doi.org/10.1038/536143a>
- McDonough SP, McEwen BJ (2016). Veterinary Forensic Pathology: The Search for Truth. *Vet. Pathol.*, 53(5): 875–877. <https://doi.org/10.1177/0300985816647450>
- Menezes RG, Monteiro FN (2023). Forensic Autopsy. StatPearls Publishing.
- Mozer A, Prost S (2023). An Introduction to Illegal Wildlife Trade and Its Effects on Biodiversity and Society. *Forensic Sci. Int. Anim. Environ.*, 3: 1-12. <https://doi.org/10.1016/j.fsiae.2023.100064>
- Naiborhu NSR (2021). State Responsibility Towards Wildlife Trade and Biodiversity Through The Cooperation of Asean Countries. *Environ. Law Dev.*, 5(2): 262–286.
- Nellemann C, Henriksen R, Raxter P, Ash N, Mrema E (2014). The Environmental Crime Crisis: Threats to Sustainable Development from Illegal Exploitation and Trade in Wildlife and Forest Resources, United Nations Environment Programme, Nairobi, Kenya, Arendal, Norway.
- Parry NMA, Stoll A (2020). The Rise of Veterinary Forensics. *Forensic Sci. Int.*, 306. <https://doi.org/10.1016/j.forsciint.2019.110069>
- Ressel L, Hetzel U, Ricci E (2016). Blunt Force Trauma in Veterinary Forensic Pathology. *Vet. Pathol.*, 53(5): 941–961. <https://doi.org/10.1177/0300985816653988>
- Shrestha R, Kanchan T, Krishan K (2023). Gunshot Wounds Forensic Pathology. StatPearls Publishing.
- Simanungkalit RH, Lubis MR (2024). Implementation of Emergency Law Number 12 of 1951 on Illegal Possession of Firearms. *J. Res. Legal, Soc. Pol. Sci.*, 1(4): 227-245.
- Simon LV, Lopez RA, King KC (2023). Blunt Force Trauma. StatPearls Publishing.
- Smith-Blackmore M, Robinson N (2018). Sharp Force Trauma. In: Brooks, J. (eds) *Vet. Forensic Pathol.* Springer, 1. https://doi.org/10.1007/978-3-319-67172-7_6
- South N, Wyatt T (2011). Comparing Illicit Trades in Wildlife and Drugs: An Exploratory Study. *Deviant Behav.*, 32, 538–561. <https://doi.org/10.1080/01639625.2010.483162>
- Touroo R, Fitch A (2016). Identification, Collection, and Preservation of Veterinary Forensic Evidence: On Scene and During the Postmortem Examination. *Vet. Pathol.*, 53(5): 880–887. <https://doi.org/10.1177/0300985816641175>
- Touroo R, Reisman R (2018). Animal Fighting. In: Brooks, J. (eds) *Vet. Forensic Pathol.* Springer 2. https://doi.org/10.1007/978-3-319-67175-8_7
- UNDP United Nations Development Programme Indonesia (2024). GEF – Combatting Illegal Wildlife Trade (CIWT).
- UNODC World Wildlife Crime Report (2020). Trafficking in Protected Species, United Nations, Vienna.
- Wahyu R (2021). Population Density of Javan Langur (*Trachytecus auratus*) in Taman Wisata Alam Pangandaran. *Wanamukti*, 24(2): 83-91. <https://doi.org/10.35138/wanamukti.v24i2.341>
- Wyatt T, Maher J, Allen D (2022). The Welfare of Wildlife: An Interdisciplinary Analysis of Harm in the Legal and Illegal Wildlife Trades and Possible Ways Forward. *Crime Law Soc. Change*, 77: 69–89. <https://doi.org/10.1007/s10611-021-09984-9>