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Research Article

Health Surveillance Actions Against Equine Glanders to Promote Public and Animal Sanity

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Abstract

Mormo is a reemerging occupational zoonosis caused by bacterium Burkholderia mallei, which affects horses, donkeys, mules and occasionally humans as accidental hosts. Disease is fatal to equines, and there is no effective vaccine or treatment to eliminate pathogen. Mormo is spread mainly through oral and nasal secretions, with digestive tract being main mode of infection. General objective of this study was to research, describe and analyze health defense actions directed at equine Glanders, passing through chain of transmission to human population, in addition to evaluating effectiveness of these actions to promote veterinary public health. Study was carried out based on an exploratory bibliographic research in scientific databases. Management errors, such as sharing feeders and drinkers, are related to transmission, but commercialization, reproduction and sports practices of asymptomatic carriers are most significant forms of dissemination. Disease presents clinical manifestations in nasal, pulmonary and clinical forms, ranging from asymptomatic cases to serious complications. Diagnosis is challenging, and terminal phase can lead to bronchopneumonia and death by anoxia. Glanders is a serious zoonosis, with cases documented in humans through direct contact with infected animals. Prelevance of research lies in high incidence of untreated and underreported fatal cases. Brazil, with third largest contingent of horses in world, faces economic challenges due to presence of Glanders. Impact includes financial losses due to euthanasia of affected animals, closure of properties, suspension of agricultural events, and restrictions on international market. Health protection against Glanders is crucial. Country has specific legislation, such as National Equine Health Program (PNSE), with mandatory notification of disease, and recent relaxation of requirements for movement of horses. Effective implementation of these measures, combined with awareness, is essential to preserve equine health and avoid economic and public health implications.

Keywords: Zoonosis; Occupational; Diagnosis; Surveillance; Public Health

Introduction

Equine glanders represents a reemerging occupational zoonosis caused by bacterium *Burkholderia mallei*, which primarily impacts equines, donkeys, mules, and, occasionally, humans as incidental hosts [10]. Disease is generally fatal for equids, with no vaccines or treatments available for pathogen elimination [6]. *B. mallei* is a facultative intracellular pathogen that can survive and replicate in phagocytic cells [4]. Due to this specificity, equine glanders is considered incurable and treatment is contraindicated in Brazil, as animal may show apparent improvement but become an inapparent carrier [6].

Spread of Glanders among equines occurs mainly through oral and nasal secretions, which contaminate environment they are in, with digestive tract being primary mode of infection. Contamina-

tion by inhalation is rare, and infection occasionally occurs through direct contact with lesions or materials used during handling of animals [4]. Management errors, mainly due to use of collective stables, such as sharing feeders and waterers, as well as acquiring new animals without quarantine, are also closely related to transmission of Glanders [6]. However, most important form of disease dissemination is linked to flow of asymptomatic carriers for commercialization, reproduction, and sporting practices [3].

Pathology varies between acute and chronic forms, with three types of clinical presentation: nasal, pulmonary, and cutaneous, exhibiting a wide range of manifestations, from asymptomatic cases to serious and lethal complications. In first phase of infection, it is normal for animal to present clinical signs not related to Glanders, such as hyperthermia, apathy, and cachexia. When bacteria reach lungs, respiratory signs are more visible, such as pyogranulomatous pneumonia, dyspnea, and mucopurulent secretion with blood streaks. Cutaneous-lymphatic form is characterized by appearance of hard nodules in lymphatic vessels, resembling a pearl necklace or rosary, in regions such as neck, side, abdomen, thoracic and pelvic limbs. Despite organism trying to react by sending defense cells to lesion area, immune system is unable to eradicate bacteria and defeat infection. In terminal phase, bronchopneumonia is observed, leading animal to death by anoxia [4].

Humans are infected through direct contact with carrier animals, especially through skin ulcers and secretions. Entry of bacteria into human body occurs through lesions on skin, ocular, and nasal mucosa. Therefore, professionals such as veterinarians, handlers, and laboratory workers are more susceptible to infection, characterizing Glanders as an occupational zoonosis. In humans, Glanders can present in various forms, including local, nasal, pulmonary, disseminated, septicemic, and chronic infections. This diversity of manifestations is attributed to various routes of infection. It is important to emphasize that Glanders in humans, if not diagnosed and treated, can result in a high incidence of fatal cases [10]. Moreover, it is an extremely severe zoonosis, whose outcome almost invariably results in fatality, being of significant relevance to public health during period when equines were predominantly used as a means of transportation. Currently, we recognize, based on case reports, that those who handle samples in laboratory assume a high risk. In 2000, a case was documented involving a microbiologist who contracted disease, probably during handling of contaminated material [8].

In economic sphere, Brazil boasts third largest equine population in world and largest in Latin America. This activity encompasses various sectors, including manufacturing of inputs, breeding, and final disposal, generating an annual financial movement of 7.3 billion reais and contributing to creation of approximately 3.2 million direct and indirect jobs [12]. Presence of Glanders incurs significant economic losses, as affected animals are subjected to euthanasia to prevent spread of bacteria in free areas. In addition, there is prohibition and suspension of equine movement on affected properties, along with possible suspension of local agricultural events as a measure to contain outbreaks. In addition, there is cost related to sanitation and testing of equines that had contact with positive animals. In addition to change in sanitary status, which imposes restrictions on access to international market [6].

Prevention and control of Glanders depend on specific sanitary programs, with early detection of infected animals, humane elimination of positive cases, strict control of animal movement, isolation, and sanitation of facilities and equipment of affected breeding [3]. Thus, present work presents importance and essentiality due to various factors. Intrinsic characteristics of disease, such as its classification as a zoonosis, fatal nature, lack of cure, designation as a bioterrorism weapon, and its resurgence, emphasize relevance of studies in this field. Moreover, impacts on economic, agricultural, public health, animal welfare, and international trade sectors give this infectious disease a prominent position. Amid this delicate context, recent relaxation of regulations brings an unknown, whose impacts cannot yet be fully measured. This situation highlights importance of addressing Glanders in current scenario, documenting existing situations and providing parameters to assess evolution of this disease in near future.

According to importance of Glanders for public and animal health, this research highlights need to reflect on effectiveness of actions applied by sanitary defense of this disease with a view to

reinforcing actions already recommended by national control programs and development of new epidemiological proposals to reduce incidence of this disease, promoting protection of humans and animals in endemic areas. It is also important to point out that there has been an intensification of epidemiological research to assist in delineation of public health actions with aim of monitoring transmissibility of this disease. Given above, general objective of this work was to research, describe, and analyze sanitary defense actions directed towards animal Glanders, encompassing transmission chain to humans. Specific objectives were to evaluate effectiveness of aforementioned actions in promoting public and animal health.

In Brazil, a case of Glanders caused by *Burkholderia mallei* was also documented in an 11-year-old boy, a horse caretaker residing on outskirts of Aracaju (SE), who previously enjoyed good health. This study analyzed clinical characteristics of disease, highlighting symptoms such as chest pain, shortness of breath, and fever, as well as addressing complications faced by patient, such as sepsis, pneumonia, and formation of multiple abscesses. Diagnosis of infection by pathogen was confirmed after collecting material from one of abscesses, which was sent for culture and resulted in growth of bacteria. After receiving treatment, child made a complete recovery. It is relevant to highlight that reports of similar cases in humans are rare, and diagnosis is generally challenging, as bacterial isolation in abscess cultures and blood samples is difficult. Even when treated, mortality rate of Glanders is approximately 50%. This case illustrates difficulties faced by doctors in identifying *B. mallei* infection, suggesting that disease may be underdiagnosed and poorly recognized [7].

According to research conducted in Tocantins by De Souza Santos [6], an increase in Mormo cases was observed between 2015 and 2021, even in face of measures adopted to contain spread of disease. Analysis of frequency and geographical distribution of cases highlights strategic points where it is crucial to intensify prevention and control actions, using georeferencing as a fundamental tool. In this context, promotion and adoption of distributed information systems are recommended, as these technologies play a crucial role in decision-making during operations to combat Glanders. Given above, general objective of this work was to research, describe, and analyze sanitary defense actions directed towards equine Glanders, encompassing transmission chain to humans. Specific objectives were to evaluate effectiveness of aforementioned actions in promoting public and animal health, as well as reducing economic impacts.

Methodology

Present study was conducted based on exploratory bibliographic research on sanitary defense of Bovine Viral Diarrhea using scientific databases such as Scientific Electronic Library Online (SciELO), Google Scholar, Medline, and Latin American and Caribbean Literature in Health Sciences (Lilacs). For search, a temporal cut-off of publications from 2015 onwards was made, using following keywords: *Burkholderia mallei*, impacts, public health, zoonosis, surveillance, diagnosis, serology, prophylaxis, vaccination, and traffic control.

Included in study were articles that addressed effectiveness of strategies applied by sanitary defense against this disease with a view to revisiting actions already recommended by control and prevention programs, total 15 articles selected for obtaining results and developing discussion. Additionally, three Normative Instructions were incorporated, as well as technical sheet of disease, all published by Ministry of Agriculture, Livestock, and Supply (MAPA). Inclusion and exclusion criteria were defined based on proposal that guides research, identification of relevant studies through different sources, composition of explanatory content based on search and inclusion/exclusion criteria, and extraction of data related to research question, including general information about study. From collected material, a qualitative analysis of selected articles was conducted, aiming to highlight and point out effects of general prophylactic measures in combating equine glanders.

Results and Discussion

Research on equine glanders is important and essential due to various factors. Intrinsic characteristics of disease, such as its clas-

sification as a zoonosis, fatal nature, lack of cure, qualification as a bioterrorism weapon, and its resurgence, emphasize relevance of studies in this field. Moreover, impacts on economic, agricultural, public health, animal welfare, and international trade sectors give this infectious disease a prominent position. Amid this delicate context, recent relaxation of regulations brings an unknown, whose impacts cannot yet be fully measured. This situation highlights importance of addressing equine glanders in current scenario, documenting existing situations and providing parameters to assess evolution of this disease in near future.

Glanders is subject to Mandatory Notification to Official Veterinary Service, as established by Normative Instruction Nº 50 of Ministry of Agriculture, Livestock, and Supply (MAPA), dated September 24, 2013, requiring immediate reporting of suspected cases [11]. Due to severity of disease, notification to World Organisation for Animal Health is mandatory, classifying Glanders as a serious zoonosis. *Burkholderia mallei*, causative agent, is categorized as a Category B bioterrorism weapon in United States [4]. Need for euthanasia in positive animals is imperative due to significant impact on public health and lack of effective treatment [11]. MAPA [9] implements National Equine Health Program (PNSE), addressing surveillance, traffic control, and immediate intervention in cases of notifiable diseases. Reference documents include Normative Instruction Nº 6, dated January 16, 2018, and MAPA Ordinance Nº. 593, dated June 30, 2023, which amend guidelines for prevention and control of Glanders within scope of PNSE [2].

Glanders is included in list of diseases subject to Mandatory Notification to Official Veterinary Service, as established by Normative Instruction Nº 50, dated September 24, 2013. This designation highlights need for immediate communication of any suspected case of disease [11]. Given severity of disease, notification of presence of Glanders is mandatory to World Organisation for Animal Health, due to its high morbidity and lethality rates, being categorized as extremely severe zoonosis. Moreover, Centers for Disease Control and Prevention in United States classifies *Burkholderia mallei* as Category B bioterrorism weapon [4].

Significant impact of Glanders on public health and absence of effective treatment and preventive measures for affected animals make practice of euthanasia mandatory for all animals that test positive [11]. MAPA [9] maintains a program dedicated to prevention, control, and eradication of diseases in equines, called PNSE, which proposes actions for Animal Health Surveillance and Defense, including activities such as sanitary education, epidemiological studies, inspection and control of equine transit, registration, inspection, and sanitary certification of establishments, as well as immediate intervention in event of suspicion or occurrence of notifiable disease [5].

Among reference documents for control of Glanders in Brazil, there is MAPA Normative Instruction Nº 6, dated January 16, 2018, which approves general guidelines for prevention, control, and eradication of Glanders in National Territory, within scope of PNSE, and MAPA Ordinance Nº 593, dated June 30, 2023, which amends Normative Instruction Nº 6, dated January 16, 2018, with a view to approving General Guidelines for Prevention, Control, and Eradication of Glanders in National Territory, within scope of National Equine Health Program.

In some countries and regions, such as Western Europe, United States, and Australia, strict epidemiological control measures have resulted in eradication of Glanders. Despite being eradicated in much of world, zoonosis has reassumed status of a reemerging disease due to recent significant outbreaks. In this scenario, *B. mallei* has been categorized as a reemerging pathogen, increasing risk of infections in humans [10]. Disease was initially identified in Brazil in 1811, probably by horses imported from Europe that were contaminated. This resulted in introduction of Glanders into national territory, triggering numerous epizootics throughout country, affecting horses, mules, and even humans, who exhibited clinical symptoms of catarrh and nasal cancer. Situation resulted in serious losses in herd, leading to hiring of French Veterinarians as a measure to control outbreak [4].

Although it was believed that Glanders had been eradicated in 1960s due to lack of records, new cases were reported in states of Alagoas and Pernambuco in 1999. Since then, cases of death have been observed in several states of Brazil, characterizing it as a reemerging disease [4]. Reappearance of Glanders in Brazil is linked to increased frequency of sampling and, therefore, of tests conducted. A study conducted in Maranhão revealed a higher incidence of positive samples during months of February to May. This effect is directly related to intensification of equestrian events during this period, resulting in an increase in mandatory diagnostics and, consequently, an expansion in detection of positive animals in tests, many of which are likely asymptomatic or presenting few symptoms. This finding is reinforced when authors establish a demonstration between frequency of positive animals and region, noting that an area with a higher incidence is not necessarily one with largest herd, but rather one with highest number of tests conducted [13].

MAPA advocates fundamental control strategies for management of Glanders. It is recommended that properties with animals positive for disease undergo a process of interdiction, followed by immediate euthanasia of animals diagnosed as positive. Subsequently, carcasses must be properly disposed of, either by incineration or burial, and all facilities and utensils must undergo a rigorous decontamination procedure. Additionally, sequential serological tests are conducted on other animals of quarantined property, with intervals of 21 to 30 days. Lifting of property's interdiction is conditioned on obtaining two consecutive negative serological results in animals [1]. Another recommended control measure refers to participation of equines in equestrian events. According to MAPA guidelines, only equines that present proof of a negative test and are free of clinical signs of disease are authorized to participate in these events in states where cases of Glanders have been confirmed. Equines native to states with confirmed presence of bacteria causing Glanders can only transit in free states after presenting proof of a negative test for disease, without clinical evidence of Glanders, with test result being valid for 60 days from date of sample collection [1].

On June 30, 2023, MAPA [9] announced through Ordinance Nº 593, published in Official Gazette, revocation and modification of provisions of Normative Instruction Nº 06, dated January 16, 2018. From this publication, MAPA no longer requires presentation of a negative Mormo test result for movement of equines. This measure takes immediate effect and allows movement of equines without requirement of a negative Mormo test in Federative Units, except in some States that have specific legislation. Another significant change introduced by this Ordinance concerns new definition for confirming presence of Glanders. Now, an equine will only be considered positive for disease if it presents positive results in both serological and complementary tests for Glanders, in addition to showing compatible clinical signs. Under these circumstances, animal will be sacrificed by Official Veterinary Service, followed by implementation of other necessary measures on property.

Recent modification in legislation by MAPA [9], especially regarding transit of equines and control of Glanders, highlights increasing importance of state autonomy in defining their regulations. Historically, Glanders has been neglected and underreported, which requires increased attention from state authorities for effective implementation of these measures. With relaxation of requirement for a negative Coggins test for EIA, responsibility of states becomes even more significant in search for efficient strategies for prevention and control of disease.

Associating these legislative changes with education, information, and awareness initiatives directed at horse owners and breeders is crucial. It is worth highlighting considerable advances in PNSE related to Glanders in recent years. Progress in ELISA test as a screening method and Western Blot as a complementary test stand out, providing greater accuracy in diagnoses, increasing sensitivity and specificity of diagnoses, and reducing possibility of human errors. However, it is essential to improve definition of foci and contaminated areas, as current data in Brazil do not allow for an accurate assessment of prevalence, largely due to repetitive nature of samples collected so far from animals in transit, as a portion of these animals are repeated.

Conclusion

Recent easing of requirements for movement of horses, notably waiver of negative test for Glanders, signals a turning point that could intensify already existing clandestine movement, especially in unsupervised sporting events. This change, while reflecting growing importance of state autonomy in defining their regulations, also raises critical concerns. In this context, urgent need to strengthen oversight and control, coupled with development of specific strategies to prevent unauthorized transport of animals, becomes evident. Imminent risk of spread of Glanders demands caution, as failure to observe sanitary measures can result in implications not only for equine health but also for international economic landscape.

Given this challenging scenario, implementation of specific sanitary programs emerges as imperative, encompassing everything from early detection of infected animals to humane elimination of positive cases. Strict control of animal movement, isolation, and sanitation in affected farms become crucial elements. Moreover, it is absolutely necessary to adopt strict and internationally aligned sanitary standards, ensuring effectiveness of measures implemented. Caution and rigorous monitoring will be essential in coming years to assess real impacts of regulatory change. Continuous collection and research of official data will play a fundamental role, providing valuable insights into effectiveness of new approach and its impact on prevalence of Glanders. Ultimately, it is essential that regulatory flexibility does not compromise disease control efforts, requiring a strategic and adaptable approach to preserve health and integrity of equine population, without disregarding fundamental principles of Health Surveillance.

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