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Outbreak of anthrax in livestock with human occupational exposures – Minnesota, 2023

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Abstract

In July 2023, the Minnesota Department of Health (MDH) was notified of possible occupational exposures to anthrax during an outbreak in animals. In consultation with the Centers for Disease Control and Prevention, MDH epidemiologists created a questionnaire that assessed exposure risks and helped determine individual illness monitoring and antibiotic post-exposure prophylaxis needs. This investigation and the resources developed for it could be useful in future scenarios where there are occupational exposures to naturally occurring anthrax.

Keywords

Occupational health; zoonosis; public health; risk

Introduction

Anthrax is a disease in animals and humans caused by *Bacillus anthracis*, a naturally occurring spore-forming bacteria present in the soil in the Central United States (US).[1,2] Exposure to animals with anthrax can lead to human infection, making animal anthrax

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cases a risk to human health.[1–3] In July 2023, the Minnesota Department of Health (MDH) was notified by the Minnesota Board of Animal Health (MBAH) of animal anthrax cases to which there were several human exposures. MDH epidemiologists consulted with the Centers for Disease Control and Prevention (CDC) and adapted exposure scenarios published in Vieira et al.[3] to develop an exposure interview and risk assessment tool. This novel assessment tool allowed epidemiologists to conduct interviews rapidly and systematically with six producers and veterinarians, characterize their exposure risks, and recommend antibiotic post-exposure prophylaxis (PEP) and symptom monitoring.

The MBAH was contacted on July 3, 2023, by a veterinarian (Veterinarian 1) who suspected that two local farms (Farm A and B) had lost livestock due to anthrax infection. The first livestock death occurred at Farm A on June 18, 2023. The producer (Producer 1) at this farm lost 8 (12.5%) of his 64 cattle within 4 days. Veterinarian 1 suspected these deaths were from anthrax, as the farm had experienced a previous outbreak of anthrax over a decade prior. Since a veterinarian was not called to the farm and the carcasses were burned and buried without testing, these deaths were later considered as highly suspect for anthrax. Under the direction of Veterinarian 1, the producer vaccinated his herd using the Sterne anthrax vaccine and treated them with a long-acting tetracycline. While concurrent anthrax vaccination and antibiotic administration is not recommended per vaccine label directions, it occurs in this Minnesota county due to resource limitations that make livestock handling more challenging. Considering the urgency of controlling anthrax outbreaks to reduce livestock loss, this strategy previously was used in emergency scenarios with success.[4] All affected properties in this outbreak administered the Sterne anthrax vaccine and long-acting tetracycline as the standard of care in this scenario, which resulted in prevention of additional livestock deaths.

Approximately 8 miles away from Farm A, Farm B reported 1 horse and 14 cows dying acutely over 4 days starting on July 1. Veterinarian 1 visited this farm, suspected anthrax, and collected a blood sample from a deceased cow. The husband-and-wife producers from Farm B (Producers 2 and 3), alongside Veterinarian 1, then vaccinated and treated the remaining herd. Anthrax was confirmed at North Dakota State University Veterinary Diagnostic Laboratory (NDSU) on July 5 by polymerase-chain reaction (PCR) that targets portions of rpoB, *pag*, and *cap* genes. The livestock carcasses were burned and buried with oversight from MBAH veterinarians.

MBAH veterinarians issued an alert to local farms of the potential risk for anthrax outbreaks and contacted MDH epidemiologists on July 5 to manage any human exposures to anthrax. On July 7, a producer (Producer 4) on another local farm five miles from Farm B (Farm C) contacted MBAH to report a suspicious goat death that occurred on July 6. Veterinarian 1 was dispatched by MBAH to collect blood samples from a deceased goat, and anthrax was confirmed at Farm C on July 13 by PCR at NDSU. In total at Farm C, four goats (4% of the herd) died acutely starting on July 6. The carcasses of the affected goats were burned and buried, and the husband-and-wife producers on Farm C (Producers 4 and 5) administered the vaccine and long-acting antibiotic concurrently on July 13. After each outbreak was identified, MDH contacted individuals present at each affected farm to gain insight into what

occupational exposures may have occurred and ensure that exposed individuals received PEP if appropriate.

Methods

Thirty-minute exposure risk interviews of Producers 1–5 and Veterinarian 1 were completed over the phone within 2 h of MDH receiving reports of possible animal anthrax on each farm. Interviewees were asked to describe their animal-related activities, any physical contact with ill animals or animal carcasses, and any PPE they wore during each activity (see questionnaire and risk assessment tool in Supplementary Materials). The need for antimicrobial prophylaxis and/or monitoring was then determined by MDH epidemiologists with reference to Vieira et al.[3] (Table 1). For individuals with multiple exposures, their highest risk exposure was used to guide decision-making.

Results

Two (33%) individuals were assessed to have low-risk exposures and were recommended to undergo 14 days of symptom monitoring.[3] Symptom monitoring included providing education on the symptoms of anthrax in humans and weekly check-ins to discuss any questions or concerns. The remaining four (67%) individuals were assessed to have moderate risk exposures due to inadequate PPE usage and were recommended to complete a 7-day PEP regimen of doxycycline and 14 days of symptom monitoring.[3] All participants agreed to the recommendations provided by epidemiologists. Notably, three (75%) of the individuals with moderate risk exposures did not wear gloves while touching ill animals or carcasses. This information provided insight into the development of educational materials for producers managing animal anthrax cases later coauthored by MBAH and MDH. Fortunately, no human illnesses were reported.

Discussion

Many public health preparedness efforts focus on intentional anthrax release, and thus it can be challenging to find information on managing human occupational exposures to naturally occurring anthrax. While professional guidance on managing these scenarios is often shared between jurisdictions with a high burden of animal anthrax cases, such guidance is not widely or publicly available. Without clear, readily available protocols or questionnaires, health departments trying to assess human risk of anthrax from natural exposures might incorrectly categorize occupational exposures and recommend interventions that are better suited for bioterrorism situations involving laboratory-manipulated *B. anthracis* spores. Thus, individuals with low or moderate risk exposures to naturally occurring anthrax might erroneously be recommended to take antibiotics for 60 days and report any symptoms for the same period.[5,6] Onerous guidance for individuals exposed to anthrax may discourage cooperation and adherence to public health recommendations, as previously observed during the United States in 2001 anthrax attacks and during a naturally occurring animal anthrax outbreak in Zimbabwe.[6–10]

Determining the risk level associated with occupational exposures during naturally occurring anthrax outbreaks in animals can be challenging given the unique interactions that producers have with ill animals and animal carcasses. Additionally, personal protective equipment (PPE) use, which can vary widely on farms, plays an important role in risk reduction[1,2] and must be considered when assessing risk. Thus, a tool was needed to systematically define exposures as low, moderate, and high risk while considering complex factors that could alter risk. To bring current guidance on categorizing risk exposures to a broader audience, MDH worked with CDC experts to adapt current best-practice protocols into an accessible exposure interview and risk assessment tool to better standardize the approach to classifying human exposures to animal anthrax.

Conclusion

While focus on *B. anthracis* as a potential bioterrorism agent is necessary for public health preparedness and response, it would be remiss to ignore its role as a naturally occurring pathogen in the US. Interventions to prevent or manage occupational exposures to anthrax should be prioritized, especially as extreme weather events become more common and may contribute to animal anthrax outbreaks globally.[11,12] In northwest Minnesota where the 2023 outbreak occurred, there were several animal anthrax outbreaks from 2000 to 2013 in drought conditions that occurred after major flooding.[2] While vaccinating for anthrax is common for cattle producers in the region, some producers may have allowed vaccines to lapse since no outbreaks had occurred since 2013. Following identification of the outbreak, livestock producers in the area surrounding the three affected farms were alerted and livestock were protected due to effective and quick action by MBAH.

Interventions require ongoing relationships and outreach to rural communities and producers to ensure compliance with recommendations provided by human and animal health agencies. While primary prevention of anthrax in animals is the best way to reduce occupational anthrax exposures, it must be paired with the early detection of animal anthrax cases through point-of care tests, for example, that would allow for a more rapid outbreak response.[13] However, even with efficient and comprehensive outbreak responses, human exposures to animal anthrax will occur and must be managed quickly and effectively.

During 1950 to 2002, occupational exposures to naturally occurring animal anthrax accounted for 85% of human anthrax investigations in the US,[14] with additional human anthrax cases associated with animal or occupational exposures in Texas and upper Midwest after 2002.[1,15] Despite the potential for exposure to naturally occurring anthrax throughout the Central US, there is little widely available guidance on managing occupational exposures to animal anthrax outbreaks. The exposure risk assessment and other materials developed for this investigation fill a critical public health gap by providing practical, standardized recommendations that reflect the most recent scientific consensus on managing occupational exposures to naturally occurring anthrax. These public health tools, and outreach and educational efforts, can only be successful when working in full partnership with state animal health officials using a One Health approach.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Summary of Human Exposures on Farms with Confirmed and Probable Animal Anthrax Cases, Minnesota, 2023.

LOCATION	INDIVIDUAL	EXPOSURE DATE	RISK LEVEL	EXPOSURE TYPE	PROPER PPE WORN[i]	MONITORING DURATION	PEP[ii]
Farm #1	Producer 1	6/18/23	Low	Wore gloves, boots, and coveralls while disposing of carcasses	Yes	None[iii]	None
Farm #2	Producer 2	7/01/23	Moderate	Handled two carcasses without gloves	No	14 days	7 days
	Producer 3	7/01/23	Moderate	Had contact with an ill animal prior to death without gloves	No	14 days	7 days
Farm #2 and #3	Veterinarian 1	7/03/23	Moderate	Administered vaccines and took blood samples without gloves	No	14 days	7 days
Farm #3	Producer 4	7/06/23	Moderate	Touched animal carcass with insufficient PPE on arms and legs	No	14 days	7 days
	Producer 5	7/13/23	Low	Wore gloves, boots, and coveralls while administering vaccines	Yes	14 days	None

[i] Personal protective equipment (PPE) necessary for the individuals listed above includes gloves, coveralls or long sleeves and long pants, and boots/boot covers.

[ii] Antibiotic post-exposure prophylaxis (PEP) may include doxycycline, ciprofloxacin, or levofloxacin.[2] Depending on resistance patterns, amoxicillin or penicillin may also be used.[2]

[iii] When this individual was interviewed, the critical 14-day monitoring period had already passed and therefore individual declined further monitoring.