GLOBAL BIOSECURITY

Qurat ul Ain, Saeeed Ahmed & Abid Saeed. Outbreak investigation of sheep pox in District Barkhan, Balochistan, Pakistan. *Global Biosecurity, 2019; 1(2).*

RAPID REPORTS

Outbreak investigation of sheep pox in District Barkhan, Balochistan, Pakistan

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Abstract

During mid-January 2018, a significant number of suspected sheep pox cases were reported from the district of Barkhan, Balochistan to the Director of Animal Health. An investigation team was deployed after an unusually high mortality rate and complaints of skin lesions accompanied by lacrimal & nasal discharge were reported. The aim of this investigation was to estimate the magnitude of the disease, identify risk factors and implement preventive measures to stop further spread of disease. We defined a sheep pox confirmed case as a sheep with fever >40˚C and necrotic skin lesions along with one or more of the following: papules or nodules anywhere on the body, mucopurulent nasal discharge, hyperemia, oedema (generalized), swollen eyelids and enlarged prescapular lymph node. Using a pre-tested questionnaire, rates and frequencies were calculated using Epi InfoTM 7 Software. A case-control study was conducted in March 2018. During active case finding, 43 farms were suspected for sheep pox infection, with a total of 4050 infected animals. Of these, infected adult sheep comprised 76% (3081), followed by 24% (969) lambs. The case fatality rate was 33% (1337/4050) with an overall attack rate of 55% (4050/7438). Almost half the farms (21/43) responded that wool shearing within a flock was done, 42% (18/43) introduced new animals into a flock without prior quarantine, but only 5% (2/43) were aware of isolation and only 21% (9/43) vaccinated the animals. New animals within flocks (OR: 3.7, CI 1.34 – 10.2, P-value 0.008) and wool-shearing (OR: 3.15, Cl 1.24 – 7.9, P-value 0.01) were statistically associated with disease spread. This outbreak of sheep pox is much larger than those previously reported. The outbreak occurred in an area with new animal arrival, low vaccine coverage, and poor biosecurity and sanitary measures. Standard biosecurity and sanitary prophylaxis measures were recommended to control the outbreak.

Introduction

Sheep pox is a devastating viral disease of sheep; it is highly contagious and widely distributed in some parts of the world [1]. In recent years it has mainly been reported from Asia and Africa. The virus belongs to the genus Capripox, sub-family Chordopoxvirinae of the Poxviridae family. The transmission of virus is either by close contact, aerosols, or indirectly by feed and water [2]. The virus can remain viable for months on wool or dried scabs.

The incubation period ranges from 8 to 13 days, with a maximum incubation of 21 days. It is one of the major viral diseases of ovines and caprines, with high morbidity and considerable mortality of 70-90% [3], which can sometimes approach 100% [4]. The sheep is the primary host and all age groups are equally affected. However, young lambs are at higher risk of death [5]. Severe economic losses occur from the high mortality, abortions, skin damage and loss of wool and mutton [6]. The disease appears on the World Organization for Animal Health (OIE) list as a notifiable disease [7-8].

During mid-January 2018, 1500 suspected sheep pox cases were reported by local field veterinarians in the district of Barkhan, Balochistan. The cases presented with skin lesions accompanied by lacrimal & nasal discharge and unusually high mortality. The investigation team was assigned on 28th February to visit District Barkhan to investigate the situation and recommend control measures for future prevention of ongoing outbreak. The district Barkhan has a total sheep population of 413,840 and shares a border with Punjab province. The aim of this investigation was to conduct an outbreak investigation and control the disease through preventive measures to stop further spread of disease.

Methods

After literature review on sheep pox, the investigation team visited the affected areas of district Barkhan on March 1st, 2018. To understand the outbreak and the perspective of the community, a combined meeting session with farmers & administrators in the area was conducted. There were very few veterinary dispensaries or hospitals in the area with records; therefore, interviews of the farmers were conducted for data collection. The investigation was carried out from the 1st to 3rd March 2018 and a descriptive followed by case-control study was conducted. By using standard case definition, a case was defined as a sheep with fever >40˚C, necrotic skin lesions and one or more of the following: papules or nodules anywhere on the body, mucopurulent nasal discharge, hyperemia, oedema (generalized), swollen eyelids and enlarged prescapular lymph node , between January 10th to March 10th, 2018 in

Barkhan. Using a semi-structured questionnaire, demographic, clinical, and risk factor data were collected. Risk factors included vaccination status, biosecurity practices and waste disposal methods. All flock owners were interviewed and animals were examined for infection.

Data Collection

To find the risk factors associated with sheep pox, flock to flock investigation was carried out in the district. The information associated with sheep pox cases was collected from farm owners or workers by using the semi-structured questionnaire. Data was collected about the mortality patterns of the flocks, total mortality in the last 50 days, and status of vaccination against sheep pox virus (SPV). Vaccination was recorded as no vaccination, single or two shots of SPV vaccine. The animal history included being a newly introduced animal, isolation and wool shearing. The history and reasons for not getting vaccine were asked in detail.

Data Analysis

Frequencies were calculated and tables and graphs were generated by using Epi InfoTM 7 and discussed with relevant stakeholders. Risk factors were analysed by calculating odds ratios for infection. The odds of getting disease in newly introduced animals versus unintroduced animals, isolation versus no isolation, and wool shearing versus no wool shearing were calculated. All significance was reported at confidence interval of 95% and p-value less than 0.05.

Active case finding was conducted in the area. A case-control study of affected and unaffected farms was conducted. The farms were selected as cases if they had sheep pox, based on our case definition and inclusion criteria. Control farms were those that were disease-free. The risk factors were coded as 0= No and 1= Yes. The controls were taken from the same and adjoining union councils of the district in a 1:1 ratio. The inclusion criteria for controls were flocks of same village or adjoining area that did not have sheep pox at that time. For comparison, a total of 43 controls were randomly selected. Vaccination practices were documented for case and control farms.

The attack rate (AR) was defined as proportion of animals that develop disease / total no. of animals at risk. We considered the at-risk population as the total population in the affected farms. We calculated the AR in the affected farms. Vaccine effectiveness among infected flocks was calculated by using the formula [Attack rate in unvaccinated - attack rate in the vaccinated] / attack rate in the unvaccinated), or [VE = [ARU – ARV]/ ARU].

Results

Active Case Finding Results

For active case finding, clinical examinations were conducted. A total of 47 farms in the affected area were investigated and 43 of them were suspected for sheep pox infection as per the case definition. A total of 43 farmers were interviewed, having 7,438 animals. These farmers had a population that comprised 80.5% (5988) adult sheep, and 19.5% (1450) lambs.

There were 4050 animals with active clinical infection or suffering from the same clinical signs as our case definition. Of these, infected adult sheep comprised 76% (3081), followed by 24% (969) lambs. The attack rate in adult sheep was 52% and 66% in lambs. The attack rate for animals is also given in Table 1 below. The overall attack rate was 55% (4050/7438).

A similar pattern was observed for the case fatality rate. The case fatality rate (CFR) is given in Table 2 below. The overall case fatality rate was 33 % (1337/4050).

Infected animals from a single flock were considered as 1 unit. Fever was reported in 88% (38/43) of flocks, along with nasal discharge in 74% (32/43) and swollen eyelids in 58% (25/43). 49% (21/43) exhibited oedema while 40% (17/43) had hyperemia (Figure 1). Necrotic skin lesions were reported in almost all infected flocks. However, 63% (27/43) of flocks had skin lesions around the face, 58% (25/43) had around ear and udder, 51% (22/43) had lesions around the mouth, and 30% (13/43) reported lesions all over the body (Figure 2).

The distribution of suspected sheep pox flocks regarding the onset of symptoms was also recorded. The first suspected infected flock (index) was reported on 17th January 2018 after new animals were introduced into a flock. Infected flocks started being reported from 20th January 2018, with the first and second peak observed on 31st January and 8th February, respectively. Then it began to decline in magnitude but remained prevalent and peaked again on 2nd March 2018. Afterwards the cases reduced significantly, and the last case was reported on 7th March.

The team found that most flocks were not vaccinated. Out of a total of 43 flocks, 34 flocks were non-vaccinated, three were fully vaccinated and six were partially vaccinated. The majority 62% (21/34) - responded that vaccine was not available in the area, 26% (9/34) faced the problem of inaccessibility to a veterinary hospital and 12% (4/34) said the vaccine was unaffordable.

Half of the case farms, 49% (21/43), responded that wool shearing within a flock was done twice a year. 42% (18/43) reported that new animals were introduced in a flock without prior quarantine. Only 5% (02/43) were aware of isolation and 21% (9/43) vaccinate the animals.

Among controls, 23% (10/43) responded that wool shearing within a flock was done, 16% (07/43) introduced new animals in a flock and 19% (8/43) were aware of isolation and 53% (23/43) vaccinated the animals. Table 3 shows the univariate analysis. The risk of disease was significantly associated with the introduction of new animals (OR: 3.7, CI 1.34 – 10, P-value 0.008) and wool shearing (OR: 3.15, Cl 1.24 – 7.9, P-value 0.01).

Vaccine effectiveness among infected flocks was 0.55, or 55% in preventing infection.

Table 1. Attack rates for the infected animals

Animals	Infected Animals	Total Population	Attack Rates	Odds ratio (OR)	95% Cl	P-value
Lamb	969	1450	66%	1.9	1.6 - 2.1	0.000
Adult	3081	5988	52%			

Table 2. The case fatality rates of the animals

Animals	No. of fatal cases	No. of infected animals	Total no. of animals	CFR %
Adult	776	3081	5988	25%
Lamb	561	969	1450	58%
Total	1337	4050	7438	33%

Figure 1. Symptoms among affected flocks during sheep pox outbreak in District Barkhan

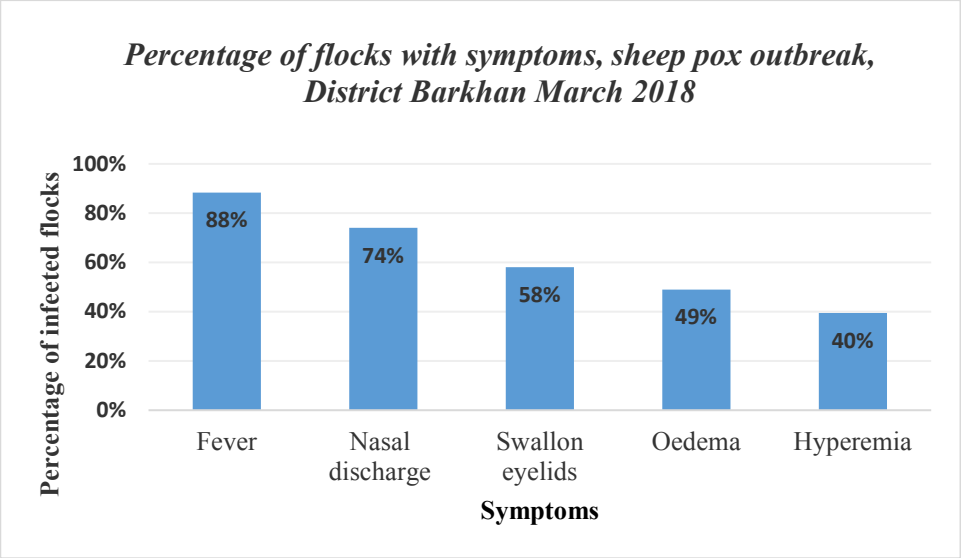

Figure 2. Skin lesions among affected flocks during sheep pox outbreak in District Barkhan

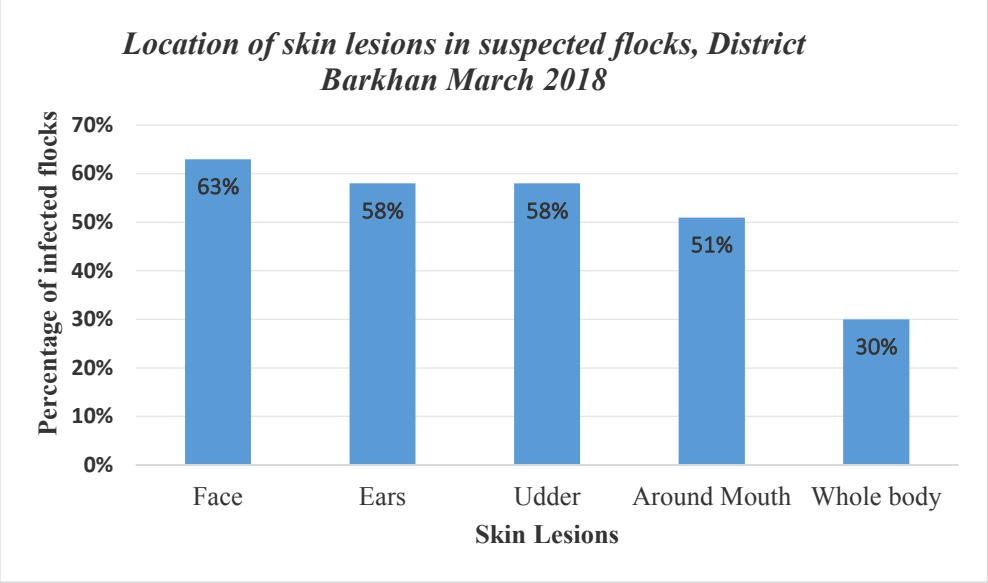

Figure 3. Suspected sheep pox cases reported from District Barkhan from January to March 2018 (n=4050)

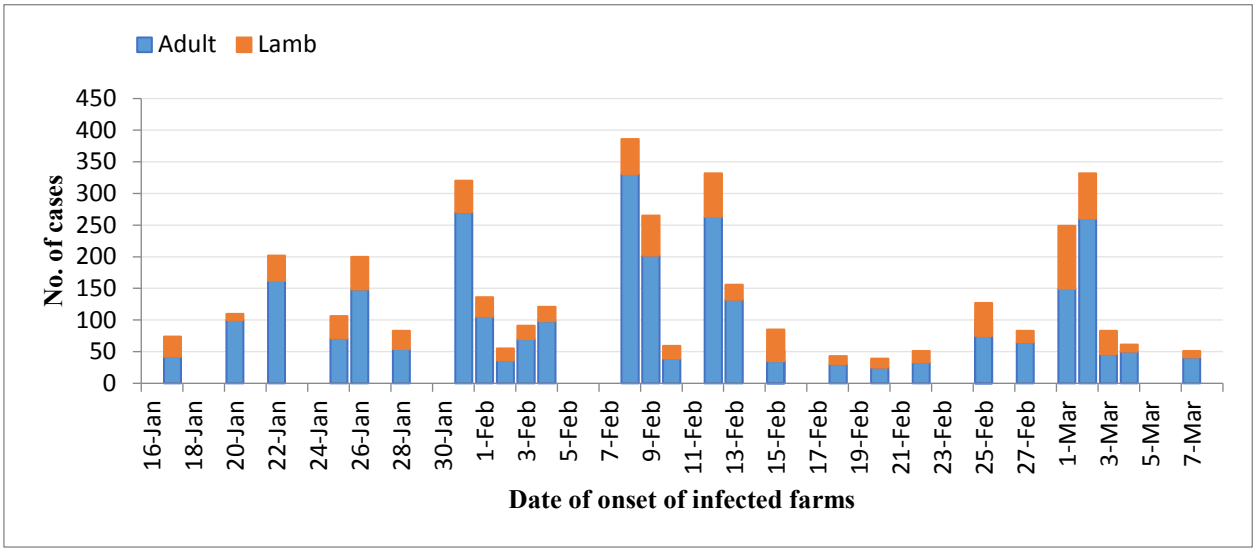

Table 3. Risk factors for sheep pox outbreaks.

S. No	Risk Factor	Cases (n %)	Controls (n %)	OR	95% Cl	P-Value
1	*Introduced new animals* Yes No	 18 (72%) 25 (41%)	 7 (28%) 36 (59%)	3.7	1.34-10.2	0.008
2	*Isolation of infected animals* Yes No	 2 (20%) 41 (54%)	 8 (80%) 35 (46%)	0.21	0.04-1.07	0.04
3	*Wool shearing* Yes No	 21 (68%) 22 (40%)	 10 (32%) 33 (60%)	3.15	1.24-7.9	0.01
4	*Vaccination status* Yes No	 9 (28%) 34 (63%)	 23 (72%) 20 (37%)	0.23	0.08- 0.59	0.001

Table 4. Case-control analysis of affected and unaffected farms

Vaccination of sheep	Case farms	Controls	Total	Risk/attack rate
Yes	9	23	32	0.28
No	34	20	54	0.63
	43	43		

Conclusion of outbreak investigation

The outbreak was attributed to the introduction of new animals into the flocks. The index flock farmer introduced new animals without prior quarantine. Other factors included wool shearing and low vaccination rates. That led the disease to spread to entire region and other Union councils. There was no scheduled vaccination in the area and a lack of awareness about safe disposal of deceased animals. The deceased animals were discarded openly, anywhere, which allowed consumption by stray dogs and wild birds.

Discussion

We describe a large propagated outbreak of sheep pox which progressed rapidly, with a vaccine effectiveness of 55%. As far as we are aware, there are no other available estimates of field vaccine effectiveness. However, Boumart et al. [9] compared live and attenuated vaccine efficacy in 2016. They found inactivated Romanian SPPV has the potential to control and prevent disease in endemic areas. A breach in biosecurity contributed to the outbreak, specifically allowing introduction of new animals without screening. This was exacerbated by shearing and low vaccination rates. Our findings are similar to

the results reported by Hamouda et al. [10]. GB Manjunathareddy et al. [11] reported disease spread mainly through close contact, introduction of new animals and transportation. In our study, the morbidity rate was high in young lambs compared to adult animals (OR: 1.9, CL 1.6 – 2.1, P 0.000). A study conducted in Ethiopia reported high seropositivity in young age (OR 2.2, Cl: 1.46 - 3.4, P 0.01) and ewes (OR: 1.99, Cl: 1.96 – 3.40, P 0.008) as compared to adults and rams. The low level of immunity in young animals explained the higher seropositivity [12]. In our study, by taking history we found that sheep pox remains endemic in the whole belt of the district and cases arise during the winter season. Most studies show that disease is more prevalent during the winter and autumn season [13]. Mixing of animals and animal movement for grazing were also potential sources of direct transmission of disease. The indirect spread of disease may have occurred through open air disposal of deceased animals. Authie E et al. [13] reported an outbreak in Greece during 2013- 2014. Greece shares borders with Bulgaria and Turkey, resulting in spread of sheep pox between the countries through direct contact with sick and dead animals. In 2014, an outbreak among unvaccinated sheep occurred in Turkey. With further investigation they found new animals had been introduced to farm recently [14]. Similar findings were reported by several other authors [2, 15, 16, 17]. Low vaccine coverage also contributed to the spread of disease. Lack of awareness, lack of access and cost all contributed to low vaccine coverage.

Actions taken and recommendations

A public awareness session was conducted in union councils where farmers were briefed about the vaccine and the significance of vaccination. The farmers were provided with free vaccination. The farms in the surrounding area of a 3 km radius were screened for sheep pox and advised accordingly. Active surveillance was conducted to detect unvaccinated infected flocks and monitoring in vaccinated flocks was started in the affected area.

The study had limitations, as age-specific and gender distribution of cases within flocks were difficult to assess. The farmers did not have the accurate birth or age records of the animals. Moreover, there was continuous purchase and sale of animals during the outbreak period. On the basis of these findings it is highly recommended that farming community should be educated about the importance of vaccination and sanitary precautions. Media and livestock workers should play a role in advocacy and communication about vaccinations to limit economic losses. More research is required to investigate field vaccine effectiveness, the variation of the strain, and to estimate the economic losses due to such outbreaks.

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How to cite this article: Qurat ul Ain, Saeeed Ahmed & Abid Saeed. Outbreak investigation of sheep pox in District Barkhan, Balochistan, Pakistan. *Global Biosecurity, 2019; 1(2).*

Published: September 2019

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