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An Outbreak of Lumpy Skin Disease in a Holstein Dairy Herd in Oman: A Clinical Report

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ABSTRACT

Lumpy Skin Disease (LSD) is an acute infectious disease of cattle with significant economic importance and endemic in Middle East and Africa. LSD re emerge once again in this decade as an important threat to livestock health and dairy industry in Middle East by repeated out breaks. This clinical report aimed to register one such LSD outbreak that occurred in 2009 in Oman in a farm population of 3200 Holstein animals. This manuscript will be the first one to report LSD occurrence in a multiple thousand Holstein cattle population, till date no LSD outbreaks were reported with such a high numbered population either in the region or around the world where farm as an epidemiological unit. In contrast to the field outbreaks, this farm LSD incidence had a high mortality of the adult herd (12%). Herd milk production dropped by 40-65% and production loss continued for few months. Control measures against LSD like eradication of both affected population and contact population, control of vectors were not feasible with this herd outbreak. Vaccination was conducted in the wake of outbreak and yielded poorer results. Treatment outcome of the affected animals was poor and recovery was typically complicated by higher ambient temperature. Source of vector to this catastrophic episode remains inconclusive. In conclusion, manuscript emphasizes the need for further epidemiological and entomological studies at a national level in Oman.

Key words: Lumpy skin disease, holstein herd-lumpy skin disease, LSD cattle, emerging disease, OIE listed cattle disease, livestock health, herd outbreak

INTRODUCTION

Lumpy Skin Disease (LSD) is an acute infectious disease of cattle which is characterized by high fever, lymphadenopathy, sudden eruption of multiple circumscribed skin nodules, necrotic plaques in mucosa and subsequent sit fasts of the nodules (Woods, 1988). LSD is caused by prototype strain of Neethling virus and belongs to the genus *Capripoxvirus* within the family Poxviridae. Sheep Pox Virus (ShPV), Goat Pox Virus (GPV) and Lumpy Skin Disease Virus (LSDV) together make up the *Capripox* group of pox viruses (Buller *et al*., 2005). The morbidity of LSD varies from 3 to 85% and mortality never exceeds 3% (Woods, 1988; Barnard *et al*., 1994). However, severity of the disease depends on the susceptibility of the host. By natural predisposition *Bos Taurus* is more susceptible than *Bos Indicus* and lactating cows appearing to be at most risk (Davies, 1982; Kitching, 2008). LSD is a constraint on livestock trade as it causes major production losses notably in high-producing exotic breeds (Davies, 1991). This is an OIE (Office International

des Epizooties) listed and a notifiable cattle disease. LSD is signified with the potential for rapid spread and is known to cause severe economic losses by loss of milk production, abortions and infertility in males and females (Irons *et al*., 2005; OIE Animal Diseases Data, 2011).

Until the 1980s, LSD was found only in sub Saharan Africa. In Middle East, outbreaks were reported in Oman in 1984, Kuwait in 1986 and 1991, Egypt in 1988 and 2006, Israel in 1989 and 2006, Bahrain in 1993 and 2002-2003 and United Arab Emirates in 2000 (USDA-APHIS Info Sheet, 2006; Brenner *et al*., 2006; El-Kholy *et al*., 2008). Epidemiological evidence indicates that biting arthropods such as *Stomoxys calcitrans* and also female mosquitoes of *Aedes aegypti* are involved in the transmission of LSDV (Kitching, 2008; Chihota *et al*., 2001). Recent experimental evidence that concluded a potential role of Ixodid ticks in the transmission of LSDV (Tuppurainen *et al*., 2011).

Brenner *et al*. (2006) reported that LSD remerged once again in Israel in June 2006 in an independent Holstein dairy herd. The outbreak affected 30 cows in a 395 lactating group among the herd strength of 605 animals. Seemingly, this outbreak was considered as a serious threat to the Israelian dairy industry as it concurred with a widespread Egyptian LSDV outbreak (Brenner *et al*., 2006). Likewise, in Oman re emergence of LSD in several regions within the country can be considered as an emerging threat to the dairy industry. This communication is not intended to be a comprehensive review of lumpy skin disease that occurred in several regions of Oman in (2009). This clinical report is written out in the personal perspective of veterinarian who handled this catastrophic episode and describes clinical features of the herd outbreak. However, this independent episode clearly raise an increased concern over LSD occurrence in intensively managed dairy farms due to the fact, that Middle East region is prominently known for its commercial dairy operations with multiple thousand populations of Holstein cattle.

The aim of the present study is to record a rare herd outbreak of lumpy skin disease in a multiple thousand Holstein farm population and describe the clinical features of this herd outbreak.

CASE DESCRIPTION

The Holstein herd is located in the Batinah region of Northern Oman and was operating with total herd strength of 3200 animals with a subset of 1250 milking cows. The farm is functioning nearly three decades and more than a decade as a closed herd. The farm operates under intensive management system, 3X milking, AI breeding and did not succumb to any other disease outbreak previously. The animals are housed at thirty three corrals and with corral cooling systems as fog/line sprinkler along with fans.

An independent cow was observed with severe lumpy/urticaria like lesions all over the skin in the early morning of 2nd May 2009. Upon immediate screening in an hour eight more cows were detected with similar signs and all were isolated. Herd check and isolation continued on the next day, to realize 40 more cows were suspected to be infected with LSD. The management was notified about this sudden catastrophe and briefed the consequences. Whole herd vaccination was conducted with KGSP 0/240 $10^{2.5}$ TCID 50- Kenya Vac^{R} (JOVAC, Jordan Bio industries centre, Jordan) 1 mL/dose, subcutaneously on the third day of outbreak. Clinical features were of characteristic lumps all over the skin, persistent high pyrexia (40-41.5°C) and profound depression. (Fig. 1). Affected animals were observed with increased salivation, nasal discharge, lacrimation anorexia and they were reluctant to move. The nodules were concentrated at neck along with pre scapular lymphadenopathy (Fig. 2). The disease continued to spread among all groups within the

Fig. 1: Large circumscribed lumpy nodules all over the skin

Fig. 2: Characteristic LSD nodules in the neck along with prescapular lymph node swelling

Fig. 3: A yearling heifer with LSD

herd including the young replacement stock (Fig. 3). Majority of the affected population was observed with variable degree of lameness that accompanied with edema of limbs (Fig. 4, 5). Affected cows were noted with kerato conjunctivitis and corneal opacity (Fig. 6). As the disease progressed, the nodules become raw ulcers, on the mucous membranes that coalesce to form a deep ulcer with severe necrosis (Fig. 7) and eventually forming a typical 'sit fast' (Fig. 8). Extensive generalization of the disease was observed in most of the affected cows. They became severely lame, recumbent in the terminal stages and observed with severe tendosynovitis of the limbs (Fig. 9). The whole disease episode lasted for 5-6 weeks since the start of May. Morbidity of LSD in the herd was 30-35% and mortality of the adult herd was 12%. Until end of two months total adult herd loss was 259 numbers that includes the adult replacement heifers signifying the loss of future production

Fig. 4: Lameness and edema of LF limb

Fig. 5: Lameness of RF and RH limb

Fig. 6: Ocular discharge and corneal opacity

stock. Upon necropsy, several ulcerative pox type lesions were noted in the upper gastro intestinal and respiratory tract. A total of 13 abortions were occurred as a direct loss of pregnancy. Recovering cows were noted with various degrees of skin lesions such as deep ulcers, agalactia, emaciation,

Fig. 7: Raw ulcers all over the skin in later stages

Fig. 8: Typical sit fast and ulcers at the left nostril

Fig. 9: Severe generalization of the disease and recumbency

lameness and recumbency. Recovery of the affected herd was typically complicated by prevailed higher ambient temperatures. The average temperature humidity indexes (THI's) were of 90 and above during the summer months of June, July and August. Added another 125 animals were died between July and August 2009 due to pronounced loss of body condition and recumbency.

As mentioned above, characteristic clinical signs such as circumscribed nodules, pyrexia, lymphadenopathy, necrosis of the nodules that later coalesce to form ulcers, lameness, severe respiratory distress, extensive generalization of the skin lesions and characteristic progressive stages of the lumps to 'sit fasts' (Fig. 1-9) all were consistent with the presence of LSDV infection in the herd and a clinical diagnosis was made. The scale of disease spread and characteristic clinical signs of LSD ruled out the possibility of other etiological involvement in the herd. The clinical diagnosis of LSD concurs with other cited works in which making a field level presumptive clinical diagnosis were given due priority at the initial stages in the emergence of an outbreak. A confirmatory laboratory diagnosis for this incidence was not undertaken, as all efforts were directed for an effective clinical management. However, both Polymerase Chain Reaction (PCR) and Fluorescent Antibody Test (FAT) are the most widely employed and reliable tests in LSD diagnosis (Brenner *et al*., 2006; El-Kholy *et al*., 2008; Razek *et al*., 2009).

DISCUSSION

On the first day of LSD occurrence the following control measures were adopted such as segregation of affected animals to a separate shed, an acaricide spray in all the corrals and glutaraldehyde spray in the farm premises to restrict the spread of disease. Implemented ward and watch for abortion in all groups of herd and advised cooling system operation round the clock as the disease complicates to produce abortion by extreme pyrexia. Local farm workers were duly instructed regarding the sanitary measures upon their entry and exit from the farm. Though LSD causes severe lesions on teat almost similar to pseudo cow pox but this disease is not of zoonotic importance and did not pose threat to handlers and milkers (Venkatesan *et al*., 2010). However, in the following days, the spread was unstoppable within the herd, as every day 40-45 animals were affected. Nevertheless, vaccination was the immediate choice in reducing the disease spread within the herd. OIE Terrestrial Manual (2004) which refers to two live attenuated strains of *Capripox* virus that have been used specifically as vaccines for the control of LSD: A strain of sheep and goat pox virus from Kenya and a strain from South Africa. Whole herd vaccination was performed with Kenya Vac^{R} KGSP 0/240 $10^{2.5}$ TCID 50 on the third day of outbreak. Davies (1991) quoted that good protection has been obtained with 10^{2} in the face of an epizootic, with both the Neethling and Kenya SGPV strains but an immunizing dose of $10^{3.5}$ TCID50 is desirable for field vaccination. However a third, different *Capripox* virus strain vaccine (RM 65 -Romanian strain sheep pox vaccine) was used during LSD outbreak in Egypt in 1989/1990 and Israel had utilized this strain to control LSD outbreaks both in 1989 and 2006 (Yeruham *et al*., 1995; Brenner *et al*., 2006). Incubation period for LSD remain largely unknown for field outbreaks or around 4-5 weeks as against the range of 6-9 days after experimental inoculation (Kitching, 2008). Despite the vaccination, the disease spread was continuing in the herd possibly due to reasons such as the vector control measures did not work efficiently and a questionable effect of vaccination to a disease exposed population. Israel in its previous outbreaks adopted sheep pox vaccine (RM 65 strain) on Holstein cattle (Brenner *et al*., 2006). However, the farm in concern had conducted vaccination with Kenyan SGPV strain but not with RM65 strain complying national regulations. Vaccination in the wake outbreak to control the disease spread and the expected immunity in the vaccinated population whilst their exposure is questionable and this decision may be debatable. However, there was no choice in the decision about vaccination as the disease occurred for the first time to this herd. Interestingly in Israel, cutaneous clinical manifestation appeared in 513 cows (11%) out of 4607 cows that had been vaccinated with the RM65 strain, to

LSDV infection during the outbreak in 2006-2007. It is important although the trend was higher in beef cattle than dairy cattle. (Brenner *et al*., 2009) This clearly suggest that vaccination induced clinical manifestation is possible in the face of an epidemic, however, there are no reports in the literature in this regard as we had vaccinated the herd with Kenyan SGPV strain. Repeat annual vaccination with Kenya Vac^{R} had been conducted in 2010 and 2011, till date the herd remains safe.

Role of biting insects (*Stomoxys calcitrans*) in the Israeli LSD outbreaks and experimental evidence of female mosquitoes of (*Aedes aegypti*) in the mechanical transmission of LSDV is well documented (Yeruham *et al*., 1993, 1995; Chihota *et al*., 2001). The arthropod control was a serious concern throughout this episode within the herd. Cypermethrin spray had been performed rigorously in the corrals since the advent but no measures could tackle the continuous cattle- insect -cattle cycle. At once even, Ivermectin administration was considered initially in the plan as a vector control measure and the decision was dropped fearing the consequences it has on the food chain and on the herd. Even when contagious transmission is considered to be inefficient route of transmission (Davies, 1991) however, communal grazing and sharing watering points are considered as a potential risk factor for transmission of LSD in Ethiopia as quoted by Gari *et al*. (2010). However, in an intensively managed herd like the one in state, where segregation of affected/ disease incubating population would be constrained by space limitations there could be a certain level (often negligible) of transmission by sharing the water trough and at the feed bunk. Although this possibility is very rare and hypothetical as Carn and Kitching (1995) proved that no spread of LSDV between cattle housed in contract in the absence of arthropods even when LSDV shed in saliva, respiratory secretions and milk.

As there is no specific antiviral treatment available for LSD infected cattle. Systemic antibiotics were suggested for skin infections, cellulitis or pneumonia (Davies, 1991). In this episode, treatment had been carried out with Penicillins, Non Steroidal Anti Inflammatory Drugs (NSAIDS) and Anti histamines to combat skin lesions, lameness and pneumonia. Clinical management and treatment of the affected cases was carried out in different batches to facilitate the handling, administration of medications and to expect the any untoward signs such as abortions in dry pregnant cows. Until end of this outbreak episode, we had handled all the treatment and recovery batches of cows by as early as 4.30-5.00 am in the morning, as handling at higher environmental temperature could hamper their recovery. Wound dressings were carried out with antiseptic sprays, antibiotic sprays and fly repellant ointments. Intravenous fluid support and nursing care were given to those recovering cows. Regardless of the effort mortality continued. Culling of the affected herd as an interim proposal was forwarded to the management's present and future consideration.

Milk production dropped by 40% and extended up to 65% until end of the episode caused a huge production loss. LSD causes considerable economic losses due to emaciation, damage to hides, infertility in males and females, mastitis, loss of milk production (Irons *et al*., 2005). However, in author's opinion, calculation of loss would never be real except for milk production and herd mortality, but not of the several opportunities that had been lost in the breeding life cycle of a cow in an intensively managed herd like this with multiple thousand population since advent of LSD until six months as the disease has significant impact on herd's health. Even a short epidemic of LSD could have devastating effects on bottom line of a dairy farm as it affects both production and reproduction. The recovering animals/early-lactation dairy cattle could have been greatly benefitted if inclusion of calcium salts of palm fatty acids (Salem and Bouraoui, 2008). Rumen protected Methionine (RPM) (Ghorbani *et al*., 2007) and or a herbal galactgogue (Preciado *et al*., 2011) in to their diets to boost milk yield and minimize the loss. However, these decisions are debatable in terms of economy and adaptability to this particular LSD recovering herd.

The 1989 LSD outbreak in Israel had clearly concluded that the spread of disease was by the biting insect population carried in air currents from Egypt but not by livestock movement as the country imposes strict quarantine regulations. Contrastingly, Egypt has traced back the infected cattle imported from Ethiopia as a source of LSDV to its outbreak in 2006 (Davies, 1991; Yeruham *et al*., 1995; El-Kholy *et al*., 2008). However, source of vector to this catastrophic episode to the herd was inconclusive except to trace back any evidential record of infected livestock movement in to Oman or to monitor unauthorized routes. The present report also appeals to the national authorities to impose further strict import regulations of live cattle and update regulations related with livestock movement.

CONCLUSION

Most importantly, the manuscript warrants conducting epidemiological and entomological studies in detail both at a regional and at national level as LSD reappeared after two decades in the Sultanate of Oman since its first report to OIE in 1984.

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