Clinico-pathological Response of indigenous sheep & goats to a virulent gazelle Peste des petits ruminants virus (PPRV)

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Abstract :

Experimental studies were conducted in an indigenous Saudi sheep and goats using a virulent Peste des Petits Ruminants (PPR) virus isolate, which caused great losses in a number of species of gazelles, in 2002, in Saudi Arabia. Both experimentally infected sheep and goats succumbed to the disease. Although the clinico-pathological response was classical in experimental sheep and goats, still it was not as severe as it was seen in the natural outbreak in gazelles. Some interesting observations were recorded in the experimentally-infected sheep and goats. The possible communication of the disease between wild and domestic small ruminants in the country was discussed.

Key words:
PPR Virus, gazelles, experimental infection, sheep & goats.

Introduction :

PPR is a disease of sheep, goats and other small ruminants. PPR was first described in Côte d,Ivoire in west Africa in 1942 (TAYLOR, 1984). Afterwards, it was recorded in subsaharan Africa, Egypt, Middle East and South East Asia (TAYLOR, 1984).

The causative agent is a Morbillivirus of the family Paramyxoviridae. It is closely related to the rinderpest virus.

Where PPR is endemic, it has always been associated with infection in sheep and goats. Existence of the disease in the wild small ruminants is rather rare (FURELY *et al.*, 1987). On the other hand, the species of the wild ruminants affected by PPR are limited so far (ANON, 2001). The confirmed susceptible wild small ruminants to PPR are Dorcas gazelles, Gemsbok, laristan sheep and the Nubian ibex.

The first record of PPR in Saudi Arabia was made in 1990 (ABU-ELZEIN *et al.*, 1990). In that occasion, it only involved sheep and goats. In 2002, the disease was reported in gazelles kept under semi range conditions (ABU-ELZEIN *et al*., 2004).

A successful experimental PPR infection has been reported (BUNDZA *et al,* 1988). However, experimental infection using wild life isolate (Dorcas islolate) yielded mild symptoms in the inoculated sheep and goats (Furley *et al,* 1989). The aim of this work is to determine the virulence profile of wild life isolate originated from gazelles (ABU-ELZEIN *et al.,* 2004).

Materials And Methods

Experimental animals:

Eight, apparently healthy, animals were used in the experiments. They were four sheep and four goats aged between 8 and 14 months. All animals were from local breeds except one locally bred Dorber sheep.

All these animals were tested for the presence of antibodies against the isolated PPR virus, as an antigen in the agar gel immuno-diffusion test (AGID) as described by the OIE (ANON, 2001), and were found negative.

The virus inoculum:

The inoculum used in the experiment originated from the gazelles, in Saudi Arabia, which were hit by the PPR virus (Gaz/Zn/Sau/02), in March 2002 (ABU-ELZEIN *et al*., 2004).

The inoculum was made into 30% suspension from a pool of homogenized spleen, liver, mesentric lymph nodes and lungs. The inoculum was positive in the AGID against the rinderpest hyperimmune serum.

Following centrifugation at 1500 r.p.m for 10 minutes, the supernatant was collected, antibiotics were added and used immediately in the transmission experiments.

Animal Inoculation:

Three sheep and three goats received 3 ml of the inoculum subcutaneously. Sheep and goats were kept together and were provided with food and water ad lib. They were kept under close daily clinical observation. One sheep and one goat were left as non-inoculated controls in a separate confinement and supplied with food & water ad lib.

Whole blood in ethylene diamine tetraacetic acid (EDTA) was collected during pyrexia; and serum was weekly collected from each animal.

Post-mortem examination :

Sheep and goats at moribund, were sacrificed and post-mortem (PM) examination was performed on them. Samples from the spleen, livers, lungs,

mesenteric lymph nodes, kidneys and from nodular lesion, around the mouth, were collected for pathological examinations.

The inoculatated sheep and goats that didn't show clinical signs, other than pyrexia, until the end of the experiment (20 days p.i.) were also sacrificed and subjected to PM examination.

Virus isolation*:*

Buffy coats from pyretic sheep and goats were used to inoculate vero cells as previously described by ABU-ELZEIN *et al*., (2004).

Virus identification: the AGID test as described by the OIE (ANON 2001), the haemagglutination inhibition (HI) as described by Ezeibe *et al* (2004).

Spleen tissues were also sent to Pirbright Reference laboratory, UK for examination by the PCR and comparison with other members of the genus *Morbillivirus***.** Such spectrum of viruses are only found in the Reference laboratory.

Sero-conversion: Sera from all animals were tested for sero-conversion using the AGID test as described by ABU-ELZEIN *et al.,* (2004).

Results:

Clinical signs in the experimental animals:

Between days 3-7, post inoculation (PI), the three inoculated sheep showed rise in their mean rectal temperatures, which peaked on day 4 PI reaching 41.4^{o} C. On day 9 PI, one sheep developed nasal discharge, lacrimation, profuse diarrhoea, distress and cough.

The mean rectal temperature of the three inoculated goats showed rise of temperature during days 2-8 PI, peaked on day 3 to reach 40.9^{o} C. On day 10 PI, one goat showed profuse diarrhea, which lasted for three days.

None of the inoculated sheep or goats died. They were sacrificed when appropriate.

None of the control animals showed rise in their rectal temperatures, nor any observable ill-effects.

Pathology:

Significant pathological changes were only seen in the ailing sheep. Tiny cutaneous nodules were present on the upper lips of affected sheep (Fig. 1). These nodules were hard in consistency and palpable. The lower lip

was less affected. The inner surface of the upper lips contained a deep single ulcer.

Figure 1.Cutaneous nodules on the upper lips of affected sheep

The lungs contained bilateral pneumonic foci, involving both right and left cardiac lobes (Fig. 2). These foci were dark-red in colour and well consolidated and firm in consistency. Other parts of the lungs were slightly congested.

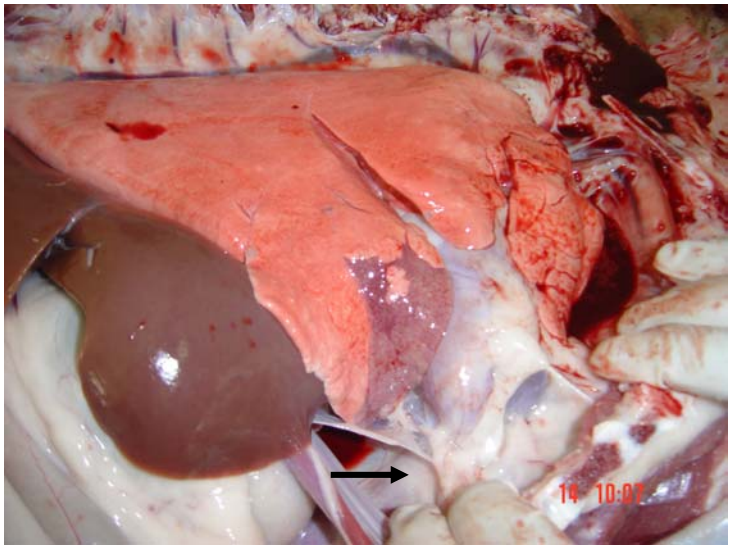

Figure 2 Affected lung showing consolidated cardiac lobe

The mesenteric lymph nodes were considerably enlarged, pale and oedematous (Fig.3). Numerous haemorrhagic spots (ecchymosis) were observed along the mesentery. The mesenteric blood vessels were also congested. Kidneys were pale. The liver was apparently normal.

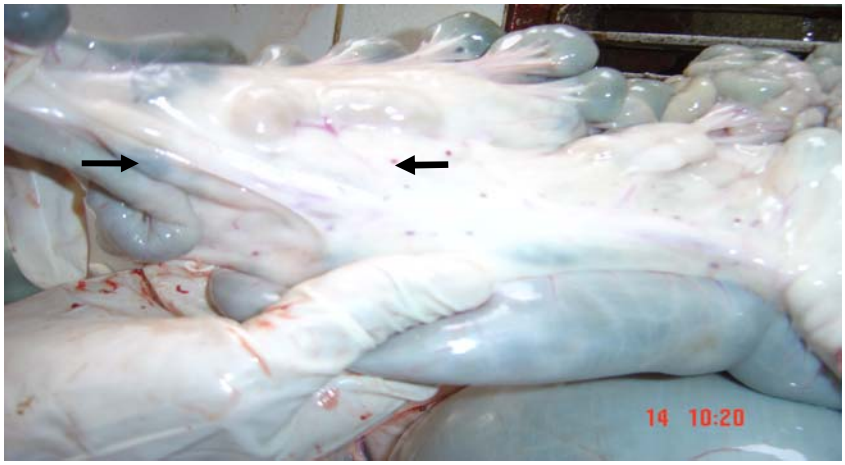

Figure 3 Enlarged mesenteric lymph nodes

The pericardiac sac contained moderate amount of pericardial fluid. Otherwise, no significant changes were detected on the cardiovascular system.The spleens were relatively enlarged and congested. The abomasum was spotted with numerous white raised nodules on the mucosal surface. Similar nodules were also observed on the intestinal mucosa, but rather smaller in size. The mucosa of the colons showed marked hyperaemia and longitudinal haemorrhages.

Virus isolation:

The vero cell culture monolayers which were inoculated with buffy coats, from the goats at fever, started showing cell rounding from day six PI. The observed CPE developed until day 17 when the whole sheet was ripped off. The virus isolate was collected and stored in aliquots at -86^{o}C until used.

Virus Identification:

The PCR results received from the IAH Reference Laboratory Pirbright, UK confirmed that the virus contained in the spleen tissue, was a PPR virus.

Only the spleens and mesenteric lymph nodes, from the ailing two sheep and one goat, gave positive reaction in the AGID test. A discernible precipitation line was produced when each of the spleen or the mesenteric lymph nodes' homogenate was reacted against the rabbit anti-rinderpest hyperimmune serum. These lines merged to form a line of complete identity.

The haemagglutinating activity of the virus isolated in the vero cell culture and that contained in the spleen and mesenteric lymph nodes was inhibited by the anti rinderpest hyperimmune serum.

Sero-conversion: Only the inoculated sheep and goats sero-convered, the control animals didn't.

Discussion

Internationally-published information on PPR, in wildlife, is scarce (FURLEY *et al*., 1987; Anon 1999). Although some wildlife species were reported to succumb to PPR infection, (FURLEY *et al*., 1987; ANON, 2001), still the host range, of the disease is to be fully explored in them. In countries, where PPR is endemic, e.g. in Africa, the Middle East and Asia, close proximity between domestic and wild ruminants cannot be ruled out. Such proximity is expected to aid in communication of PPR between the susceptible species in both sides.

Nevertheless, presence of PPR susceptible species in zoos and as fancy animals in some PPR endemic countries , can always create a fringe spot of the disease.

Published data, denotes that PPR in wildlife, in the Arabian peninsula was mentioned three times. In the first occasion, HAFEZ et al., (1987) suspected PPR infection in gazelles and deer in Saudi Arabia, but virus isolation was unsuccessful. In two other occasions, PPR virus was isolated by Furley *et al* (1987), in the United Arab Emirates and by ABU-ELZEIN *et al.*, (2004) in Saudi Arabia.

The present study, indicated that the wildlife PPR virus isolate, which was isolated by ABU - ELZEIN et al., (2004) gave salient clinical features in the inoculated indigenous sheep and goats. The experimental sheep and goats also sero-converted and the virus antigen was detected in their tissues. Although the natural PPR was severe and lethal to the affected gazelles' species, in the original outbreak (ABU-ELZEIN *et al*., 2004), it was non-lethal to the experimental sheep and goats. This was also found by FURLEY *et al.,* (1987). However, the symptoms elicited by the experimental sheep and goats in the present study were more severe than those reported by

FURLEY *et al.,* (1987). This could be due to the fact that, the inoculum we used, was from tissues of the naturally affected gazelles (ABU-EL ZEIN *et al.*, 2004) and not cell culture propagated virus, as in their case.

In Saudi Arabia, PPR has always been associated with sheep and goats. However, where wildlife ruminants are in close contact, they can contract the disease. This seemed to have happened in the latest outbreak of the disease in the gazelles in KSA (ABU-ELZEIN *et al*., 2004), which coincided with report of the disease in sheep and goats (HOUSAWI *et al.,* 2004).

The authors are of the opinion that, known PPR-susceptible wildlife species, which are kept in zoos or as fancy animals, in Saudi Arabia, should be included in the national PPR vaccination campaigns.

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الاستجابة الإكلينيكية و المرضية لدى الغنم و المعز المحلية للعدوى بفيروس طاعون المجتران الصغيرة المعزول من الغزلان

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تم إجراء دراسة تجريبية في الغنم والمعز المحلية في المملكة باستخدام فيروس طاعون المجتران الصغيرة الذي سبب خسائر كبيرة في العديد من أنواع الغزلان في المملكة. وذلك عام ٢٠٠٢ م.

تم إحداث المرض معمليا في الغنم و المعز.

تم تسجيل بعض الأعراض الاكلينيكيه و المرضية الكلاسيكية للمرض ولكن لم تكن بنفس الصورة الحادة المسجلة في الغزلان.

تم تسجيل بعض الملاحظات الهامة وتم مناقشة إمكانية انتقال المرض بين المجتران البرية و المستأنسة في المملكة