BRIEF NOTE

Evidence on Horizontal Transmission of Bovine Leukemia
Virus due to Blood-sucking Tabanid Flies

Kan-ichi OHSHIMA, Kōsuke OKADA, Shigeru NUMAKUNAI
Yōtarō YONEYAMA*, Shigeru SATO and Kiwao TAKAHASHI

Department of Veterinary Pathology, School of Veterinary Medicine,
and *Teaching and Experimental Farm, Faculty of Agriculture,
Iwate University, Morioka-shi, Iwate 020

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Enzootic bovine leukemia has been gradually increasing in occurrence in Iwate Prefecture [11], as well as in several districts of Japan, during the past decade. It is accepted that the disease is associated with bovine leukemia virus (BLV). Vertical, as well as horizontal, transmission of BLV is suspected deeply from partial experimental results [1, 7, 16, 17].

It appears empirically that the area of occurrence of the disease correspond to the habitat of tabanid flies in Iwate Prefecture. It was reported that many animals were turned to be positive for antibodies against BLV after the grazing season of summer in herds where no specific countermeasures had been conducted [1, 3, 14]. BLV would not be endogenous [2, 4]. Only $2.5 \times 10^8$ lymphocytes, equivalent to $5 \times 10^{-4} \text{ml}$ of blood, may transmit the virus to a new host [6], even though the virus release is inhibited by the presence of antibodies in the circulating blood. Mechanical transmission of such organisms as trypanosomes will be completed, if a fly sucks the blood of an infected host which drives it away while it is sucking, and if it bites a new host while its proboscis is still wet [5].

In order to determine whether the tabanid fly was one of the mechanical transmitters of BLV or not, an experiment was performed. A 7-year-old cow infected with BLV was used as a blood offering host. She was positive for serum antibody against BLV membranous glycoprotein (gp)-antigen [12], and for persistent lymphocytosis. BLV particles were demonstrated in a short-term lymphocyte culture by electron microscopy [8]. Autopsy was performed on this cow about 2 weeks after the beginning of this experiment. It revealed initial lesions [9, 10] in lymph and hemolymph nodes macroscopically and histologically.

Four lambs were used as experimental animals, because C-type viruses originated from ovine and bovine lymphosarcoma are identical and BLV infection produces lymphosarcoma readily in sheep [13, 15]. Of them, three served for transmission, and the other one as a control. They were male or female 4 or 5 months old and negative for antibodies against BLV. Their body wool was shaved on the day before the beginning of experiment.

The cow and lambs were kept together in a mosquito-net at a corner of the pasture
which was a pathway of tabanid flies in the daytime for 4 days from the 10th through 13th July, 1979. About 2 kg of solid carbon dioxide was set in the net every morning. The population of tabanid flies used in this experiment was composed of Tabanus nipponicus (more than 90%) and T. trigeminus, T. chrysurinus and Chrysops vanderwulpi.

The flies were enticed into the net by CO₂ sublimated from the solid carbon dioxide, came to the skin of the cow, and began to suck her blood. The authors took hold of them by their fingers about ten seconds later they started to suck the blood from the cow. The flies were immediately put on the denuded skin of the lambs in a plastic cup transparent and fenestrated. Most of them placed on the skin began to suck blood from the lambs soon or later. They did not leave to take off even when the cup was removed before they were satisfied with blood sucking. This procedure was repeated 131–140 times on each experimental lamb during 4 days. Observation was made on the lambs in an isolated barn for more than 8 months since that time. No clinical and hematologic abnormalities were observed in two experimental and a control lambs. The other female lamb died of parasitic infection on the 40th day post biting trial with tabanid flies.

Antibodies against BLV were checked at intervals of about 2 weeks. It was proved by the immunodiffusion test (ID) with gp-antigen [12] that the sera of 2 experimental male lambs became positive for them on the 38th day post biting trial. Examination on twofold serial dilutions of serum disclosed a gradual increase in titer from 1:16 at the beginning to 1:128 or 1:256 four months later in both animals (Table 1). A serum sample was collected from the third lamb just before its death, or on the 40th day post biting trial. It was positive for ID with 1:8 dilution. The control male lamb remained negative for antibodies against BLV throughout an observation period of 8 months.

From the present experiment, it was evident that tabanid flies played a role in the transmission of BLV from one animal to another. In the natural field condition, a fly begins to suck blood from an infected host. If the host drives the fly away due to biting irritation, and if the appetite of the fly is not yet satisfied, the fly will suck blood from another animal while its proboscis is still wet with blood containing BLV-infected lymphocytes. During the summer season an uninfected host may be exposed hundreds of times to biting by tabanid flies in this manner. It is desirable for BLV-positive cattle to be discarded from the herd in order to prevent susceptible cattle from contracting infection.

References

BLV TRANSMISSION DUE TO TABANID FLIES


要約

野外における吸血アブによるウシ白血病ウイルスの水平伝播について（短報）：大島寛一・岡田幸助・沼宮内茂・米山隆太郎*・佐藤繁・高橋善秀（岩手大学農学部家畜医学科家畜病理学教室、*付属農場）

実験には4-5カ月齢の子ヒツジ3頭と対照の1頭を用いた。BLV感染ウシを吸血途中のアブ（90％以上がTabanus sp.）を有孔透明プラスチックカップを用いて、子ヒツジの皮膚に置き、吸血を続けさせた。この操作を4日間に131-140回／頭行なった。1頭は寄生虫感染で死亡したが、吸血後40日目の血清BLV gp抗体は1:8と陽性を示した。他の2頭は吸血後38日目以来抗体が検出され、はじめ1:16の力価が4-5カ月後には1:128あるいは1:256と上昇した。対照では抗体は認められていない。以上の結果から、感染したウシから吸血途中で追われたアブが、別の宿主から吸血を継続する場合、BLVを伝播する可能性のあることが確かめられた。