Bovine Tuberculosis of Korean Native Cattle in an Abattoir

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Received September 24, 2009 / Accepted November 26, 2009

Bovine tuberculosis is generally detected postmortem because it is a chronic debilitating disease. Since tuberculosis is mainly found in the lungs, clinical signs including coughing, nasal discharge, and difficulty breathing can occur in severe instances. In the present study, specimens were collected from the heart, liver, kidney, lung, pleural cavities, lymph nodes and intestines of carcasses found in an abattoir. According to post-mortem examination and inspection of carcasses, tuberculosis lesions were varied in appearance and size. Tubercles of a white cream color were disseminated throughout the pleural cavity including the lymph nodes, lungs and mesentery containing pus. Gram and Ziehl-Neelsen’s acid-fast staining for the lung and lymph nodes revealed a highly positive histochemical reaction. The acid-fast organisms were observed histologically in the lesions under a microscope. This report demonstrated the histopathology of bovine tuberculosis based on the histological Findings of Mycobacterium bovis, which is a suspected causative agent.

Key words : Abattoir, bovine tuberculosis, Ziehl-Neelsen’s acid fast staining, granuloma, Korean native cattle, M. bovis

Introduction

Mycobacterium bovis (M. bovis) and M. tuberculosis, two of the most important agents of bovine tuberculosis among many different types of Mycobacterium, are the only ones which can be spread between humans and animals [19]. The disease primarily affects respiratory tract, but it can also be spread to other parts of the body. Tuberculosis (TB) is a chronic, progressive disease that can cause gradual debilitation and is manifested mainly by emaciation, depression, and intolerance to exercise. Several mammalian species are known to be susceptible to M. bovis, such as hoofed mammals, marsupials, carnivores, primates, pinnipeds, lagomorphs, rodents, and other species [15,18]. Some avian species including parrot-like birds and rock doves are also susceptible to M. bovis infection. Human are also susceptible to M. bovis [12]. Throughout the world, the most commonly recognized host for M. bovis is domesticated cattle [2]. Various factors affect the efficiency in which M. bovis is spread within cattle [8]. The lesion that is most commonly associated with bovine TB involves the presence of a granuloma, which is a nodular inflammatory lesion containing numerous phagocytes within suspect tissue [21]. Post-mortem findings have shown that tubercular granulomas were present in the lymph nodes, head, lung, and intestine of the carcass. The carcasses of animals affected with TB were condemned [10]. A diagnostic test is performed on cattle via an intra-dermal injection of purified bovine protein derivative (PPD) tuberculin [7]. The status of infection with TB was judged based upon the results obtained from caudal fold tuberculin. The possible presence of bovine TB is determined by comparing the responses of the two injection sites 72 hours (plus or minus 6 hrs) after injection [9]. As bovine TB may be found even without the presence of tubercles, which should be investigated whether there are other diseases capable of causing the lesions which are difficult to distinguish from tubercles [13]. Therefore, gross lesions compatible with bovine TB is not conclusive evidence. Histochemical analysis, polymerase chain reaction (PCR) and tissue culture are necessary for the rapid and accurate diagnosis. In this study, histological and histochemical analyses for bovine TB were demonstrated in various organ/ tissue of abattoir cases, suggesting bovine TB is caused by M. bovis infection that is the important zoonotic threat with highly infectious in human by causing similar diseases to that by M. tuberculosis.

Materials and Methods

Case history

Between December 2006 and February 2007, TB lesions
were found in two cases during a slaughter inspection in a Yeongcheon abattoir of Gyeongbuk province. Tubercular granulomas were found in the lymph nodes of lungs, intestines and nodules as white to yellowish spot on the pleura and peritoneum.

**Histopathology**

Heart, liver, kidneys, lungs, lymph nodes and intestines were collected for histopathology and the carcasses were condemned. Multiple tissue samples were fixed in a 10% phosphate-buffered formalin and then routine H-E staining was done. Moreover, gram and Ziehl-Neelsen’s acid-fast staining was performed in order to detect causative agents.

**Results**

**Gross findings**

During a post mortem inspection in carcasses, TB lesions was revealed as white cream color and tubercles were disseminated in the pleural cavity including lymph nodes, lungs and mesentery (Fig. 1A, 1B, 1C). The lymph nodes were replaced by tubercular granuloma (Fig. 1D, 1E) characterizing multinodular and white to pinkish colored lesion with 1-10mm in diameter and homogenous whitish lesions on the cut section (Fig. 1F, 1G). Some masses filled with a large amount of cheese-like pus were found in the lymph nodes and lungs (Fig. 1H).

**Histology and Histochemistry**

The most common lesion had tubercular granuloma, which is nodular inflammatory lesion composed of numerous phagocytes. Dystrophic calcification was found in the multiple lesions of lungs and lymph nodes (Fig. 2A). The foci of caseous necrosis were surrounded by granulomatous inflammatory cells such as multinucleated giant cells (Langhans’ type), epithelioid cells and lymphocytes (Fig. 2B). The affected lymph nodes showed that normal architecture was deranged by caseous necrosis and disruption of

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Fig. 1.  

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Fig. 2
parenchymal cells. Other organs including liver, kidneys and heart revealed also mild inflammation (Fig. 2C, 2D, 2E). Ziehl-Neelsen’s staining revealed acid-fast bacilli trapped in the necrotic central lesion, accompanying diffused calcification and infiltration of Langhans’ type giant cells (Fig. 2F, 2G, 2H).

Discussion

Bovine TB is a significant infectious disease of cattle and other species in many countries and still one of the most important zoonotic diseases in developed countries although modern pasteurization of dairy products and widespread eradication programs have been practiced. Moreover it poses a significant risk to domestic livestock, wildlife, companion animals and humans in many countries throughout the world [3,11]. It is estimated that more than 50 million cattle are infected with M. bovis worldwide, thus resulting in severe economic losses [20]. Bovine TB in cattle was first reported in Korea in 1940 and eradication program was employed. Mycobacterium spp. has been shown to be highly resistant to chemical disinfectants [22]. In vivo, once ingested by cells of the macrophage series, M. bovis may replicate itself in these cells [4]. Accumulation of live and dead macrophages, bacteria, and tissue cells in a focal area is called a tubercle [16]. Following acid-fast staining, M. bovis appeared as short and red or pink rods. Based on the examination of gross lesions and the result of acid-fast staining, tuberculoïd granulomas in collected tissues were compatible with TB caused by M. bovis. Current diagnosis of TB in cattle relies on tuberculosis skin testing, and detection of a delayed-type hypersensitivity reaction to intradermal inoculation of tuberculin [17]. Increased thickness of skin was mostly due to inflammatory edema containing meshwork of fibrin deposits around the collagen bundles in reticular dermis [5].

An accurate and reliable diagnosis of M. tuberculosis complex is important. New diagnostic methods including molecular techniques and chemical sensors such as an electronic nose should be applied in order to identify Mycobacterium spp [7,14]. Surveillance of bovine TB in cattle is an essential component for disease control program in developed countries. Presence of M. bovis in bovine carcasses with lesions like our cases suggests that humans may be exposed to these organisms as a result of contact and ingestion [1]. Therefore, surveillance programs must include ante-mortem testing, and the slaughter surveillance of both livestock and other captive animal species.

Acknowledgement

This work was supported by grant (A081039) from Health & Medical Technology R&D program, Health & Korea Health Industry Development Institute in Republic of Korea.

References

초록 : 도축장 내의 한우에서 발견된 소 결핵 보고

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소 결핵은 반성적으로 서서히 진행되어 죽어가는 지기 때문에 일반적으로 사후 검시 후에 확인 된다. 소결핵의 감염이 대부분 측에서 발생하기 때문에 심한 경우에는 기침, 흉부 및 호흡곤란을 유발 한다. 본고에서는 도축장에서 나온 사체의 심장, 간, 신장, 폐, 심부, 염화곡 및 대장에서 얻은 사료를 분석한 것이다. 사체의 부검 검시 도중 다양한 모양과 크기의 결핵 병변이 관찰 되었다. 펜어 드림 계획의 결핵은 황동성으로 염화곡, 폐 및 간질의 만음과 함께, Ziehl-Neelsen의 acid-fast 염색 결과 강한 조직학적 양상을 나타내었다. Acid-fast에 염색된 유기체들이 현미경 검사에서 발견 되었다. 본고에서는 의심 원인체로 사료되는 Mycobacterium bovis의 조직학적 발견을 근거로 이에 의한 소결핵의 조직병리학적 소견을 보고하는 바이다.