Analysis of Bovine Herpes Virus-Type 1 Isolates by Restriction Endonuclease Fingerprinting

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With 6 Figures

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Summary

In an effort to determine whether distinct types of bovine herpesvirus 1 are responsible for causing specific syndromes, the polypeptides and DNA of 93 BHV1 isolates from the province of Alberta as well as vaccine strains and numerous other Canadian, U.S. and European isolates were analyzed by PAGE and restriction endonuclease fingerprinting, respectively. The polypeptide patterns showed only slight variations: only six isolates contained polypeptides that varied from the norm in their molecular weight, or were absent. Although on the basis of endonuclease patterns the isolates could be categorized into three “strain”s and nine “sub-strains”, we were unable to associate any of the strains with specific clinical signs. This suggests that the type of disease caused may be determined more by the route of infection and animal management practices than by the inherent properties of certain types of BHV1. Most of the Albertan isolates were of one BHV1 type and sub-type.

Introduction

Bovine herpesvirus type-1 (BHV1), which is also known as infectious bovine rhinotracheitis (IBR) virus or infectious pustular vulvovaginitis (IPV) virus, is a typical herpesvirus (22). It is similar in structure to other herpesviruses, possesses a double stranded DNA genome about $100 \times 10^6$ in molecular weight (9), and temporally controls the expression of its genes in a manner similar to that of other herpesviruses (25). Also like other herpesviruses the virus can become latent in animals, probably in the trigeminal ganglion, and can be reactivated with ease (13, 25).
BHV1 is an economically important pathogen of cattle. It is associated with a wide variety of syndromes which, in addition to the more common infections of the upper respiratory and genital tracts (18, 29), also include encephalitis (3), enteritis (11, 30), abortion (5), conjunctivitis (1) and mastitis (12). Although the viruses isolated from these disorders are immunologically similar, it has been suggested that at least some of these syndromes, in particular the respiratory and genital infections, may be caused by different strains or types of the virus (10) much in the manner that herpes simplex types (HSV1 and HSV2) cause lesions on the upper and lower portions of the human body respectively (7). This suggestion is supported by the observation that respiratory infections involving BHV1 are rarely found in conjunction with genital infections caused by the virus (23). Thus, respiratory infections are prevalent in feedlots of the western United States and Canada whereas, until recently, genital infections were predominant in Europe (14, 23).

Restriction endonuclease analysis has been used to successfully differentiate HSV1 from HSV2 as well as epidemiologically distinct strains of each HSV type (4, 21), human cytomegalovirus (15) and Epstein-Barr virus (6). This technique has also been used to differentiate between strains of murine cytomegalovirus that differ in virulence (24).

In an effort to determine whether different forms of the virus are responsible for the various BHV1-associated syndromes we have analyzed almost 100 isolates collected from cases of upper respiratory tract infection, pneumonia, abortion, enteritis, rumen ulceration, paralysis and conjunctivitis that occurred in the province of Alberta over a period of five years. This report describes the DNA analysis of these isolates as well as those from a number of IBR vaccines and respiratory and genital isolates from other regions in Canada, the United States, Britain and Europe.

**Materials and Methods**

**BHV1 Isolates**

Isolates #1 to #122 were received in April 1976 from Dr. J. Pantekoek, Provincial Veterinary Laboratory, Alberta Agriculture, Edmonton. They were collected from various locations throughout Alberta during the years 1970 to 1976. Enough virus was grown from 93 of these isolates to provide material for endonuclease studies. Sixty-six of the strains were identified according to their location. Clinical histories were available for 64 of the isolates: these histories showed that 32 isolates were from cases of respiratory disease (pneumonia, rhinitis, tracheitis), 14 isolates were from cases of abortion, 5 isolates were from cases where only conjunctivitis was noted and 13 isolates were from animals dying for other reasons (scours, bloat, sudden death, paralysis). Three of the isolates were collected in 1970, 20 in 1971, 24 in 1972, 20 in 1973, 11 in 1974, 7 in 1975 and 3 in 1976. Isolate #123, BHV1 strain #108 (16), was also propagated for study of its nucleic acid because it has been used for many investigations at Lethbridge and Saskatoon. It is highly pathogenic for calves and is able to produce high titer stocks of virus when grown in cultures of bovine foetal kidney (BFK) cells. This strain was received from Dr. G. Klavano of the Provincial Veterinary Laboratory, Edmonton, and was derived from the placenta of a calf that was aborted.

Other BHV1 isolates, #124 to #127, were obtained from Dr. G Dulac of the Animal Diseases Research Institute, Nepean, Ontario. All were from aborted foetuses. Three of these isolates were from Ontario, the other from Quebec. The DNA of Scottish strains of BHV1 (isolates #128 to #135) was obtained from Dr. Allan Herring,