JC virus genotypes in a Taiwan aboriginal tribe (Bunun): implications for its population history*

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Summary. The origin of Taiwanese aborigines remains obscure; it has been speculated that they may be from either mainland China or southeastern Asia. We used the JCV genotyping method to elucidate the origin of Bunun aborigines who now live in central mountain areas of Taiwan. We found that Bunun aborigines carried two major (B1-a2 and CY) and two minor JCV genotypes (B1-a1 and SC). This was contrasted with the JCV genotype profile in modern Taiwanese: one major (SC) and two minor genotypes (CY and B1-a1). It thus appears that B1-a2 and CY are indigenous to the Bunun tribe. B1-a2 was first identified in this study as a discrete cluster that contained only Bunun and Philippine JCV isolates and that was closely related to B1-a1, one of the three common JCV genotypes in China. CY predominates in North China, while SC predominates in South China and southeastern Asia. The present findings suggest that the Bunun tribe is an admixture of two ethnic groups, one carrying B1-a2 and the other carrying CY. In other words, it is likely that the Bunun tribe was established by two waves of immigrations from mainland Asia, predating those by southern Chinese which began in the 17th century.

Introduction

JC polyomavirus (JCV) is the causative agent of a fatal demyelinating disease known as progressive multifocal leukoencephalopathy [23]. This virus is ubiquitous among humans, however, infecting children asymptomatically and then...
persisting in renal tissue [9, 19, 24, 25, 30]. Most adults excrete JCV DNA into
the urine [1, 6, 17], from which it can readily be isolated by the polymerase chain
reaction (PCR) method [11, 34]. The main mode of transmission of JCV is from
parents to children through cohabitation [14, 20].

A new method using urinary JCV DNA has been developed to trace human
migrations [28]. This method is based on the fact that each distinct JCV genotype
has a unique domain in the Old World [28]. If a group of individuals from a
previously unstudied area are found to be infected with a particular known JCV
genotype, they are presumed to be descendants of migrants from the domain of
that genotype. Conversely, if a certain number of individuals in a region show a
previously unknown JCV genotype distinctly different from prevalent genotypes
of that area, they are thought to be descendants of migrants whose origin must be
re-evaluated. Indeed, Agostini et al. [2] detected Asian genotypes of JCV from
Native Americans and a Pacific Island population, which is consistent with the
Asian origin of these native populations. This analysis may be applied to any hu-
man population, since JCV is prevalent in essentially all human populations [25].

A majority of modern Taiwanese are descendants of immigrants who began
arriving in the 17th century. The indigenous people who had lived on the island
soon became a minor population, and now live in mountain areas and along the
eastern coast. The Taiwanese aboriginal people are classified into nine tribes:
Atayal, Saisiat, Bunun, Tsou, Paiwan, Rukai, Ami, Puyuma and Yami. Their
origins remain obscure; it has been speculated that they may have been derived
from either mainland China or southeastern Asia ([22; references cited therein].
In this study, we used the JCV genotyping method [28] to elucidate the origin of
the Bunun aboriginal tribe.

The total population of the Bunun tribe is about 30,000. Bunun aborigines
live in central mountain areas around the Nantou, Hualan, Taitung, Koasiung and
Pintiung counties. Urine samples were collected from Bunun individuals when
the medical service team of Chung Shan Medical and Dental College visited
their villages (see below) in Nantou county to provide physical examinations and
medication.

**Materials and methods**

*Urine collection*

Urine samples were collected in the summer of 1997 from Bunun aborigines living in Southern
Lake Village (originally named Isiyan) and Double Dragon Village (originally named Isiloa)
in the Nantou county located at the central mountain area of Taiwan Island. All urine samples
were kept on ice for two days during collection and were then frozen until analyzed.

*Extraction of DNA from urine*

DNA was extracted from urine essentially as described [8].

*PCR*

The DNA extracted from the urine was used to amplify JCV DNA. Primers JBR1 and JBR2
[32] were used for amplifying the regulatory region (RR region), while primers P1 and P2