Lack of evidence for the transmission of JC polyomavirus
between human populations*

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Summary. Human polyomavirus JC virus (JCV), the causative agent of
progressive multifocal leukoencephalopathy, is ubiquitous in humans, infecting
children asymptotically then persisting in renal tissue. Since JCV DNA can
readily be detected from urine, it should be a useful tool with which to study
the mode of virus transmission in humans. Based on this notion, we examined the
extent to which JCV was transmitted from the American to Japanese
populations in Okinawa Island, Japan. (A population of about 50,000 American
soldiers and families have been stationed in Okinawa since 1945.) Four JCV
types (A to D) were identified in American populations in U.S.A., whereas only
type B was prevalent in elder Japanese in Okinawa who had reached adulthood
by 1945. Thus, types A, C, and D served as indicators of the transmission of
JCV from American to Japanese populations. We then examined whether types
A, C, and D were detectable in Japanese in Okinawa aged 30–50 years who
may have been in contact with Americans during childhood. However, all the
125 isolates from the younger Japanese population were type B without
exception. From this finding, we concluded that JCV is rarely transmitted
between human populations.

Introduction

Human polyomavirus JC (JCV) was first identified as the causative agent of
a fatal demyelinating disease in the central nervous system, known as progres-

* DNA sequence data reported here have been deposited in the GSDB, DDBJ, EMBL,
and NCBI nucleotide sequence databases under numbers D84153 through D84172.
sive multifocal leukoencephalopathy (PML) [19]. This virus, however, is ubiquitous in humans, infecting children asymptptomatically then persisting in renal tissues [4, 18, 22]. In most adults, renal JCV is not latent but replicates to generate progeny in the urine [11, 12]. A means of using this urinary JCV was developed to elucidate routes of JCV transmission in humans [12, 13].

We recently showed that parent-to-child transmission is relatively common in the spread of JCV in humans [13]. This finding suggested that the transmission of JCV occurs through close contact of children with adults shedding JCV [13]. To further elucidate the mode of JCV transmission, we investigated how frequently JCV is transmitted from the American to Japanese populations in Okinawa Island in which they have coexisted since 1945. The American population in Okinawa (soldiers and their families) now account for about 50,000, while the Japanese populating in Okinawa is about 1,200,000. Americans and Japanese live in different areas of Okinawa, but the two populations occasionally intermingle with each other. For example, about 20,000 Japanese workers daily enter American military zones, and American soldiers frequently visit Japanese towns to refresh themselves.

We collected a number of urine specimens from younger Japanese in Okinawa aged 30 to 50 years and screened them for the presence of American JCV types. These Japanese may have come in contact with JCVs shed by Americans during their childhood when they were susceptible to JCV infection. We considered that the incidence of American JCVs in the Japanese population will help determine the extent to which JCV is transmitted between neighboring human populations.

**Materials and methods**

**Urine donors**

Urine specimens were collected from 337 younger Japanese (aged 30–50 years) and 188 elderly Japanese (over 70 years) in the following regions of Okinawa Island; Nago, Okinawa, Kita-nakagusuku, Nakagusuku, Nishihara, Urazoe, Naha, Haebaru, and Tomigusuku. Since the elderly Japanese had reached adulthood by the end of the Pacific War (1945), they had rarely been in contact with Americans in childhood. On the other hand, the younger Japanese were born between 1945 and 1965 and therefore should have had opportunities to come in contact with Americans during childhood. All urine donors were healthy volunteers or patients attending urology clinics, and none of them were receiving immunosuppressive therapy. Urine specimens were collected from 41 AIDS patients who were admitted to North Shore University Hospital, New York, to elucidate the JCV subtypes prevalent in the U.S.A.

**Polymerase chain reaction (PCR)**

From DNAs extracted from urine specimens [11], a 610 base-pair region, designated here as IG, that encompasses the 3′-terminal sequences of both the T-antigen and VP1 genes [3], was amplified by means of PCR using primers P-1 and P-2 as described [13].