Distinctive Change in Male Liver Cancer Incidence Rate between the 1970s and 1990s in Japan: Comparison with Japanese-Americans and US Whites

Hideo Tanaka¹, Fumi Uera², Hideaki Tsukuma¹, Akiko Ioka¹ and Akira Oshima¹

¹Department of Cancer Control and Statistics, Osaka Medical Center for Cancer and Cardiovascular Diseases, Osaka and ²Department of Internal Medicine, Toyonaka Municipal Hospital, Osaka, Japan

Received August 23, 2006; accepted October 12, 2006; published online March 1, 2007

Objective: To characterize the time trend of the male liver cancer incidence rate in Japan.

Methods: We obtained data on male liver cancer incidence rates from the ‘Cancer Incidence in Five Continents (CI5) Series’. Data from the population-based cancer registries of Miyagi, Osaka, Nagasaki, Hiroshima, Saga and Yamagata between 1962 and 1997 were combined and used as the data for the Japanese. To characterize the time trend in rate, we chose and combined the data on Japanese-Americans from the cancer registries of Hawaii and Los Angeles County, California between 1968 and 1997. Data on US whites who participated in the Surveillance, Epidemiology, and End Results program in 1973–1997 were obtained from the Data Series. The age-standardized incidence rate (ASR) and birth-cohort-specific rate were calculated in the three groups using a computer program in ‘CI5 Vols I–VIII’.

Results: Among Japanese males in Japan, the ASR increased sharply starting in the mid 1970s and leveled off in the mid 1990s. In contrast, among both the Japanese-Americans and US whites, the ASR continued to increase throughout the observation period. Among the US whites, an increasing trend was more apparent during 1983–97 than during 1973–87. The trend by birth cohort among Japanese males in Japan clearly showed that there was a peak incidence among men aged 45–59 years. They had been born between 1931 and 1935.

Conclusions: The present calculations clarified the distinctive time trend of liver cancer between the 1970s and 1990s in Japanese males. A possible explanation for the observed trend is discussed.

Key words: liver cancer – Japanese – incidence – population-based cancer registry – emigrant

INTRODUCTION

Over the last 30 years, liver cancer has been the third leading cause of cancer death among Japanese males (23,421 deaths in 2004) (1). Ninety-five per cent of liver cancer cases consist of hepatocellular carcinoma (2), which is mainly caused by chronic hepatitis C virus (HCV) infection rather than chronic hepatitis B virus (HBV) infection in Japan (3). Liver cancer is more common in males than in females (4) although the prevalence of HCV infection between males and females is similar in Japan (5). The geographic difference in liver cancer incidence is positively correlated with the geographic pattern of the prevalence of HCV infection among the general population of Japan (6). By molecular clock analysis of the sequences of HCV isolates, it has been hypothesized that a major spread of HCV infection in Japan occurred in the 1940s and 1960s, while in the USA it occurred in the late 1960s and 1970s (7). This might yield different trends of liver cancer incidence rates between the two countries.

Comparison of liver cancer incidence trends among Japanese in Japan, Japanese-Americans, and another population in the USA may provide interesting results from an epidemiological and public health perspective. Thus, we studied the trends in male liver cancer incidence rates in the three groups using data from population-based cancer registries.

METHODS

We obtained data on the incidence rate of male liver cancer from the CD-ROM of the ‘Cancer Incidence in Five Continents’ series.
Continents (CI5) Vols I–VIII’ (8), which is supported by the International Agency of Research on Cancer (Lyon, France). This is a computer program that provides access to data in the CI5 Series. The data in CI5 including the incidence data of cancer together with the corresponding population data, had been submitted from population-based cancer registries worldwide, which had standard data quality (9). We used the data of the cancer registries of Miyagi, Osaka, Nagasaki, Hiroshima, Saga and Yamagata between 1962 and 1997 when these data were available as the data of Japanese in Japan. The data on Japanese-Americans were obtained from the cancer registries of Hawaii and Los Angeles County, California between 1968 and 1997, because these were the only two registries with Japanese immigrants in which consecutive data were available in the CI5 Series. The third group was white Americans who participated in the Surveillance, Epidemiology, and End Results (SEER) program between 1973 and 1997.

The data were selected from the CD-ROM and the subgroups within the three groups were combined to calculate the incidence of liver cancer in each group. Trends in age-standardized incidence rates (ASRs) of male liver cancer for five calendar years (world population as the standard population), and trends in 5-year birth-cohort-specific rates were calculated in the three groups. Classification of liver cancer titled malignant neoplasm of liver and intrahepatic bile ducts in the CI5 in 1963–67 (Vol. II), 1968–77 (Vols III–IV), 1978–92 (Vols V–VII) and 1993–97 (Vol. VIII) was coded to the International Classification of Diseases (ICD) 7th (155.0), 8th (155), 9th (155) and 10th (C22) Revision, respectively. All of the calculations were performed by a computer program in the ‘CI5 Vols I–VIII’ (8).

RESULTS

Figure 1 shows the time trends of the age-standardized incidence rate of liver cancer among the Japanese males, Japanese-American (US Japanese) males and US white males. Among Japanese males in Japan, the ASR increased slowly from 34.2 to 36.7 per 10^5 between 1963 and 1977. From the mid 1970s, the incidence rate rose sharply until the early 1990s to 85.9 per 10^5 and then it leveled off in the mid 1990s. Among Japanese-Americans, the ASR increased slowly throughout the observation period from 10.3 to 14.2 per 10^5. Among US whites, there was an increasing trend in the ASR during the observation period. The trend was more apparent during 1983–97 (5.3–8.6 per 10^5) than during 1973–87 (4.6–5.3).

The time trends of the age-specific incidence rate of liver cancer by birth cohort are shown in Figs 2–4. The horizontal axis shows years of birth. Among the Japanese in Japan, the incidence rate seemed to be constant between the ages of 35 and 44 years in the birth cohort between 1921 and 1960 (Fig. 2). The incidence rates at ages 45–59 were highest in the birth cohort between 1931 and 1935. Among Japanese-Americans, the incidence rates seemed to be highest in birth cohorts around 1901–1905 and 1926–1930, although they were fluctuating because of the small number of the incidence in this population (Fig. 3). Among US whites, all of the age-specific incidence rates (35–84 years) among those born from 1891 to 1960 increased as the birth cohort descended (Fig. 4).
DISCUSSIONS

Our study demonstrated that the ASR of liver cancer among Japanese males in Japan has changed remarkably between the 1970s and 1990s. It increased sharply starting in the mid 1970s and it had more than doubled by the early 1990s, but then it leveled off in the mid 1990s. The time trends by birth cohort clearly showed that the rate was the highest among people born between 1931 and 1935 and with ages of 45 years and over. A similar birth cohort effect on liver cancer mortality in Japanese male has been reported (10). How did this effect appear? The prevalence of HCV infection among Japanese males in Japan was thought to be highest among the generation born around 1931–1935 based on data on first-time blood donor candidates (11), although data on older Japanese individuals are not available (5, 12). This assumption is supported by the recent study on molecular tracing of the HCV epidemic in Japan that reported that exponential spread of HCV-1b infection started in the 1940s (7), which coincided with an outbreak of parenteral amphetamine use in the devastated society after the Second World War (11, 13). The spread was considered to be amplified through blood transfusions and parenteral medical procedures in the 1950s and 1960s (11, 13), but it subsequently ended by the early 1990s at the latest, as evidenced by the very low incidence of HCV infection among repeat blood donors (14, 15). It is realistic to consider that Japanese males born between 1931 and 1935, who were adolescents in the early 1950s, were the most susceptible to HCV transmission from these circumstances.

As for Japanese-Americans, the first group of Japanese emigrated to the USA before 1924, when immigration of Japanese into the USA was prohibited by the ‘Quota Immigration Amendment Act’. Therefore, the next generations of Japanese-Americans were free from HCV epidemics within Japan that yielded different trends of rates between Japanese in Japan and Japanese-Americans. The ASR of liver cancer among US whites has increased since the mid 1980s, although the rates are the lowest among the three groups. This finding may also be attributed to the previous finding that the spread of HCV-1a, a dominant genotype in the USA (16), began in 1965 based on molecular tracing of the HCV epidemic in the USA (7). This is approximately 25 years after the HCV outbreak started in Japan (7).

In conclusion, the present calculation of liver cancer incidence rates shows a distinctive time trend between the 1970s and 1990s in Japanese males. The trend was affected by the birth cohort effect which was possibly attributed to HCV outbreaks in Japan. If this trend is maintained, the male Japanese liver cancer incidence rate is likely to further decline in the current decade.

Acknowledgement

This study was financially supported in part by a Grant-in-Aid for Cancer Research, The Japanese Ministry of Health, Labor and Welfare (Grant number 14–2).

Conflict of interest statement

None declared.

References


Figure 3. Age-specific incidence rates of liver cancer according to year of birth from 1891 to 1960 in Japanese-American males (US Japanese).

Figure 4. Age-specific incidence rates of liver cancer according to year of birth from 1891 to 1960 in US white males.