

Regional difference in cancer detection rate in prostate cancer screening by a local municipality in Japan

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Purpose: We conducted the present retrospective study to elucidate regional differences in the quality of secondary screening in the prostate cancer (PCA) screening program by a local municipality in Japan.

Methods: Of 115,881 men who attended the PCA screening in 36 municipalities between 2001 and 2011, a total of 6,099 men consulted hospitals for secondary screening. The cancer detection rate (CDR) at the secondary screening was calculated, and municipalities were classified into three CDR groups according to the age-adjusted observed-to-expected ratios of CDR. Of the secondary screening facilities, hospitals in Ibaraki Prefecture screening less than 100 patients were classified as group I facilities and the others as group II facilities.

Results: Overall, 2,320 of 6,099 secondary screening patients underwent prostate biopsy, and 1,073 men were diagnosed with PCA. The overall CDR at the secondary screening was 17.6%, but it varied from 5.6% to 34.4% among municipalities. Although there were no significant differences in age and prostate-specific antigen (PSA) distribution among the three CDR groups, a significantly higher rate of patients in low CDR municipalities visited group I facilities. Both biopsy rates and CDRs of secondary screening at group II facilities were significantly higher than those of group I facilities ($P=0.0001$). Multivariate analysis showed that the secondary screening at group II facilities as well as age and PSA levels were independent contributing factors for PCA detection.

Conclusions: CDRs at secondary screening varied widely among municipalities in Ibaraki Prefecture. Variation in CDRs was associated with biopsy rates.

Keywords: Prostate neoplasms, Prostate-specific antigen, Early detection of cancer

INTRODUCTION

Prostate cancer (PCA) is one of the common malignancies in men. The number of PCA patients increasing, and PCA is expected to become the second most frequent male cancer in Japan. Further, the PCA mortality rate will increase by 2.8 folds in 2020 compared to 2000 [1]. This increase of prevalence rate is affected by various factors including age of the population,

food, genetic factors, and also screening systems using prostate-specific antigen (PSA). PCA was generally identified by metastatic symptoms before the PSA era, but the introduction of PSA made it possible to identify PCA in the early stages.

Generally, prevention and early detection reduce the mortality rate of malignancies. For this reason, national population-based screening systems have been established in Japan for five major malignancies including lung, stomach, breast,

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colon, and cervical cancer. PSA-based screening systems for PCA have not been established by the Japanese government, but mostly administered by municipal governments since the 1990s. The Japanese Urological Association (JUA) recommends PSA-based screening for men over 50 years old, and also further examinations for patients with more than 4 ng/mL or age-adjusted cut off levels of PSA to assess the presence of PCAs [2]. Further examinations including digital rectal examinations, transrectal ultrasonography, blood examinations, magnetic resonance imaging, and/or prostate biopsy are performed as secondary screening. The definitive diagnosis of PCA is made by prostate biopsy, although the actual indication for a biopsy largely depends on decision-making practices at each facility.

The cancer detection rate (CDR) is an important indicator to evaluate screening systems for malignancies. CDR of PSA-based screening is known to be higher than those of national screening systems for the other five major cancers. According to a survey by the Japan Cancer Society, the CDR of PCA screening was 0.5% in 2011, whereas those of the other five cancer screenings were 0.04% to 0.22%. However, large regional differences in the CDRs of PCA screening were reported; the 2005 annual report of the Japanese Foundation for Prostate Research (JFPR) revealed that the CDR among men attending a primary screening varied from 0.0% to 5.1% in 218 municipalities throughout Japan [3]. Multiple factors, including the age distribution of the target population, exposure rates of PSA screening, rate of persons receiving secondary screening, quality of secondary screening, and others might be responsible for the variability. Comprehensive analysis of these factors might reveal strategies to improve the CDR, but this type of information is limited in Japan. Improvement of CDR is considered to be a common issue in most of Asian countries, where PSA exposure rates are very lower than Western countries [4]. In the present study, we extensively analyzed factors contributing to regional differences in CDRs at the secondary screening using the practice-based, retrospective data of 115,881 men who participated in PSA-based screening programs of Ibaraki Prefecture during the past 10 years. Ibaraki Prefecture is located about 100 km from Tokyo. To our knowledge, this is the first study to examine factors responsible for regional differences in CDRs of PCA screening programs by municipal governments in Japan.

MATERIALS AND METHODS

1. PSA-based screening program in Ibaraki Prefecture

PSA screening was started in Ibaraki Prefecture in 1999, and 36 of 44 municipalities in Ibaraki Prefecture have participated

in the PSA-based screening program. In the first screening, the serum PSA level alone with a cut off of 4.0 ng/mL was used, and notifications for further examinations were mailed to participants by the Ibaraki Health Service Association (IHSA). When the participants were referred to hospital or clinics for secondary screening, each facility sent the results of further examinations to IHSA using the screening report form. The available information from the screening report including examination date, patient age, name of the facility, PSA levels at secondary screenings, and the results of a prostate biopsy if performed. The percentage of individuals referred for secondary screening and CDR were aggregated annually for each municipality by IHSA. We obtained permission of IHSA committee for use of anonymised data on PCA screening in the present study.

2. Patients and facilities

Because the aggregate screening data is available from 2001, we analyzed the results of 115,881 men who attended a PSA-based screening for the first time between 2001 and 2011. During this period, as a result of municipal mergers, 84 municipalities in Ibaraki Prefecture were integrated into 44 municipalities. Therefore, we adjusted the data of each municipality according to the consequence of these municipal mergers.

In the present study, we excluded men who had previously attended the PSA-based screening program of Ibaraki Prefecture. Among 115,881 men, 8,473 men (7.3%) had a serum PSA level higher than 4.0 ng/mL at the first screening, and finally a total of 6,099 (72.0%) received the secondary screening. The profiles of these 6,099 patients are presented in Table 1. During the study period, a total of 376 hospitals or clinics conducted the secondary screening. Of them, 299 facilities were located in Ibaraki Prefecture and the remaining 77 facilities were located outside of Ibaraki Prefecture. We divided these facilities into two groups according to number of patients screened during the study period. The hospitals or clinics with less than 100 patients in 10 years were classified as group I facilities. Those with 100 or more patients and those located outside Ibaraki Prefecture were classified as group II facilities. Thus, 240 facilities and 136 facilities were classified as group I and group II facilities, respectively.

3. Statistical analysis

CDR at secondary screening, the rates of prostate biopsies performed and positive biopsy rates were calculated using the following equations:

$$\text{CDR at secondary screening} = \frac{\text{number of PCA patients}}{\text{number of patients who received secondary screening}}$$

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