Evaluation of Cancer Screening in Multiphasic Health Testing and Services

Yoshihiro Mizuma; Yoshio Nakagawa; Fumio Misaki; Shigeru Mochizuki; Shohken Tomita; Minoru Miyanaga; and Kenji Matsuoka

Kansai Occupational Health Association

ABSTRACT

The aim of this study was to clarify the validity and efficacy of cancer screening in the Multiphasic Health Testing and Services (MHTS). A total of 19,922 people visited our Health Evaluation Center for MHTS between 1995 and 1996. There were 14,422 males who all received chest X-rays, barium meal, abdominal ultrasonography, and fecal occult blood test, and 5,500 females who additionally received palpation of mamma, and uterine cervical cytology. By collating the Osaka cancer registry with the examinee’s list, the cancer cases with unknown results of further examination, the false negative cancers, the progressive stage, the treatment and so forth were clarified. Esophageal cancer, gastric cancer, hepatic cancer, biliary tract cancer, pancreatic cancer, renal cancer, colon cancer, breast cancer, and uterine cervical cancer were defined as cancers detected by the MHTS. A detected cancer was defined as a cancer registered within one year after a positive result of the screening. A false negative cancer was defined as a cancer registered within one year after a negative result of the screening. As a result, the prevalence of the cancer was 0.225%. The sensitivity was 73.3% and the specificity was 81.3%. With regard to the progressive stage of the detected cancer, localized cancer (no metastasis) or carcinoma in situ accounted for 78.8%. The existence of cancer with neighboring organ invasion or distant metastasis was not described. With regard to the treatment of the detected cancer, a curative resection was done in 84.8%. It is expected that the stage of the detected cancer in the MHTS is comparatively early and the possibility of the curative resection is high.

Key Words: Multiphasic Health Testing and Services; Cancer Screening; Prevalence; Sensitivity; Specificity

INTRODUCTION

In the Multiphasic Health Testing and Services (MHTS), the cancer screening of many organs is executed concomitantly. In the present study, the validity of the cancer screening in such an integrated health evaluation system was clarified by collation with the regional cancer registry. The efficacy of the cancer screening in the MHTS was also collated by disclosure of the progressive stage and the treatment of the detected cancer.

MATERIALS AND METHODS

A total 48,682 people visited our Health Evaluation Center for a medical check-up between 1995 and 1996, and 29,834 of those people lived in Osaka prefecture at that time. Among them there were 19,922 people containing of 14,422 males who all received chest X-rays, barium meal, abdominal ultrasonography, and fecal occult blood test in the MHTS, and 5,500 female who all received chest X-rays, barium meal, abdominal ultrasonography, fecal occult blood test, examination of mamma, and the gynecological examinations in the MHTS. The mean age was 48.7 years old, 48.6 years old in males and 48.9 years old in females. Table 1 shows the sex and ages of the examinees.

In 1995 and 1996, palpation was done for the examination of mamma, cervical cytology was performed for the gynecological examination, and the single-day immunological fecal occult blood test was used. The cancers detected in the MHTS were defined as lung cancer, esophageal cancer, gastric cancer, hepatic cancer, biliary tract cancer, pancreatic cancer, renal cancer, colon cancer, breast cancer, and uterine cervical cancer.

The Osaka cancer registry was used for collation with the list of examinees in the MHTS. The Osaka cancer registry is composed of two stages; registration from the medical institution in Osaka Prefecture and supplementation by the cancer death certificate. In April, 2001, the latest Osaka cancer registry until 1997 was collated with the file of examinees of the MHTS between 1995 and 1996. The same patient between the cancer registry and the file of examinees was identified by the correspondence of the address, name, sex, and date of birth. The cancer registry offered location of cancer, histopathology, date of diagnosis, stage of the cancer, contents of treatment and surgery, and date of death of the identified patient. As to the progressive stage, carcinoma in situ, localized (no metastasis), regional lymph node metastasis, neighboring organ invasion, and distant metastasis were shown. As the treatment, surgical operation, radiation, chemotherapy, hormone therapy, Transcatheter arterial embolization (TAE), immunotherapy, ethanol injection, hyperthermia, and laser therapy were disclosed. Regarding the content of surgical operations, curative resection, noncurative resection, anastomosis, and laparotomy were clarified.

A detected cancer by collation with the cancer registry was defined as a cancer registered within one year after a positive result of the cancer screening. A false negative cancer was defined as one registered within one year after a negative result of the cancer screening. The false negative cancer included a cancer detected as one registered within one year after a negative result of the cancer screening. A false negative cancer was defined as a cancer registered within one year after a negative result of the screening. As a result, the prevalence of the cancer was 0.225%. The sensitivity was 73.3% and the specificity was 81.3%. With regard to the progressive stage of the detected cancer, localized cancer (no metastasis) or carcinoma in situ accounted for 78.8%. The existence of cancer with neighboring organ invasion or distant metastasis was not described. With regard to the treatment of the detected cancer, a curative resection was done in 84.8%. It is expected that the stage of the detected cancer in the MHTS is comparatively early and the possibility of the curative resection is high.

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ed at the screening in the following year.

The validity of the cancer screening in the MHTS was shown by the sensitivity, the specificity and so on. Moreover, the efficacy of the cancer screening was collated by disclosing the progressive stage and the treatment of the detected cancer.

RESULTS

1) Prevalence (Table 2)

The prevalence of cancer was 0.225%. Sixteen cases of esophageal and gastric cancers included one esophageal cancer and fifteen gastric cancers. Three cases of hepatic, biliary, pancreatic, and renal cancers included two extrahepatic bile duct cancers and one pancreatic cancer. The prevalence was high in the order of uterine cervical cancer, colon cancer, esophageal and gastric cancers, breast cancer, hepatic, biliary, pancreatic, and renal cancers, and lung cancer. One case of multiple myeloma and one cerebral meningioma were registered but they were excluded from this study. The patient with multiple myeloma was diagnosed with severe anemia by the blood test. The patient with cerebral meningioma was examined by the optional brain magnetic resonance image (MRI).

2) Sensitivity and Specificity (Table 2)

Sensitivity was 73.3%. By the abdominal ultrasonography, none of the cases of two bile duct cancers and one pancreatic cancer were detected. One of two breast cancers was not detected by the palpation of mamma. Sixteen esophageal and gastric cancers included one esophageal cancer, which was false negative.

Specificity was 81.3%. It was greater than 90% in the screening of each organ.

3) Rate of necessary further examination, rate of detected cancer, and positive predictive value (Table 2)

The rate of necessary further examination was 18.8%, the rate of detected cancer was 0.17%, and the positive predictive value was 0.88%. The positive predictive value was high in the order of lung cancer, colon cancer, breast cancer, uterine cervical cancer, and etc.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Validity of cancer screening in Multiphasic Health Testing and Services (MHTS).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung cancer</td>
<td>Esophageal and gastric cancers</td>
</tr>
<tr>
<td>Prevalence %</td>
<td>0.01 (2/19,922)</td>
</tr>
<tr>
<td>Sensitivity %</td>
<td>100 (2/2)</td>
</tr>
<tr>
<td>Specificity %</td>
<td>99.4 (19,810/19,920)</td>
</tr>
<tr>
<td>Rate of necessary further examination %</td>
<td>0.56 (112/19,922)</td>
</tr>
<tr>
<td>Rate of detected cancer %</td>
<td>0.01 (2/19,922)</td>
</tr>
<tr>
<td>Positive predictive value %</td>
<td>1.79 (2/112)</td>
</tr>
</tbody>
</table>

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<tr>
<th>Table 3</th>
<th>Progressive stage of detected cancer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung cancer</td>
<td>Gastric cancer</td>
</tr>
<tr>
<td>Carcinoma in situ %</td>
<td>0 (0/2)</td>
</tr>
<tr>
<td>Localized (No metastasis) %</td>
<td>0 (0/2)</td>
</tr>
<tr>
<td>Regional lymph node metastasis %</td>
<td>5 (1/2)</td>
</tr>
<tr>
<td>Neighboring organ invasion or Distant metastasis %</td>
<td>0 (0/2)</td>
</tr>
<tr>
<td>Unknown %</td>
<td>50 (1/2)</td>
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<th>Table 4</th>
<th>Treatment of detected cancers.</th>
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<tbody>
<tr>
<td>Lung cancer</td>
<td>Gastric cancer</td>
</tr>
<tr>
<td>Curative resection %</td>
<td>50 (1/2)</td>
</tr>
<tr>
<td>Noncurative resection, etc. %</td>
<td>0 (0/2)</td>
</tr>
<tr>
<td>Unknown %</td>
<td>50 (1/2)</td>
</tr>
</tbody>
</table>
esophageal and gastric cancer, and hepatic, biliary, pancreatic and renal cancer.

4) Progressive stage of detected cancer (Table 3)

With regard to the progressive stage, carcinoma in situ or localized cancer (no metastasis) was 78.8% and unknown cases accounted for 12.1% of detected cancers. No cancers with neighboring organ invasion or distant metastasis were found in the cancer registry.

5) Treatment of detected cancer (Table 4)

A curative resection was performed in 84.8% of cases. The treatment was unknown in 12.1% of detected cancers. One case of colon cancer without metastasis was not treated. There were no cases with noncurative resection or some other treatment than surgical operation.

DISCUSSION

In the MHTS, the cancer screening of more than one organ is executed in three or four hours. The rate of detected cancer in the cancer screening has been reported.\(^1\)\(^{10}\) The degree of its sensitivity and specificity, however, has not been reported, as retrieved from PubMed of the National Library of Medicine. The reason why the sensitivity and specificity are difficult to clarify is that false negative cancers is difficult to identify. False negative cancers, the follow-up by a prospective study is the most preferable. It is, however, difficult to follow up a large number examinees for a long term. Therefore, collation with the regional cancer registry is useful as a source of the follow-up instead of the prospective study.\(^4\) The accuracy of the regional cancer registry is shown by the ratio of DCO (Death Certificate Only).\(^5\) In Japan the nationwide cancer statistics is executed using the comparatively accurate cancer registry, which is required to be less than 25% of the DCO ratio. The DCO ratio of the Osaka cancer registry in 1997 was 22.1%.\(^6\) It could be clarified as a false negative cancer and the cancer cases with unknown results of further examinations, by collating the Osaka cancer registry with the list of examinees in the MHTS. It was, therefore, possible to obtain the sensitivity and the specificity of the cancer screening in the MHTS.

The sensitivity of the cancer screening in the MHTS was 73.3%. The sensitivity of chest X-rays, barium meal, fecal occult blood test, and uterine cervical cytology was high, and the sensitivity of palpation of mamma and abdominal ultrasonography was low. However, it was reported that the sensitivity of abdominal ultrasonography was 90.5% by collation with the regional cancer registry.\(^7\) The present low sensitivity of the abdominal ultrasonography was due to the existence of two extrahepatic bile duct cancers in which diagnosis was difficult. In extrahepatic bile duct cancer, dilation of the bile duct becomes the clue for detection, however, the description of the tumor is difficult.\(^8\)

It was reported that the sensitivity of the screening of breast cancer was 73.3% by palpation and 93.5% by mammography for patients over 50 years old.\(^9\) The mammography should be introduced to improve sensitivity. With regard to the fecal occult blood test, the 2-day method is currently used instead of the single-day method used between 1995 and 1996. The sensitivity of the immunological fecal occult blood test was reported to be 58% in the single-day method, 89% in the 2-day method, and 100% for the 3-day method, where the 2-day method is the most effective considering the specificity.\(^10\) It is suggested that the sensitivity of fecal occult blood test is improved at present using the 2-day method.

The specificity of cancer screening was 81.3%. The specificity of each organ was 90% or greater.

With regard to the progressive stage, about 80% of cancers were detected at comparatively early stages of carcinoma in situ or localized cancer (no metastasis). With regard to the treatment, a curative resection accounted for 80% or greater. The progressive stage of a colon cancer which had not been treated was localized (no metastasis). When this case was counted in the cases with curative resection, all detected cancers except unknown cases were resected curatively. With regard to the hepatic, biliary, pancreatic and renal cancers, no cancers were detected. It was reported that the resection rates of detected cancers were 25% in hepatocellular carcinoma, 88% in gallbladder cancer, 49% in pancreatic cancer, 99% in renal cell carcinoma, and 64% in all cancers by the abdominal ultrasonography.\(^11\) It is suggested from the present findings that the effective treatment of gallbladder cancers and renal cancers will be detected using the present cancer screening method.

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