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Title

Diagnostic accuracy of FDG-PET cancer screening in asymptomatic individuals: use of record linkage from the Osaka Cancer Registry

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[ABSTACT]

BACKGROUND: Whole-body cancer screening with multimodalities including [F-18] -fluorodeoxyglucose positron emission tomography (FDG-PET) detects a wide range of tumors. This program has been recognized as an option of opportunistic screening, particularly in Japan. However, reports on diagnostic accuracy have been limited. We aimed to evaluate the detectability and related properties of this screening program among asymptomatic individuals in a community setting.

METHODS: Study participants were 1,762 residents of Osaka Prefecture, Japan, who underwent opportunistic cancer screening at Higashitemma Clinic for the first time between November 2004 and December 2005. FDG-PET cancer screening was performed with several imaging modalities (e.g., FDG-PET, computed tomography, magnetic resonance imaging, ultrasonography), and fecal occult blood test. Screening records were linked to the Osaka cancer registry within one year after the screening to determine sensitivity, specificity and positive predictive values.

RESULTS: After excluding 12 participants with cancer detected before the screening, 33 were identified by the cancer registry to have primary cancers. Of these, the present screening program detected that 28 were positive (6 prostate, 5 lung, 5 colorectal, 5 thyroid, 3 liver, 4 others). Sensitivity, specificity and positive predictive values were 84.8% (28/33, 95%-confidence interval : 69.1 to 93.3), 86.8% (1,491/1,718, 85.1 to 88.3) and 10.1% (28/277, 6.4 to 12.9), respectively.

CONCLUSIONS: FDG-PET cancer screening with multimodalities reasonably and accurately detects existing asymptomatic cancer. However, the numbers of false negatives and false positives were not insignificant. Facilities that provide the screening should inform participants of relevant information, including the limitations of this program.

[Mini-abstract]

The diagnostic accuracy of FDG-PET cancer screening with multimodalities for asymptomatic adults have been unknown in a community setting. This study revealed that the sensitivity, specificity were 84.8%, 86.8%, respectively.

[Key Words]

[F-18]-fluorodeoxyglucose positron emission tomography, Sensitivity, Specificity, Cancer Registry, Early detection of cancer

[TEXT]

INTRODUCTION

To reduce cancer-related mortality, improving cancer screening is highly prioritized in all developed countries [1-3]. Population-based screening for gastric, uterine, lung, colon, and breast cancer are provided officially in Japan [4]. Besides, many other cancer screening programs are offered privately [5-7]. [F-18] -fluorodeoxyglucose positron emission tomography (FDG-PET) imaging, which is used for patients with cancer, can detect a wide range of tumors [8, 9]. This technology has been also used to screen for cancer in asymptomatic adults, but this effectiveness is not currently well evaluated. As of 2011, approximately 100 facilities in Japan provided FDG-PET as a private and opportunistic screening program [10].

Because the sole use of FDG-PET imaging to screen cancer has several limitations [11], the practice guidelines for FDG-PET cancer screening in Japan recommend that it be used alongside other modalities [12]. Therefore, FDG-PET cancer screening typically comprises whole-body FDG-PET in addition to other modalities such as computed tomography (CT), magnetic resonance imaging (MRI), ultrasonography (US), fecal occult blood test (FOBT) and tumor markers. This combined screening process is called “FDG-PET cancer screening with multimodalities.”

By using these multimodalities, many types of cancer in various organs can be detected in a single examination (detection rate, 0.7-2.1% [13-20]), but admittedly, reports on diagnostic accuracy has been limited. In terms of the diagnostic validity of screening in asymptomatic participants, only Nishizawa et al. reported sensitivity and specificity of FDG-PET cancer screening with multimodalities, (81.8% and 82.0%, respectively

[21]). However, their study population was restricted to employee volunteers at one company, with a mean age of 46.7 years, which was considerably younger than what is considered the susceptible age for cancer. To facilitate discussion on the role and limitations of FDG-PET cancer screening with multimodalities, more data from studies of community-dwelling adults who more accurately represent potential participants of this program are necessary.

To determine the diagnostic accuracy of FDG-PET cancer screening with multimodalities for diverse participants, we conducted the present study at a private facility for medical examination in a community and used population-based cancer registry data as the reference.

STUDY PARTICIPANTS AND METHODS

Ethical Statement

The study protocol was approved by the ethics committee of Kyoto University Graduate School and Faculty of Medicine (E1339). Information regarding the use of screening data and handling of personal information was posted on the clinic homepage as well as in the waiting room. Participants were informed that data would be used for academic purposes only, and refusal of participation was assured if desired.

Participants

Participants were 1,762 residents of Osaka prefecture, Japan, who underwent FDG-PET cancer screening with multimodalities for the first time at Higashitemma Clinic, one of the private facilities that provide

FDG-PET cancer screening with multimodalities in Japan, from November 2004 to December 2005, regardless of age and past cancer screening histories. The participants were charged approximately $2,000 to undergo the screening, which was nearly equal to the amount of medical fee reimbursement for these tests in Japan. Participants understood this and participated autonomously in this screening program. Written informed consent was obtained from all participants.

Cancer Screening

FDG-PET cancer screening with multimodalities covered whole-body FDG-PET, chest and abdominal CT, brain and pelvic MRI, thyroid, abdominal, and breast US and FOBT. The tumor markers were measured as a way to provide additional information (Table 1). When levels of these tumor markers exceeded the normal ranges but were not accompanied by abnormal image findings, detailed examinations were not conducted immediately after the screening, but were re-examined after several months. We did not use upper gastrointestinal series and gastroscopy but did measure Helicobacter pylori antigen and serum pepsinogen for detecting atrophic gastritis.

Image Acquisition

Whole-body FDG-PET studies were performed on a PET (Allegro, Phillips Medical Systems) or a PET-CT scanner (Discovery ST, GE Healthcare). The participants fasted for more than 4 hours and subsequently

received an injection of 3.7 MBq/kg FDG. The scan was started 50 minutes after the FDG injection and performed from the base of the skull to the proximal thigh. Chest and upper abdominal CT scans were performed using an X-ray CT (LightSpeed Ultra 16, GE Healthcare) or PET-CT scanner without contrast media (3.75 mm slices; 512 × 512 matrix size; FOV 50 cm). MRI was performed using a 1.5T MRI device (Intera 1.5T, PHILIPS; Signa EchoSpeed Plus EXCITE Xi 1.5T, GE Healthcare) without contrast media. Transaxial T1-, T2- and FLAIR images of the brain, and transaxial T1-, T2- and fat-saturation T2 (for men), transaxial T1-, T2-, sagittal T2- (for women) images were taken of the pelvis. Thyroid, abdominal, or breast US was performed using a LOGIQ 7 Discovery system (GE Healthcare).

Image interpretation

PET, CT, and MRI imaging data were acquired by radiological technologists and interpreted by two highly experienced radiologists. Trained clinical laboratory technicians performed all examinations and generated key images for all US examinations and one well-experienced ultrasound radiologist followed up with their interpretation. Imaging reports were created by referencing images taken by other modalities and materials.

Integrated diagnosis and report

A physician wrote up an integrated diagnosis based on radiologist reports and biochemical test results. The participants suspected to have cancer were advised to receive a definitive diagnosis at another hospital.

Record Linkage

The use of population-based cancer registries as the reference has been widely accepted when assessing the accuracy of cancer screening programs [22-25]. We linked all screening results with data from a population-based cancer registry in Osaka (Osaka Cancer Registry). The Osaka Cancer Registry has been in operation since December 1962 and covers the entire Osaka Prefecture (population of 8.86 million, as of the 2010 census) [26]. The Cancer Registry registers cancer case reports sent from hospitals or clinics as well as death certificates from healthcare centers as computer files. These files contain all essential data relevant to participants with cancer and deaths in the resident population of Osaka Prefecture. Data from the Osaka Cancer Registry during the period between January 2004 and December 2006 were used for the analysis. References used for individual identification included name, sex, birth date, and address [27]. Registry data for participants with cancer included cancer origin, histopathology findings, stage, and date of diagnosis.

The participants who had been diagnosed with cancer before screening were excluded from this analysis.

Test performance values

Presence of cancer at screening was defined as cancers that were confirmed within one year of screening. The rationale for this was that FDG-PET cancer screening with multimodalities targets various types of cancers and the one-year definition is used widely in other population-based cancer screenings in Japan, including that for gastric, colorectal, and lung cancer [4].

Statistical Methods

The present study primarily used descriptive data analysis (i.e., sensitivity, specificity, positive predictive values for FDG-PET cancer screening with multimodalities and FDG-PET alone). 95% confidence intervals (CIs) of these proportions were obtained according to the Wilson method using the Web calculator provided by the Oxford Center of Evidence-based Medicine [28]. All data are reported according to the STARD criteria [29].

RESULTS

Participants

A total of 1,762 residents (males, 1,073; females, 689) underwent FDG-PET cancer screening with multimodalities between November 2004 and December 2005. Participants' characteristics are detailed in Table 2.

Screening Results

Of the 1,762 participants, 12 were excluded due to previous cancer diagnoses. There identified 277 sites with suspected cancer in 254 of the 1,750 participants. Of these, 232 participants had one site with suspected cancer, 21 had two sites, and 1 had three sites. Of the 254 participants with cancer suspicions, 28 primary cancer sites among the 27 participants were pathologically confirmed as true-positive (including one

case with two cancer sites). Of the 1,496 participants who were screened as free from cancer suspicion, five primary cancer regions were noted by the cancer registry, but confirmed as false-negative cases (Figure 1). Sensitivity, specificity and positive predictive values were 84.8% (28 of 33), 86.8% (1,491 of 1,718) and 10.1% (28 of 277), respectively, for FDG-PET cancer screening with multimodalities (Table 3). Specifically, the false negative rate was 15.2% (5 of 33) and the false positive rate was 13.2 % (227 of 1,718). FDG-PET alone suspected the presence of 106 sites with cancer among 106 of the 1,750 participants, 19 of which were identified as true-positives. Among 1,644 participants who were screened to be free from suspected cancer, 14 primary cancer regions were identified among 13 participants as false-negatives (including one case with two cancer sites) (Figure 1). Sensitivity, specificity and positive predictive values were 57.6% (19 of 33), 94.9% (1,631 of 1,718) and 17.9% (19 of 106), respectively, for FDG-PET alone (Table 4).

Details for 33 sites of cancer identified by the Osaka Cancer Registry are shown in Table 5. The number of true-positive and false-negative sites was 28 and five, respectively. Of these, one individual showed two sites of cancer (No. 16 and No. 22 in Table 5). Of the 28 true-positive sites, one distant metastatic case was identified, while the others were early stage. The prevalence of cancer by age group was high in participants in their 60s to 70s.

DISCUSSION

The present study revealed the diagnostic accuracy of the FDG-PET cancer screening with multimodalities in a community setting with linking to the population-based cancer registry data. Sensitivity

values for FDG-PET cancer screening with multimodalities and FDG-PET alone were 84.8% and 57.6%, respectively, while specificity values were 86.8% and 94.9%, respectively. These findings confirmed that the risk of false-negatives by FDG-PET alone screening was reduced by adding multimodalities to FDG-PET, albeit with slightly lower specificity due to the cumulative false-positive cases [30].

Although integration of various modalities is the main advantage of FDG-PET cancer screening, some consideration is required when evaluating sensitivity and specificity. Sensitivity and specificity results for FDG-PET cancer screening with multimodalities should be carefully interpreted because the calculation method differs from that of the usual single modality screening. While the main advantage of FDG-PET cancer screening with multimodalities is the ability to detect a wide range of cancer types in various organs concurrently, this capability also makes it difficult to evaluate the sensitivity, and especially the specificity, of screening. In general, cancer screening is site-specific, but FDG-PET cancer screening with multimodalities targets all organs. This means that one or more sites with suspected cancer can be detected in one participant. According to the number of cancer cases and sites confirmed by the cancer registry data, we calculated “the number of cases without cancer” in the screening. However, “the number of sites without cancer” cannot be calculated. Considering these properties of FDG-PET cancer screening with multimodalities, we calculated the sensitivity using the number of cancer sites and the specificity using the number of participants.

In addition, the sensitivity and specificity of FDG-PET cancer screening with multimodalities differ by characteristics of study populations and combination materials with FDG-PET. These issues need critical interpretations when comparing the present findings with that of a similar study. Actually, the findings of

Nishizawa et al. were derived from a group of confined and young employees (mean age, 46.7 years) at one company [21]. None of their participants were detected to have colorectal cancer, the most detectable cancer by FDG-PET cancer screening with multimodalities. Nishizawa explained this discrepancy by stating that most participants had received annual health check-ups including FOBT and that some of them were excluded from their study. In contrast, the present participants were general community-living adults (mean age, 55.0 years); consequently, many kinds of cancer including five colorectal cancers were detected, in a manner consistent with other previous studies. Furthermore, the selection of combination materials affects the sensitivity and specificity. Nishizawa et al. examined other combination with FDG-PET in terms of sensitivity/specificity and concluded that imaging modalities with PSA was the best. Based on their combination materials (which excluded FOBT), we recalculated our results, which changed the sensitivity and specificity values of 84.8% to 72.7% and 86.8% to 91.9%, respectively. This shows that it is necessary to consider study populations and combination materials in comparison.

This screening potentially detects not only fatal cancers but also non-fatal cancers like thyroid cancer, that even stop growing and/or. In the present results, five of 28 true-positive cases were thyroid cancers. Detection of these indolent cancers may increase unnecessary definitive examinations and deteriorate participants' quality of life [31]. This means that the effectiveness of cancer screening should not be evaluated only by the number of detectable cases of cancers in the screening. It is desirable to confirm a reduction in mortality rates among the population in which screening is applied, especially for official organized screening programs. The levels of sensitivity and specificity for a cancer screening program represent indirect evidence of

its effectiveness [32]; thus, to establish FDG-PET cancer screening with multimodalities as an option of private opportunistic screening, the sensitivity and specificity of the program must be determined.

The potential risk of screening modalities/materials are an important factor to consider when determining the combination. As many imaging modalities involve radiation, radiation exposure is understandably an important concern. This is especially true for Japanese people, because the frequency of diagnostic X-ray usage in Japan is the highest among all developed countries [33]. Radiation dose with FDG-PET is estimated to be 4.2 mSv (0.019 mSv per MBq × 60 kg×3.7 MBq) [34], equivalent to the dose used for X-ray diagnosis of gastric cancer (3.7-4.6 mSv) [35]. Gotbi et al. estimated that effective radiation dose for PET-CT was 6.34-9.48 mSv (at 60 kg body weight) in a single whole-body scan, and surmised that many healthy individuals exposed to at least 6.34 mSv would not benefit from the screening if found to be without cancer [36]. Murano et al. estimated radiation exposure as well as the risks and benefits of FDG-PET in cancer screening and concluded that FDG-PET cancer screening was potentially beneficial for examinees, but this benefit varied by age, gender, and the type of examination (PET or PET-CT) [37]. Although FDG-PET cancer screening with multimodalities is an opportunistic screening based on individual preference, the use should not be expanded to the younger populations which possess a relatively low risk of cancer.

The potential risk of screening modalities/materials are an important factor to consider when selecting the combination tools. In this study, two cases of gastric cancer were false-negative. However, these participants were instructed to undertake definitive examinations due to suspicions of chronic atrophic gastritis. In Japan, population-based screening for gastric cancer is conducted using a barium X-ray examination, which inevitably

results in radiation exposure. Some facilities that provide FDG-PET cancer screening with multimodalities use gastrofiberscopy to avoid additional radiation exposure [18], but this is invasive. Our program included neither barium X-ray examination nor gastrofiberscopy to detect gastric cancer. Instead, we used Helicobacter pylori antigen and the serum pepsinogen test to detect chronic atrophic gastritis, the pre-cancerous stage of gastric cancer [38, 39]. The inclusion of a barium X-ray examination or gastrofiberscopy critically affects the sensitivity of this screening program. Further examination is required to select an optimal combination of modalities/materials that also takes into account participant preference and cost.

This study has some limitations. First, this was a single-facility study. However, study participants were recruited from a variety of regions in Osaka Prefecture and participated autonomously in the screening. This setting was consistent with other private facilities for FDG-PET cancer screening in Japan. Furthermore, participant age distribution was similar to that observed in the general FDG-PET cancer screening facilities in Japan [18], so a significant age-related bias was not likely. A second limitation was that participants who visited hospitals outside of Osaka Prefecture were not followed. However, 60 hospitals designated as regional cancer centers are capable of administering cancer care in Osaka [40], and all participants were expected to visit one of these hospitals. The Osaka Cancer Registry, the quality of which has been assured by the International Agency for Research on Cancer (IARC), has been utilized widely for research [22, 23, 41, 42] and covers all of these facilities, so the possibility of leaked records was very low. The third limitation concerns the definition of false-negative cases. In this study, the presence of cancer at screening was defined as the diagnosis of cancer

within one year of screening and identified in the cancer registry, just as other studies did [22, 23]. Some cancer cases may not have been diagnosed within the year; in fact, our extended follow-up for another year identified two other cancer cases. Based on this finding, the sensitivity of FDG-PET cancer screening with multimodalities was recalculated, which changed the value from 84.8% to 82.9%. However, an extended follow-up period may introduce the risk of detecting “de novo” cancer developing after the screening.

FDG-PET cancer screening with multimodalities is an innovative method, and thus accuracy, technical properties, safety, efficacy and/or effectiveness and economic attributes need to be assessed when applying this technique to screen asymptomatic populations [43]. At present, the materials and imaging modalities combined with FDG-PET vary slightly by facility, so reports on the accuracy of the screening from more facilities are necessary. Furthermore, from the perspective of screening service quality, a system that constantly reviews the screening accuracy using their own facility data needs to be established. Population-based cancer rregistries provide assessors of the screening program with reliable external references for that purpose.

CONCLUSIONS

FDG-PET cancer screening with multimodalities detected existing asymptomatic cancer with reasonable accuracy. However, numbers of false-negative and false-positive results were not negligible. While this method serves as one option for opportunistic screening based on individual preference, facilities should inform participants of the relevant information, including limitations of this program.

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FIGURE LEGENDS

Figure 1. Flow diagram for study participant recruitment and data collection

TABLES

Table 1. Tumor markers

Tumor markers	Normal Range
Carcinoembryonic antigen (CEA)	≤5.0 ng/ml
Alpha-fetoprotein (AFP)	≤10.0 ng/ml
Carbohydrate antigen 19-9 (CA19-9)	≤37.0 U/ml
Squamous cell carcinoma antigen (SCC)	≤1.50 ng/ml
Cytokeratin-19 fragment (CYFRA)	≤3.5 ng/ml
Pro-gastrin releasing peptide (Pro-GRP)	≤45.9 pg/ml
Prostate-specific antigen (PSA) [Male]	≤4.0 ng/ml
Carbohydrate antigen 125 (CA125)[Female]	≤35.0 U/ml

Table 2. Participant characteristics (N = 1,762)

	Male	Female	Total	
Population	1,073	689	1,762	
（%）	60.9%	39.1%	100.0%	
Mean age (years)	55.2	54.6	55.0	-
Standard deviation	10.8	11.0	10.9	-
				(%)
10-19	1	0	1	0.1
20-29	2	9	11	0.6
30-39	98	62	160	9.0
40-49	224	146	370	20.8
50-59	335	225	560	31.4
60-69	325	193	518	29.1
70-79	85	51	136	7.6
80-89	3	3	6	0.3
BMI, kg/m^2				
				(%)
-18.5	28	74	102	5.8
18.5-22.0	197	313	510	28.9
22.0-25.0	440	186	626	35.5
25.0-30.0	364	103	467	26.5
30.0-	44	13	57	3.2
Blood glucose (ml/dl)				
				(%)
-100	554	414	968	54.9
100-200	507	273	780	44.3
200-	12	6	18	1.0
Smoking status				
				(%)
Smoker	442	155	597	33.9
Nonsmoker	629	533	1162	65.9
Unknown	2	1	3	0.2

Abbreviations: BMI, body mass index.

Table 3. Sensitivity, specificity, and positive predictive values for multimodal cancer screening with FDG-PET.

			Record Linkage		Total
			Cancer (+)	Cancer (-)	
Test result	Positive	Site	28	249	277
		Participant	27	227	254
	Negative	Site	5	-	-
		Participant	5	1,491	1,496
Total		Site	33	-	-
		Participant	32	1,718	1,750
Sensitivity,% (95% CI)			84.8, (69.1 - 93.3) [28/33]		
Specificity, % (95% CI)			86.8 (85.1 - 88.3) [1,491/1,718]		
Positive predictive value, % (95% CI)			10.1 (6.4 - 12.9) [28/277]		

Abbreviations: FDG-PET, [F-18] -fluorodeoxyglucose positron emission tomography; CI, confidence interval.

Table 4. Sensitivity, specificity, and positive predictive values for screening using FDG-PET alone.

			Record Linkage		Total
			Cancer (+)	Cancer (-)	
Test result	Positive	Site	19	87	106
		Participant	19	87	106
	Negative	Site	14	-	-
		Participant	13	1,631	1,644
Total		Site	33	-	-
		Participant	32	1,718	1,750
Sensitivity, % (95% CI)			57.6 (40.8 - 72.8) [19/33]		
Specificity, % (95% CI)			94.9 (93.8 - 95.9) [1,631/1,718]		
Positive predictive value, % (95% CI)			17.9 (11.8 - 26.3) [19/106]		

Abbreviations: FDG-PET, [F-18] -fluorodeoxyglucose positron emission tomography; CI, confidence interval.

Table 5. Characteristics of 33 cancers identified by record linkage

No.	Sex	Age (years)	Cancer region	Histological type	Extent of the cancer	Multiple screening	FDG-PET alone	Positive findings in other modalities	Time to cancer diagnosis (months)
1	Male	65	Prostate cancer	Adenocarcinoma	Localized	Positive	Positive	Pelvic MRI, PSA	3
2	Male	72	Prostate cancer	Adenocarcinoma	Localized	Positive	Positive	Pelvic MRI, PSA	11
3	Male	76	Prostate cancer	Adenocarcinoma	Localized	Positive	Normal	Pelvic MRI, PSA	3
4	Male	61	Prostate cancer	Adenocarcinoma	Localized	Positive	Normal	Pelvic MRI, PSA	2
5	Male	67	Prostate cancer	Adenocarcinoma	Localized	Positive	Normal	Pelvic MRI, PSA	3
6	Male	55	Prostate cancer	Adenocarcinoma	Localized	Positive	Normal	Pelvic MRI, PSA	2
7	Male	63	Prostate cancer	Adenocarcinoma	Localized	Negative	Normal	PSA	10
8	Male	63	Lung cancer	Bronchioloalveolar Carcinoma	Localized	Positive	Positive	Chest CT	3
9	Male	69	Lung cancer	Carcinoid	Localized	Positive	Positive	Chest CT	4
10	Female	66	Lung cancer	Squamous cell carcinoma	Localized	Positive	Positive	Chest CT	2
11	Male	71	Lung cancer	Alveolar cell carcinoma	Regional lymph node metastasis	Positive	Positive	Chest CT, CYFRA	1
12	Male	61	Lung cancer	Adenocarcinoma	Regional lymph node metastasis	Positive	Positive	Chest CT, CEA	3
13	Man	61	Colorectal cancer	Adenocarcinoma	Regional lymph node metastasis	Positive	Positive	FOBT	2
14	Female	39	Colorectal cancer	Adenocarcinoma	In situ	Positive	Positive		4
15	Male	66	Colorectal cancer	Adenocarcinoma	Localized	Positive	Positive	FOBT	2
16	Male	57	Colorectal cancer	Adenocarcinoma	Localized	Positive	Normal	FOBT	2
17	Male	58	Colorectal cancer	Adenocarcinoma	Localized	Positive	Normal	FOBT	2
18	Male	54	Thyroid cancer	Adenocarcinoma	Localized	Positive	Positive	Thyroid US	8
19	Female	61	Thyroid cancer	Adenocarcinoma	Adjacent organ involvement	Positive	Positive	Thyroid US	8
20	Male	49	Thyroid cancer	Adenocarcinoma	Adjacent organ involvement	Positive	Positive	Thyroid US	9
21	Female	66	Thyroid cancer	Adenocarcinoma	Regional lymph node metastasis	Positive	Normal	Thyroid US	4
22	Male	57	Thyroid cancer	Adenocarcinoma	Regional lymph node metastasis	Positive	Normal	Thyroid US	1
23	Female	52	Breast cancer	Ductal carcinoma	Distant metastasis	Positive	Positive	(no breast US examination), CEA	1
24	Female	61	Breast cancer	Ductal carcinoma	Localized	Positive	Positive		8
25	Male	75	Liver Cancer	Hepatocellular carcinoma	Unknown	Positive	Positive	Abdominal CT, US, AFP, CA19-9	5
26	Male	67	Liver Cancer	Hepatocellular carcinoma (mixed type)	Localized	Positive	Positive		6
27	Female	69	Liver Cancer	Hepatocellular carcinoma	Localized	Positive	Normal	Abdominal US, AFP	2
28	Female	69	Gall bladder cancer	Unknown	Unknown	Positive	Positive	Abdominal CT, US, CA19-9	3
29	Male	63	Gall bladder cancer	Adenocarcinoma	Localized	Negative	Normal		9
30	Male	61	Gastric cancer	Adenocarcinoma	Regional lymph node metastasis	Negative	Normal	Helicobacter pylori-antigen and Pepsinogen	4
31	Male	70	Gastric cancer	Adenocarcinoma	Localized	Negative	Normal	Helicobacter pylori-antigen and Pepsinogen	7
32	Male	71	Bladder cancer	Transitional cell carcinoma	Localized	Negative	Normal		8
33	Male	36	Testis cancer	Unknown	Unknown	Positive	Positive	Pelvic MRI	2