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Decision-tree sensitivity analysis for cost-effectiveness of whole-body FDG PET in the management of patients with non-small-cell lung carcinoma in Japan

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Background: Whole-body 2-fluoro-2-D-[^{18}F]deoxyglucose [FDG] positron emission tomography (WB-PET) may be more cost-effective than chest PET because WB-PET does not require conventional imaging (CI) for extrathoracic staging. ***Methods:*** The cost-effectiveness of WB-PET for the management of Japanese patients with non-small-cell lung carcinoma (NSCLC) was assessed. Decision-tree sensitivity analysis was designed, based on the two competing strategies of WB-PET vs. CI. WB-PET was assumed to have a sensitivity and specificity for detecting metastases, of 90% to 100% and CI of 80% to 90%. The prevalences of M1 disease were 34% and 20%. One thousand patients suspected of having NSCLC were simulated in each strategy. We surveyed the relevant literature for the choice of variables. Expected cost saving (CS) and expected life expectancy (LE) for NSCLC patients were calculated. ***Results:*** The WB-PET strategy yielded an expected CS of $951US to $1,493US per patient and an expected LE of minus 0.0246 years to minus 0.0136 years per patient for the 71.4% NSCLC and 34% M1 disease prevalence at our hospital. PET avoided unnecessary bronchoscopies and thoracotomies for incurable and benign diseases. Overall, the CS for each patient was $833US to $2,010US at NSCLC prevalences ranging from 10% to 90%. The LE of the WB-PET strategy was similar to that of the CI strategy. The CS and LE minimally varied in the two situations of 34% and 20% M1 disease prevalence. ***Conclusions:*** The introduction of a WB-PET strategy in place of CI for managing NSCLC patients is potentially cost-effective in Japan.

Key words: cost-benefit analysis, fluorine-18-deoxyglucose, emission-computed tomography, non-small-cell lung carcinoma, life expectancy

INTRODUCTION

LUNG CANCER CONTINUES to be a major health problem worldwide. The incidence and mortality of lung cancer are increasing, and lung cancer is the leading cause of cancer-related death in Japan as well as in other developed countries. Early stages of non-small-cell lung carcinoma (NSCLC) are surgically curable, but an accurate preoperative staging diagnosis is imperative to obviate unnecessary thoracotomies and reduce medical costs. Japan is now faced with the serious economic problem of spiraling health care costs, as in many Western European countries and the United States. Recent studies in the United States have demonstrated the potential cost-effectiveness of using 2-fluoro-2-D-[^{18}F]deoxyglucose-positron emission tomography (FDG PET) for the management of NSCLC.[1–6] Nevertheless, this finding is not necessarily true for Japanese hospitals because of the great difference between health care systems and medical costs in Japan and the United States.[7]

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In the aforementioned cost-effectiveness studies, the intrathoracic staging of NSCLC was evaluated by means of chest FDG PET. Whole-body FDG PET (WB-PET) is considered to be more cost-effective than chest FDG PET because functional or metabolic imaging with WB-PET can be used to avoid unnecessary morphologic images for extrathoracic staging.[8–11] If only 1 focus of distant metastases is detected by WB-PET in a patient with NSCLC, then further diagnostic studies for extrathoracic staging are unnecessary because the patient is at clinical Stage IV and is therefore not a candidate for a thoracotomy.

The aim of this study was to assess the cost-effectiveness of the WB-PET strategy for the management of Japanese patients suspected of having NSCLC. We used a decision-tree sensitivity analysis to rigorously evaluate the cost-effectiveness, based on the 2 competing strategies of WB-PET and conventional imaging (CI).

MATERIALS AND METHODS

The present study built upon and expanded the analysis performed in our previously published paper on the cost-effectiveness of chest FDG PET.[7] A WB-PET strategy that precisely models the dependence upon chest computed tomography (CT) and PET scans was added to the analysis. To determine the expected cost saving (CS) and expected gain in life expectancy (LE), a decision-tree analysis was designed[1,7,12] based on the 2 competing strategies of conventional imaging (CI) and WB-PET for selection of potential surgical candidates. The LE of the patients with benign disease, who were expected to achieve their full life expectancy, was based on our published data.[7]

CI for preoperative staging in patients suspected of having NSCLC means a combination of conventional examinations: abdominal CT with contrast, brain magnetic resonance imaging (MRI) with contrast, and whole-body skeletal scintigraphy.[13,14] This combination of examinations has been performed nationwide for the first staging for NSCLC patients. The CI strategy is usually adopted for pathologically confirmed NSCLC patients and indeterminate patients, except NSCLC patients with definite N3 and/or M1 on chest CT. The WB-PET strategy includes both chest FDG PET with a three-dimensional acquisition mode and whole-body FDG with a two-dimensional acquisition mode. In the WB-PET strategy WB-PET is usually performed when a differential diagnosis is required or for preoperative staging in patients suspected of having NSCLC, except NSCLC patients with definite N3 and/or M1 on chest CT. All patients who are only positive in chest FDG PET, therefore eventually receive a WB-PET examination in the WB-PET strategy, which has been recently introduced at approximately 30 hospitals in Japan. A simulation of one thousand patients suspected of having NSCLC (Stages I to IV) was created for each strategy with a decision-tree and baselines of other relevant variables (Figs. 1 and 2).

Chest CT was incorporated into the first stage of the

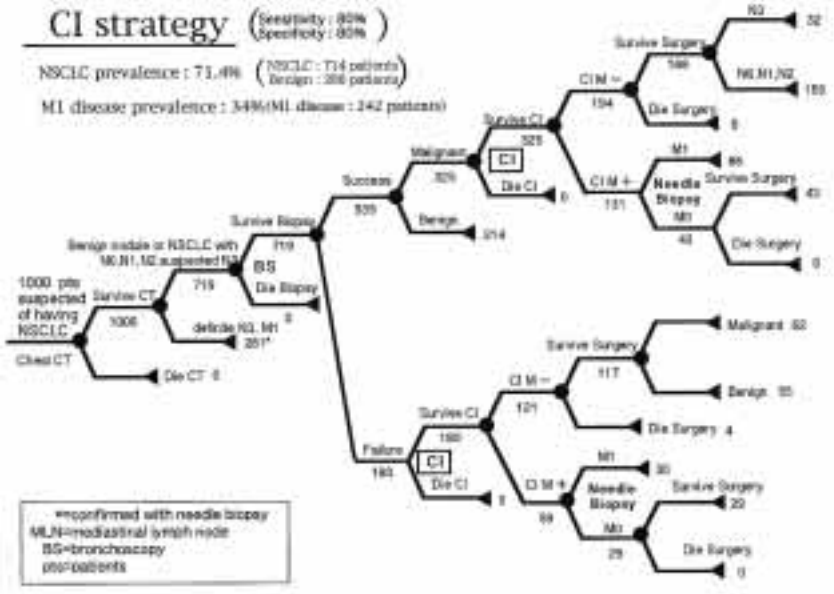

Fig. 1 Decision-tree for the CI (conventional imaging) strategy in a simulation of 1,000 patients with a solitary pulmonary nodule. The patients' group was assumed to have an NSCLC prevalence of 71.4% and an M1 disease prevalence of 34%. CI was assumed to have a sensitivity of 80% and a specificity of 80% for detecting metastatic foci. The "definite N3, M1" arm includes N2 disease patients, but does not include N0, N1 disease patients. The N2 disease patients in that group are those with more advanced N2 lesions characterized by metastatic involvement of high paratracheal lymph node groups, fixed lymph nodes, and multilevel involvement. Therefore, they are not candidates for curative surgery.

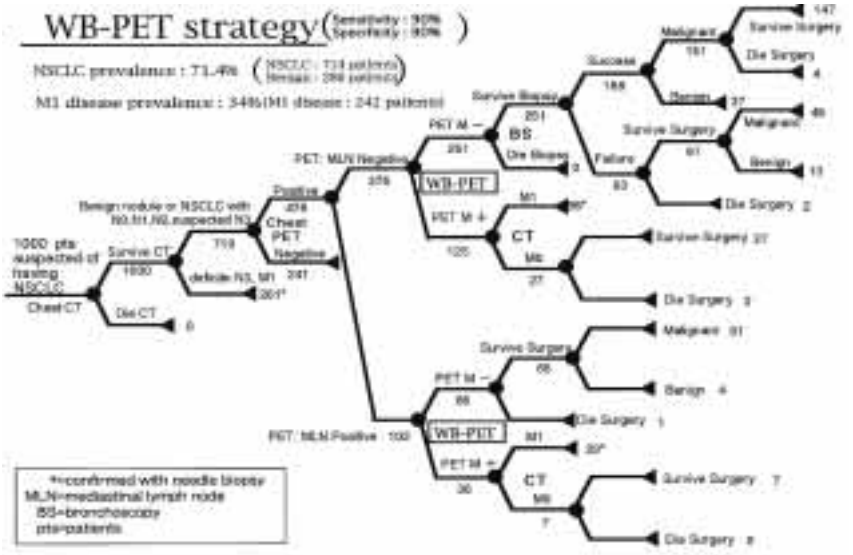

Fig. 2 Decision-tree for the WB-PET (whole-body FDG PET) strategy in a simulation of 1,000 patients with a solitary pulmonary nodule. The patients' group was assumed to have an NSCLC prevalence of 71.4% and an M1 disease prevalence of 34%. WB-PET was assumed to have a sensitivity of 90% and a specificity of 90% for detecting metastatic foci. The "definite N3, M1" arm includes N2 disease patients, but does not include N0, N1 disease patients. The N2 disease patients in that group are those with more advanced N2 lesions characterized by metastatic involvement of high paratracheal lymph node groups, fixed lymph nodes, and multilevel involvement. Therefore, they are not candidates for curative surgery.

decision-trees for each strategy because chest CT is now a required examination for the diagnostic workup of lung cancer. In fact, most patients suspected of having NSCLC have undergone a chest CT at a local hospital or clinic before visiting a cancer institution or university hospital. Mediastinoscopy was not incorporated in each strategy. In general, respiratory physicians and thoracic surgeons in Japanese hospitals do not perform a mediastinoscopy, or are performing it less often in patients with NSCLC.

Sensitivities and specificities of diagnostic methods, mortalities, life expectancies, and costs were cited from published data (Table 1). The prevalence (pretest likelihood) of distant metastasis (M1 disease) and the success rate of transbronchial lung biopsy (TBLB) were adopted in 34% and 75.0%, respectively.[7] These variables were obtained from the results over a recent one-year period at our hospital, that is, 57 of the 169 first diagnosed NSCLC patients had distant metastasis. In our concern about low prevalence of M1 disease, the 20% prevalence strategy was also assessed as opposed to the high prevalence of 34%. The prevalence of NSCLC varied within a reasonable range, but the prevalence of distant diseases and the success rate of TBLB were fixed for both decision-tree analyses. The exact probability of each outcome in the decision trees was calculated according to the Bayesian theory.[15]

The cost in Japanese yen was based on the bills of outpatients and inpatients at our hospital between April 1998 and March 1999. The average costs are listed on Table 1. The cost of an outpatient examination includes the costs of laboratory tests, chest radiographs, electrocardiography, and so forth. The costs of thoracotomies include the costs of standard lobectomy, lymphadenectomy, anesthesia, antibiotic chemotherapy, pre- and postoperative examinations, and hospital charge, and so on. Depreciation of the positron camera cost, personnel expenses and overhead costs were not taken into account, although the first two items are estimated to be approximately 20,000 yen per examination in Japan.[43] The cost in US dollars was calculated at a yen-dollar conversion rate of 120 yen to one US dollar.

Sensitivity analysis

The accuracy of CI and WB-PET in detecting distant metastatic foci has not been well documented, even though these values may have a great influence on the clinical setting and vary from institution to institution.[10,11,39,40] The prevalence of NSCLC can also vary according to the institution. Therefore, sensitivity analyses to determine the influence of NSCLC prevalence values on the CS and gain in LE were performed for the CI strategy versus the WB-PET strategy. Referring to the published literature,[10,11,39,40] WB-PET was assumed to have a sensitivity and specificity of 90% to 100% for detecting metastatic foci and CI of 80% to 90% on a patient-by-patient basis (not a focus-by-focus basis). In these analyses, an NSCLC

Table 1 Baseline of all relevant variables used in the decision trees

Variables	Baseline	Range	References
Lung cancer			
Prevalence (%)	10–90*	51–71.4	7, 16–19
PET sensitivity (%)	96.3	89–100	20–29
PET specificity (%)	78.6	52–92	20–29
Mediastinal lymph nodes			
Prevalence (%)	31.0	28–38	30–36
CT sensitivity (%)	67.0	61–73	30–34
CT specificity (%)	73.0	62–86	30–34
PET sensitivity (%)	90.0	79–100	35–38
PET specificity (%)	91.0	81–100	35–38
Distant Metastasis			
Prevalence (%)	20, 34	27–60	10, 39, 40
PET sensitivity (%)	90–100*	91–100	10, 11, 40
PET specificity (%)	90–100*	94.3–98	10, 11, 40
CI sensitivity (%)	80–90*	80–82.1#	10, 11, 40
CI specificity (%)	80–90*	88.6#–89	10, 11, 40
Success rate of biopsy			
Bronchoscopy	75.0		7
Mortality (%)			
PET	0	0–1	1, 2, 7
CT	0.0025	0–1	1, 2, 7
Thoracotomy	3.0	0–20	1, 2, 7
Life Expectancy (yr)			
NSCLC			
Surgical cure	7.0	1–15	1, 2, 7
Follow-up in pts with surgically curable ca.	1.0	0.2–2	1, 2, 7
Radiotherapy in pts with surgically curable ca.	2.0		1, 2, 7
Irradiation/surgery in N3 pts without M	1.5	0.1–2	1, 2, 7, 41
Follow-up in N3 pts	0.5		1, 2, 42
Follow-up/irradiation/surgery in pts with M	0.5		1, 2, 42
Benign disease	28.2		7
Costs			
Bronchofiberscopy	¥74,150	($618US)	
Thoracotomy (malignant)	¥2,234,420	($18,620US)	
Thoracotomy (benign)	¥1,025,240	($8,544US)	
Skeletal scan	¥54,180	($452US)	
Brain MRI with C	¥35,370	($295US)	
Abdominal CT with C	¥41,200	($343US)	
Whole-body PET	¥129,000	($1,075US)	
Laboratory tests	¥34,280	($286US)	
Needle Biopsy	¥24,280	($202US)	

* = sensitivity analysis was performed.
CI = conventional imagings: skeletal scintigraphy plus brain MRI with contrast plus abdominal CT with contrast
# = Brain metastasis is not included.
ca. = cancer, pts = patients, M = metastasis, C = contrast medium

prevalence of 71.4% was highlighted because our hospital has a prevalence equal to this value. We calculated the net costs devoid of the costs of radiotherapy and chemotherapy.

RESULTS

Figures 3 and 4 show the sensitivity analysis for NSCLC prevalences, ranging from 10% to 90% on the expected overall costs for the CI strategy and the WB-PET strategy. The expected overall costs increase as prevalence increases, because the numbers of thoracotomies for curable disease and the numbers of CI and PET studies increase. Thoracotomy for NSCLC is very costly ($18,620US), and is a principal factor in the rising costs. By using the WB-PET strategy instead of the CI strategy for the management of NSCLC patients in hospitals with a NSCLC prevalence of 10%, the CS for each patient would be from $1,837US to $2,010US for M1 prevalence of 34% (Appendix, Fig. 3), and from $1,852US to

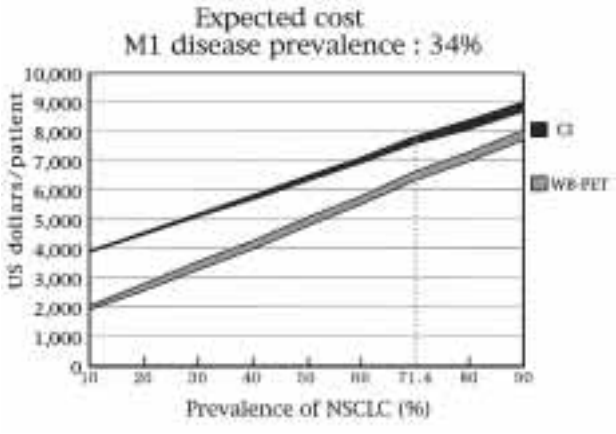

Fig. 3 Results of the sensitivity analysis for NSCLC prevalence values ranging from 10% to 90% on the expected overall cost savings per patient enabled by the CI strategy vs. the WB-PET strategy, when a prevalence of M1 disease is 34%.

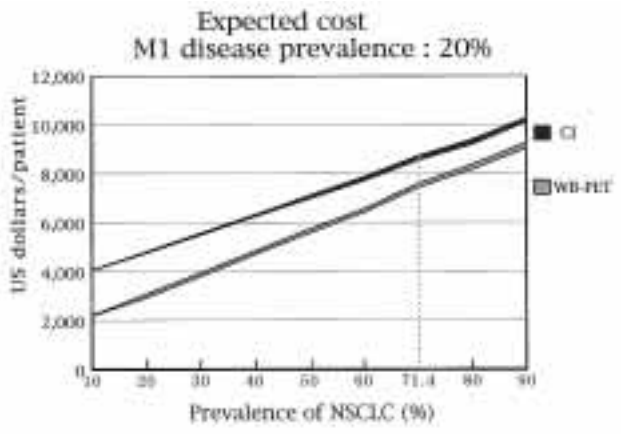

Fig. 4 Results of the sensitivity analysis for NSCLC prevalence values ranging from 10% to 90% on the expected overall cost savings per patient enabled by the CI strategy vs. the WB-PET strategy, when a prevalence of M1 disease is 20%.

Table 2 The numbers of CI, PET, bronchoscopy, and unnecessary thoracotomy for the M1 disease prevalence of 20% and 34% in the CI vs. WB-PET strategy

Prevalence	CI strategy			WB-PET strategy		
	CI	Bronchoscopy	Unnecessary thoracotomy	PET	Bronchoscopy	Unnecessary thoracotomy
10%	285	955–959	234–236	251	186–212	68–84
20%	320	914–919	217–221	287	197–228	67–86
30%	357	877–881	191–207	325	207–244	66–85
40%	392	837–841	185–192	361	218–259	67–86
50%	428	798–803	170–178	399	228–276	68–87
60%	463	758–762	155–164	436	240–295	65–86
71.4%	505	714–718	132–147	478	251–313	67–89
80%	535	680–684	118–135	510	262–327	65–88
90%	570	640–644	103–121	546	273–344	66–89

$1,875US for M1 prevalence of 20% (Fig. 4), but the CS gradually decreases as the NSCLC prevalence increases. In our hospital with a NSCLC prevalence of 71.4%, the CS for each patient would be from $951US to $1,493US for an M1 prevalence of 34%, and $958US to $1,295US for an M1 prevalence of 20%. Overall, the CS for each patient was $833US to $2,010US at NSCLC prevalences ranging from 10% to 90% and M1 disease prevalences of 34% and 20%.

Table 2 shows the numbers of CI, WB-PET procedures, bronchoscopies and unnecessary thoracotomies for benign and incurable diseases that occurred for M1 disease prevalences of 20% and 34%. WB-PET would therefore enable unnecessary bronchoscopies to be avoided, with a reduction rate of approximately 18% to 53%. The reduction in unnecessary bronchoscopies would in turn lower the prevalence. WB-PET would also reduce the number of unnecessary thoracotomies by 29% to 86%. The number of unnecessary thoracotomies would gradually

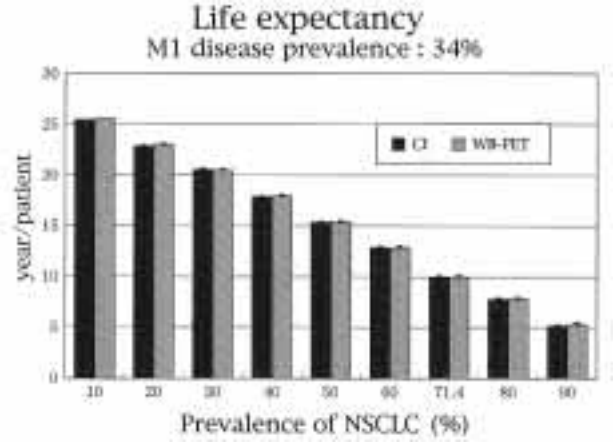

Fig. 5 Results of the sensitivity analysis for NSCLC prevalence values ranging from 10% to 90% on the overall life expectancy per patient in all patients for the CI strategy vs. the WB-PET strategy, when a prevalence of M1 disease is 34%.

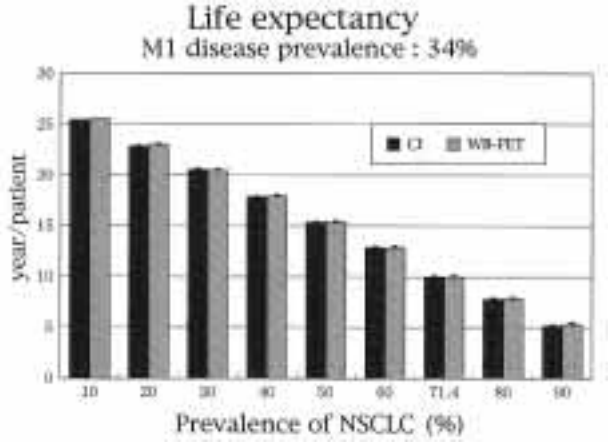

Fig. 6 Results of the sensitivity analysis for NSCLC prevalence values ranging from 10% to 90% on the overall life expectancy per patient in all patients for the CI strategy vs. the WB-PET strategy, when a prevalence of M1 disease is 20%.

decrease as the number of thoracotomies for curable diseases increased at higher prevalence values.

The introduction of the WG-PET strategy in place of the CI strategy yielded LE gain at NSCLC prevalences of 60% or less for 34% and 20% prevalence of M1 disease, respectively (Figs. 5 and 6). A small loss of life was observed in the WB-PET strategy at NSCLC prevalences of 60% or more. For an NSCLC prevalence of 71.4%, the gain in LE would be from minus 0.0246 years to minus 0.0136 years per patient for an M1 disease prevalence of 34%, and from minus 0.0236 years to minus 0.0174 years for an M1 disease prevalence of 20%.

DISCUSSION

Even though several new therapies for lung cancer are appearing, the fundamental principle of managing of patients with pathologically confirmed NSCLC is to assess whether or not the patient is a surgical candidate. A majority of patients with Stage IIIA or less NSCLC who undergo surgical treatment have a favorable chance of survival. Nearly all NSCLC patients who are Stage IV patients (M1 disease), Stage IIIB, including N3 and/or T4, and some patients with Stage IIIA are not surgical candidates and have an unfavorable prognosis. Extrathoracic staging before the surgical treatment of patients with NSCLC is therefore of extreme importance. The extent of thoracic disease is not a reliable indicator of extrathoracic metastases; 25% of patients with no intrathoracic adenopathy have been shown to have extrathoracic metastases.[44] Recently, small adenocarcinomas, such as localized bronchioalveolar carcinoma and atypical adenomatous hyperplasia, have been detected by mass screening for lung cancer with spiral CT. They are at an early stage or a premalignant state of lung cancer, and have no metastasis.[45] Patients with small adenocarcinoma are a possible exception to the policy of extrathoracic staging. Transbronchial lung biopsy was adopted for pathological diagnosis in our scenario. CT guided transthoracic needle biopsy is an accurate and sensitive procedure for diagnosing malignancy, but pneumothorax remains the most frequent complication and requires hospitalization.[46] Multidetector-row CT (MDCT) may be superior in the depiction and diagnosis of pulmonary nodules as compared to axial standard CT. MDCT has the potential to avoid biopsy in patients with early stage pulmonary adenocarcinoma in the near future.

Radiologic staging in patients with lung cancer is now pursued with a combination of studies that usually include brain MRI with contrast medium, abdominal CT with contrast medium, and skeletal scintigraphy for extrathoracic imaging.[13,14,44,47] Anatomical imaging, however, does not always enable an accurate assessment of the extent of the disease. No single method provides all of the requisite information. Some investigators have reported that metabolic WB-PET examinations are superior to a combination of morphological imagings for staging lung cancer.[8–11] As nuclear medicine specialists, the authors believe that metabolic imaging is on the way to overtaking anatomical imaging as the first step in diagnosing many forms of cancer.

No reports on the cost-effectiveness of WB-PET for the management of NSCLC patients have been made, probably because only a few documents comparing the accuracy of WB-PET and CI in detecting distant NSCLC metastases are available. The reason for this is that a histological confirmation of all positive WB-PET findings is neither practically nor ethically feasible. Furthermore, microscopic or submacroscopic metastases are beyond the resolution capability of any macroscopic imaging method. Such inaccuracy is inevitable in imaging methods. WB-PET is, however, the most accurate and reliable method for detecting metastatic foci out of all imaging methods if accuracy is assessed on a patient-by-patient basis,[8–11,40] with a single exception. Post-contrast brain MRI has a slightly higher accuracy than WB-PET in detecting cerebral metastasis, if accuracy is assessed on a lesion-by-lesion basis.[11]

Compared to CI, WB-PET effectively reduces the management costs of NSCLC patients in the United States because WB-PET avoids unnecessary series of conventional imaging examinations.[48] But this assessment is not necessarily true in Japan because of the large difference in health care systems and medical costs.

In our current study, the strategy is either WB-PET, cost $1,075US, or CI, which encompasses a brain MRI, abdominal CT, and skeletal scan, total cost $1,090US. The CS for choosing the FDG-PET strategy was from $833US to $2,010US at NSCLC prevalences ranging from 10% to 90% and M1 disease prevalences of 34% and 20%. The WB-PET strategy has higher overall sensitivity and specificity than the CI strategy. Negative results in a

chest PET study would avoid bronchoscopy (cost $618US) and unnecessary thoracotomy for benign disease (cost $8,544US). Identification of M1 disease by a WB-PET study would also avoid thoracotomy for incurable disease (cost $18,620US).

The cost-effectiveness of WB-PET for the management of NSCLC patients depended upon the NSCLC prevalence, as shown in a previously published document on the cost-effectiveness of chest FDG PET for intrathoracic NSCLC staging.[7] The CS gradually decreased as the NSCLC prevalence increased because thoracotomy for curable disease increased. The costs of hospitalization, including surgical costs, are relatively high in Japan. The ratio of surgical costs to WB-PET cost is an important factor, with the cost-effectiveness of WB-PET increasing as the cost ratio increases. The LE of the WB-PET strategy was longer than that of the CI strategy at the lower NSCLC prevalence, but a minimal LE decrease was observed at the higher NSCLC prevalence. This can be explained by the fact that there were a few NSCLC patients in the chest PET arm group (241 patients on Fig. 2), who were classified as negative. The above group must be placed on a regular schedule and be judiciously followed up for the rest of their life. Immediate treatment would be needed whenever sequential chest radiographs exhibit aggravation of the findings. Overall, introduction of the WB-PET strategy would be more cost-effective, because the WB-PET strategy did not involve a definite loss of LE as compared to the alternate CI strategy. Cost-effectiveness analyses are always based on user-specific factors and reimbursed costs. They are only valid temporarily, because a new national insurance reimbursement system has recently been introduced in Japan. In our series, however, cost-saving was principally achieved by eliminating bronchoscopy and unnecessary thoracotomy.

The gain in LE would increase as the proportion of NSCLC patients with Stage IIIA or less increases. The level of patient anxiety with regard to surgical procedures and complications such as postoperative infections, were not taken into account in the current study. Further studies that employ quality-adjusted life-years instead of gain in LE may prove to be a more useful method for evaluating cost-benefit.

Overhead costs, depreciation of the positron camera cost, and personnel expenses were not taken into account in the present study. We also assumed that equipment for WB-PET examinations was readily available. Calculating the exact overhead costs, such as patient's loss of income and traveling expenses, is very difficult, and such cost analyses are beyond the scope of the current study. Overhead costs, depreciation of the positron camera cost, and personnel expenses would be negligible in a cost-effectiveness analysis designed to determine the difference in total costs and the difference in health outcomes between one intervention and an alternative.[49,50]

Our study may be criticized for not applying discounting of costs and LE. Our simulation models, however, are not screening tests but the two competing strategies of a new WB-PET and ongoing CI study for patients suspected of having NSCLC. Discounting or opportunity money costs would be negligible in our study.

Attaining a gain in both LE and CS for higher NSCLC prevalences may be impossible in actual clinical settings, but the final goal of the health-care system is not "cost-containment," but the maintenance of health while containing health-care costs to a reasonable level. WB-PET examination can improve both intra- and extrathoracic NSCLC staging, provided that the accuracy of WB-PET is superior to that of CI (90% to 100% vs. 80% to 90%). For the 71.4% NSCLC and 34% M1 disease prevalence, an expected LE was from minus 0.0246 years to minus 0.0136 years per patient. In other words, NSCLC patients seen at our hospital live an extra –0.0246 years to –0.0136 years each for a saving of $951 to $1,493 US per patient. We can put these in terms that are more familiar to those responsible for medical budgets. These results mean that the overall annual net saving to the Japanese health-care system would be from $35.7 million to $56.0 million for a range of 510 years to 922.5 years of life loss, assuming that of the 50,000 lung cancer patients who die in Japan every year, 75% are NSCLC patients.[6]

Last but not least, abdominal CT with contrast might be unnecessary because chest CT often also includes the upper abdomen. Routine bone scans might also be unnecessary in metastatic workups in asymptomatic patients. Because of the high glucose uptake by the normal brain and the small size of metastases in general, the sensitivity of WB-PET for detecting brain metastases is not very high. Therefore, the use of WB-PET for the staging of NSCLC is expected to be somewhat limited and to remain economically variable in Japan where there are many choices of strategies to choose from. Nonetheless, it is very important to assess the cost-effectiveness of newly introduced PET strategies in each country, and it is unlikely that the strategies described in this paper, which represent the pattern of practice in Japan, will be applicable in other countries.

In conclusion, the present study quantitatively showed that WB-PET in place of CI for managing NSCLC patients would be potentially cost-effective in Japan.

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APPENDIX

Calculation of cost (1000 patients suspected of having NSCLC)

- CI strategy with 80% CI sensitivity and 80% CI specificity for M1 disease, 34% M1 disease preva-

lence, and 10% NSCLC prevalence.
¥2234420 × 44 (thoracotomy, malignant) + ¥1025240 × 225 (thoracotomy, benign) + ¥74150 × 960 (bronchofiberscopy) + ¥130750 × 285 (CI) + ¥34280 × 1000 (laboratory test) + ¥24200 × 69 (needle biopsy) = ¥473391030 = $3944US/patient

w CI strategy with 90% CI sensitivity and 90% CI specificity for M1 disease, 34% M1 disease prevalence, and 10% NSCLC prevalence.
¥2234420 × 42 (thoracotomy, malignant) + ¥1025240 × 225 (thoracotomy, benign) + ¥74150 × 960 (bronchofiberscopy) + ¥130750 × 285 (CI) + ¥34280 × 1000 (laboratory test) + ¥24200 × 44 (needle biopsy) = ¥468317190 = $3902US/patient

e PET strategy with 90% WB-PET sensitivity and 90% WB-PET specificity for M1 disease, 34% M1 disease prevalence, and 10% NSCLC prevalence.
¥2234420 × 40 (thoracotomy, malignant) + ¥1025240 × 75 (thoracotomy, benign) + ¥74150 × 186 (bronchofiberscopy) + ¥129000 × 251 (WB-PET) + ¥34280 × 1000 (laboratory test) + ¥26620 × 42 (CT) = ¥247838740 = $2065US/patient

r PET strategy with 100% WB-PET sensitivity and 100% WB-PET specificity for M1 disease, 34% M1 disease prevalence, and 10% NSCLC prevalence.
¥2234420 × 39 (thoracotomy, malignant) + ¥1025240 × 61 (thoracotomy, benign) + ¥74150 × 206 (bronchofiberscopy) + ¥129000 × 251 (WB-PET) + ¥34280 × 1000 (laboratory test) + ¥24200 × 69 (CT) = ¥232121700 = $1934US/patient

From the results of q , w , e and r , the cost saving for each patient is from $1837US to $2010US for M1 disease prevalence of 34% when CI is replaced by WB-PET for the management of NSCLC patients in hospitals with a NSCLC prevalence of 10%.

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