

ORIGINAL ARTICLE

Nation-Wide Korean Breast Cancer Data from 2008 Using the Breast Cancer Registration Program

Yong Sik Jung, Kuk Young Na, Ku Sang Kim, Sei-Hyun Ahn¹, Soo-Joong Lee², Heung Kyu Park³, Young Up Cho⁴

Department of Surgery, Ajou University School of Medicine, Suwon; ¹Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul; ²Department of Surgery, Yeungnam University College of Medicine, Daegu; ³Department of Surgery, Gachon University of Medical and Science, Incheon; ⁴Department of Surgery, Inha University College of Medicine, Incheon, Korea

Purpose: Since 1996, the Korean Breast Cancer Society has collected nation-wide breast cancer data and analyzed the data using their online registration program biannually. The purpose of this study was to evaluate the characteristics of Korean breast cancer from 2008 and examine chronological based patterns. **Methods:** Data were collected from 38 medical schools (67 hospitals), 20 general hospitals, and 10 private clinics. The data on the total number, gender, and age distribution were collected through a questionnaire as well as other detailed data analyzed via the online registration program. **Results:** In 2008, there were 13,908 patients who were newly diagnosed with breast cancer. The crude incidence rate of female breast cancer was 57.3 among 100,000 and the median age was 49 years. The age distribution had not

changed since the initial survey; however the proportion of post-menopausal patients had increased and median age was older than the past. In staging distribution, the proportion of early breast cancer (stage 0, I) was 47.2% with, breast-conserving surgery performed in 58% and mastectomy in 39.5%. **Conclusion:** Compared to past data, the incidence of breast cancer in Korea continues to rise. Furthermore, the proportion of those detected by screening and breast conservation surgery has increased remarkably. To understand the patterns of Korean breast cancer, the nation-wide data should continuously investigated.

Key Words: Breast neoplasms, Korea, Online system, Registries

INTRODUCTION

For the first time in 1998, the Korean Breast Cancer Society (KBCS) began a national status investigation to establish elementary resources regarding breast cancer in Korea for year 1996. Since data was provided for 1997 and 1998, such investigations have been conducted every two years, and the characteristics and changing trends of breast cancer in Korea have been made public [1-6]. Also, the KBCS developed a web-based breast cancer registration program in 2001 and they have utilized it for a cancer registration project ever since. Using such a program, data have been collected and a national database established, through which various studies examining the characteristics and changing patterns of breast cancers in Koreans have been performed.

This study investigated the status and characteristics of breast

cancer patients in Korea in 2008, and compared these results to those from 1996 and also to those internationally.

METHODS

The number of patients, ages, and genders at each hospital were surveyed in order to determine the total number of patients who had been newly diagnosed with breast cancer and treated throughout Korea from January 1st, 2008 to December 31st, 2008.

The authors carried out a survey targeting 41 medical schools, general hospitals that had been designated as surgeon training hospitals by the Korean Surgical Society, and private hospitals and clinics specializing in breast disease. A questionnaire which was composed of the total number of patients, gender, and age group was forwarded to the physicians from each hospital.

Thirty-eight of the 41 medical schools (67 hospitals), 20 of the general hospitals, and 10 of the private hospitals and special clinics participated in the survey, totaling 97 hospitals and clinics.

Detailed information other than that relating to the number of patients, age, and gender distributions were obtained from

Correspondence: Yong Sik Jung

Department of Surgery, Ajou University School of Medicine, San 5 Woncheon-dong, Yeongtong-gu, Suwon 443-721, Korea
Tel: +82-31-219-5200, Fax: +82-31-219-5755
E-mail: drjys@ajou.ac.kr

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the 2008 resources from the KBCS's breast cancer registration program. The items analyzed through the registration program included resources such as risk factors, clinical symptoms and physical findings, test findings (confirmation method of cancer diagnosis, pre-surgical blood test findings), surgical findings (surgery method, stage differentiation), pathological findings (stage, histological categorization, TNM stage, hormone receptor, HER2) among others. The analysis target for crude incidence, age, and gender distribution was 13,908 patients who had been treated for breast cancer in 2008. Other analyses were performed using the population from the online registration program. The number of patients analyzed was different depending on each item.

Using the StatXact® 9th version (Cytel Inc., Cambridge, USA) program, The Cochran Armitage test was done to assess trends related to changing patterns in menopausal status, clinical manifestations, and histologic types. A *p*-values of less than 0.05 were considered statistically significant.

RESULTS

Head count, gender, and age distribution

The number of breast cancer patients who had been newly diagnosed in 2008 was 13,908 (Table 1). According to the type of hospitals, university hospitals were involved in 11,570 cases (83.2%), general hospitals in 1,632 (11.7%), and private clinics in 706 patients (5.1%). The youngest among the patients was 13 years old, and the oldest was 92 years old, with a median age of 49 years. The age distribution of female patients was the highest in the 40s with 5,529 (39.8%), followed by the 50s with 3,703 (26.7%), and the 30s and 60s. The number of male breast cancer patients was 49 (0.4%), with the 60s as the highest (*n* = 17), followed by 50s (Table 1).

Table 1. Age distribution

	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-	Total (%)
Female	9	198	1,850	5,529	3,703	1,826	643	101	13,859 (99.6)
Male	0	0	7	5	10	17	7	3	49 (0.4)
Total	9	198	1,857	5,534	3,713	1,843	650	104	13,908 (100)
%	0.1	1.4	13.4	39.8	26.7	13.2	4.7	0.7	100.0

Table 3. Risk factors

	Age of menarche No. (%)	Age of menopause No. (%)	Age of first delivery No. (%)	Obesity (BMI) No. (%)	Family history No. (%)	Marriage No. (%)	Breast feeding No. (%)				
≤13	1,171 (18.9)	≤49	923 (43.2)	≤19	111 (2.1)	<20	878 (11.9)	Yes	535 (7.7)	6,929 (94.7)	4,348 (70.2)
14-20	5,009 (80.8)	50-54	1,002 (46.9)	20-24	1,583 (29.4)	20-25	4,356 (59.1)	No	6,419 (92.3)	384 (5.3)	1,844 (29.8)
>20	21 (0.3)	≥55	213 (9.9)	25-29	2,859 (53.2)	25-30	1,827 (24.8)				
			≥30	825 (15.3)	>30	311 (4.2)					
Total	6,201 (100)	2,138 (100)	5,378 (100)	7,372 (100)	6,954 (100)	7,313 (100)	6,192 (100)				

Clinical symptoms and physical findings

On examination of the symptoms of 6,672 patients registered in the online registration program in 2008, painless lump was found to be the highest with 3,526 cases (52.8%), followed by a lump with pain in 4.9%, and nipple discharge in 3.0%. The number of patients uncovered through regular screening was 2,179 (32.6%) (Table 2).

Risk factors

Patients who experienced menarche before 13 years of age comprised 18.9% of those registered in the online registration program, and those who experienced menopause after 55 years of age were 9.9%. The proportion of unmarried patients was 5.3%, those with first childbirth before 30 years of age 15.3%, and those breast feeding 70.2%, those who were overweight with body mass index (BMI) over 25 comprised 29%, and those with a family history compared 7.7% (Table 3).

Diagnostic methods

The most popular method used to confirm the diagnosis of breast cancer was fine needle aspiration which was done in 49.4% of cases; 42.2% of patients who had been diagnosed with

Table 2. Clinical manifestations

Symptoms	No. (%)
No symptom, detected on screening	2,179 (32.6)
Painless lump	3,526 (52.8)
Painful lump	326 (4.9)
Nipple discharge	203 (3.0)
Axillary mass	57 (0.9)
Skin change, retraction	64 (1.0)
Breast pain, discomfort	128 (1.9)
Nipple retraction	119 (1.8)
Others	70 (1.1)
Total	6,672 (100.0)

ultrasound-guided fine needle aspiration, and 7.2% of those who had been diagnosed without the use of ultrasound (Table 4). The diagnosis of 34.6% of patients was confirmed through core needle biopsy, and through excisional biopsy in 9.3%.

Surgery and staging

Among 7,195 patients whose surgical methods could be confirmed, lumpectomy with axillary lymph node dissection was the most common with 2,791 cases (38.8%), followed by modified radical mastectomy with 2,579 cases (35.8%) (Table 5). Breast conservation surgery, including segmentectomy and quadrantectomy in lumpectomy, was performed in 4,079 cases (58%), which was significantly higher than mastectomy (39.5%), implying that it was more frequently used. The number of patients whose stage could be classified was 7,206, 34.8% of whom were at stage I and the highest, followed by IIa at 25.4%, stage 0 at 12.3%, IIb at 11.0%, and IIIa at 8.6% (Table 6).

With respect to surgical method per stage, 59.0%, 70.9%, and 59.3% of stages 0, I, and II, respectively, involved breast conservation surgery, which was conducted in 44.4% of stage III cases as well, confirming that the breast conservation surgery is widely used for advanced breast cancer as well (Table 7).

Table 4. Preoperative diagnostic methods

Methods	Patients No. (%)
Fine needle aspiration	469 (7.2)
Excisional biopsy	602 (9.3)
Core needle biopsy	2,250 (34.6)
Incisional biopsy	71 (1.1)
USG guided biopsy (FNA)	2,744 (42.2)
Wire localization biopsy	57 (0.9)
Stereotactic biopsy	24 (0.4)
Frozen biopsy	239 (3.7)
Etc.	46 (0.7)
Total	6,502 (100.0)

USG = ultrasonography; FNA = fine needle aspiration.

Table 5. Operation methods

Methods	No. (%)
Extended radical mastectomy	3 (0.1)
Radical mastectomy	27 (0.4)
Modified radical mastectomy	2,579 (35.8)
Simple mastectomy	232 (3.2)
Segmentectomy (lumpectomy)	396 (5.5)
Quadrantectomy with ALD	892 (12.4)
Lumpectomy with ALD	2,791 (38.8)
Biopsy	93 (1.3)
Etc.	182 (2.5)
Total	7,195 (100.0)

ALD = axillary node dissection.

Pathology

Among 6,659 patients whose pathologic results could be confirmed, invasive ductal carcinoma was the most common with 5,616 cases (84.3%), followed by ductal carcinoma *in situ* (DCIS) in 790 (11.9%), and invasive lobular carcinoma in 151 (2.3%) (Table 8). Classified according to the World Health Organization (WHO), invasive ductal carcinoma NOS was the most popular with 4,597 cases (85%), followed by invasive ductal carcinoma with an intraductal predominant type with 268 (5.0%), mucinous carcinoma with 176 (3.3%), papillary carcinoma with 88 (1.6%), tubular carcinoma with 85 (1.6%), and medullary carcinoma with 46 (0.9%). The number of patients whose tumor size could be confirmed was 7,206, 46.9% of whom were at T1 being the highest, followed by T2 at 33.9%, Tis at 12.2%,

Table 6. AJCC staging

Stage	No. (%)
0	882 (12.2)
I	2,475 (34.3)
IIA	1,807 (25.1)
IIB	781 (10.8)
IIIA	614 (8.5)
IIIB	69 (1.0)
IIIC	366 (5.1)
IV	126 (1.7)
Others	18 (0.2)
Unknown	68 (0.9)
Total	7,206 (100.0)

AJCC = American Joint Committee on Cancer.

Table 7. Operation methods according to the stage

	Mastectomy	BCO	Biopsy, etc.
Stage 0	274 (31.1)	521 (59.0)	87 (9.9)
Stage I	658 (26.6)	1,755 (70.9)	62 (2.5)
Stage II	1,009 (39.0)	1,535 (59.3)	44 (1.7)
Stage III	573 (54.6)	466 (44.4)	10 (1.0)
Stage IV	74 (58.7)	50 (40.0)	2 (1.3)

BCO = breast conserving operation.

All values represent number (%).

Table 8. Histologic type

Histologic	No. (%)
Ductal carcinoma <i>in situ</i>	790 (11.9)
Invasive ductal carcinoma	5,616 (84.3)
Lobular carcinoma <i>in situ</i>	20 (0.3)
Invasive lobular carcinoma	151 (2.3)
Paget's disease (pure form)	4 (0.1)
Malignant phyllodes tumor	19 (0.3)
Lymphoma	3 (0.0)
Sarcoma	4 (0.1)
Others	49 (0.7)
Total	6,659 (100.0)

T3 at 4.4%, and T4 at 2.2% (Table 9).

For nodal staging, N0 was the most common with 4,604 cases (64.7%), followed by N1 with 1,528 (21.5%), N2 with 574 (8.1%), and N3 with 412 (5.8%) (Table 10).

Biological marker

The proportions of estrogen and progesterone receptor expression were 66.9% and 59.5%. For the expression of c-erbB2, immunohistochemically negative cases were 52.2%, 1+ 16.6%, 2+ 11.5%, and 3+ 19.7% (Table 11). According to the immunohistochemical stain for p53, negative cases were 53.3%, 1+ 19.8%, 2+ 7.8%, and 3+ 18.4% (Table 11).

Changing patterns of Korean breast cancer by year

Since 1996 when the KBCS announced the occurrence of

Table 9. TNM staging of tumor

T staging	No. (%)
T0	34 (0.5)
Tis	867 (12.2)
T1	3,346 (46.9)
T2	2,417 (33.9)
T3	311 (4.4)
T4	160 (2.2)
Tx	53
Others	18
Total	7,206 (100.0)

Table 10. TNM staging of lymph node

N staging	No. (%)
N0	4,604 (63.9)
N1	1,528 (21.2)
N2	574 (8.0)
N3	412 (5.7)
Nx	88 (1.2)
Total	7,206 (100.0)

Table 11. Biological marker

	ER, No. (%)	PR, No. (%)
Negative	2,177 (33.0)	2,657 (40.3)
Positive	4,417 (66.9)	3,929 (59.5)
Unknown	9 (0.1)	12 (0.2)
Total	6,603 (100.0)	6,598 (100.0)
	p53, No. (%)	c-erbB2, No. (%)
Negative	2,810 (53.3)	3,402 (52.2)
Weak (1+)	1,045 (19.8)	1,083 (16.6)
Intermediate (2+)	410 (7.8)	754 (11.5)
Strong (3+)	971 (18.4)	1,291 (19.7)
Unknown	34 (0.6)	12 (0.2)
Total	5,270 (100.0)	6,542 (100.0)

ER=estrogen receptor; PR=progesterone receptor.

breast cancer patients, the annual occurrence has continuously increased. The number of breast cancer patients in 2008 was 13,908, which had increased by 23.4% from 11,275 in 2006, and was about 3.7 times greater than the number in 1996 (Figure 1). Calculation of the crude incidence rate of Korean female breast cancer cases in 2008, including carcinoma *in situ* yielded 57.3 per 100,000, showing a significant increase from 46.8 in 2006. Among all breast cancers, infiltrating cancer showed 50.2 per 100,000, and carcinoma *in situ* 7.1 per 100,000, thus confirming that the crude incidence rate was increasing for both (Figure 2).

The age specific crude incidence rate was the highest in the 40s with 134.5 per 100,000, followed by 123.1 in the 50s, 89.2 in the 60s, 45.7 in the 30s, and 44.9 in the 70s (Figure 3). The age specific incidence was similar to that in the past. The crude incidence rate increased evenly for all age groups; however, there were some differences in the degree of increment per age group. As for the 60s and 70s, the crude incidence rate increased by 3 times from 31.5 and 14.6 per 100,000 in 1998 to 89.2 and

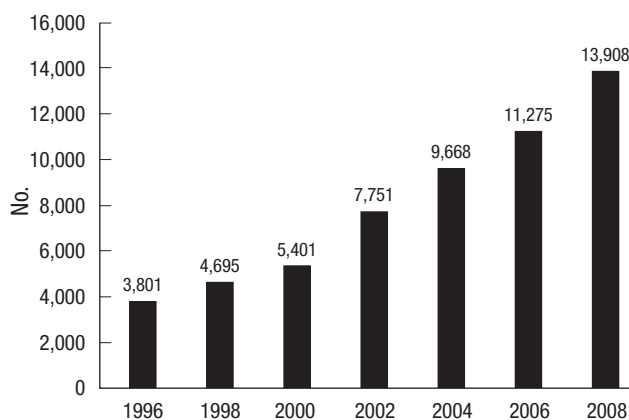


Figure 1. Annual number of Korean breast cancer patients.

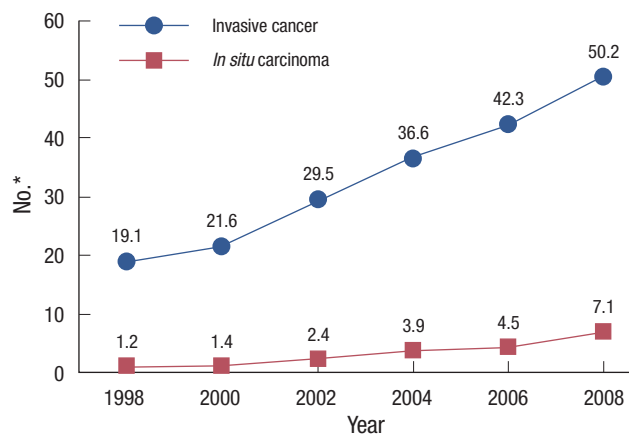


Figure 2. Annual crude incidence of Korean female breast cancer. *Patients number per 100,000 women.

44.9 in 2008, respectively. The increment for the 30s was 2 times, and was 2.2 times for the 40s and 50s, showing that the increased rate of incidence was higher for older groups. Moreover, the median age was 49, which is slowly increased, and the ratio of menopausal females also slightly increased ($p < 0.001$) (Table 12).

With respect to diagnosis and treatment, cases where breast cancers were discovered without symptoms but rather through screening only comprised 32.6%, showing continuous increases every year ($p < 0.001$) (Table 13), and the ratio of DCIS increased somewhat from 10.8% in 2006 to 11.9% ($p < 0.001$) (Table 14).

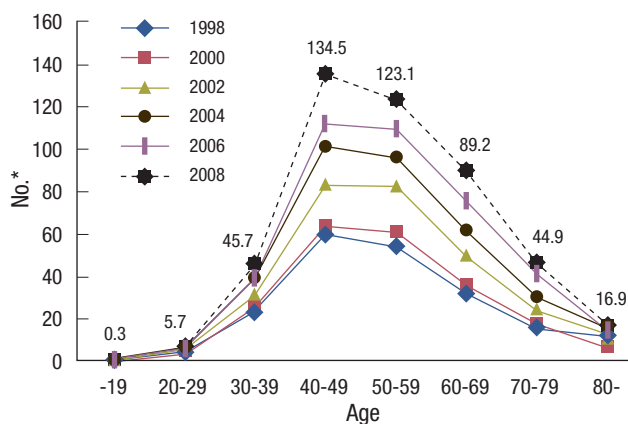


Figure 3. Age specific crude incidence of Korean female breast cancer. *Patients number per 100,000 women.

With regard to stage I breast cancer, however, the ratio decreased from 37.9% in 2006 to 34.8%, therefore, the ratio of early breast cancer (stages 0, I) decreased slightly (Figure 4). Regarding surgical methods, breast conservation surgery was the most common with 58%, demonstrating that it was performed more than mastectomy for the first time (Figure 5).

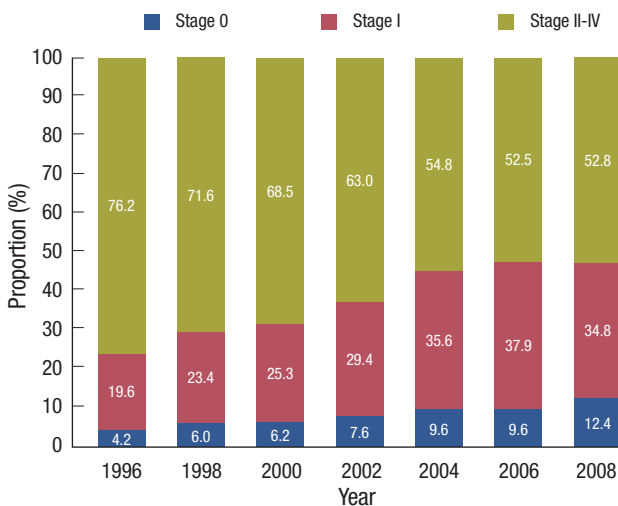


Figure 4. Proportion of AJCC staging of Korean breast cancer. AJCC=American Joint Committee on Cancer.

Table 12. Proportion of premenopausal patient

Year	1996	1998	2000	2002	2004	2006	2008
Premenopause, No. (%)	959 (63.8)	1,253 (61.3)	1,820 (62.3)	3,599 (57.9)	4,397 (60.7)	5,008 (56.9)	4,766 (54.9)
Postmenopause, No. (%)	545 (36.2)	792 (38.7)	1,102 (37.7)	2,615 (42.1)	2,844 (39.3)	3,788 (43.1)	3,920 (45.1)
Median age (yr)	46	46	46	47	47	48	49

Table 13. Clinical manifestation

Year	1996	1998	2000	2002	2004	2006	2008
Detect on screening	45 (5.0)	94 (7.9)	146 (7.7)	700 (12.9)	1,054 (17.4)	1,651 (23.8)	2,179 (32.6)
Symptomatic cancer	853 (95.0)	1,097 (92.1)	1,755 (92.3)	4,715 (87.1)	5,010 (82.6)	5,282 (76.2)	4,493 (67.4)

Values represent number of patients (%).

Table 14. Histological types

Year	1996	1998	2000	2002	2004	2006	2008
DCIS	61 (4.9)	94 (5.6)	150 (6.5)	413 (7.4)	641 (9.6)	882 (10.8)	790 (11.9)
IDC	1,137 (91.4)	1,496 (89.2)	2,075 (89.3)	5,084 (88.8)	5,491 (82.2)	6,811 (84.0)	5,616 (84.3)
LCIS	3 (0.2)	3 (0.2)	3 (0.1)	8 (0.1)	9 (0.1)	16 (0.2)	20 (0.3)
ILC	31 (2.5)	39 (2.3)	58 (2.5)	123 (2.1)	131 (2.0)	185 (2.3)	151 (2.3)
Paget's disease	6 (0.5)	9 (0.5)	4 (0.2)	18 (0.3)	14 (0.2)	11 (0.2)	4 (0.1)
Etc.	6 (0.5)	37 (2.2)	34 (1.5)	79 (1.4)	98 (1.5)	200 (2.5)	75 (1.1)

DCIS=ductal carcinoma *in situ*; IDC=invasive ductal carcinoma; LCIS=lobular carcinoma *in situ*; ILC=invasive lobular carcinoma. Values represent number of patients (%).

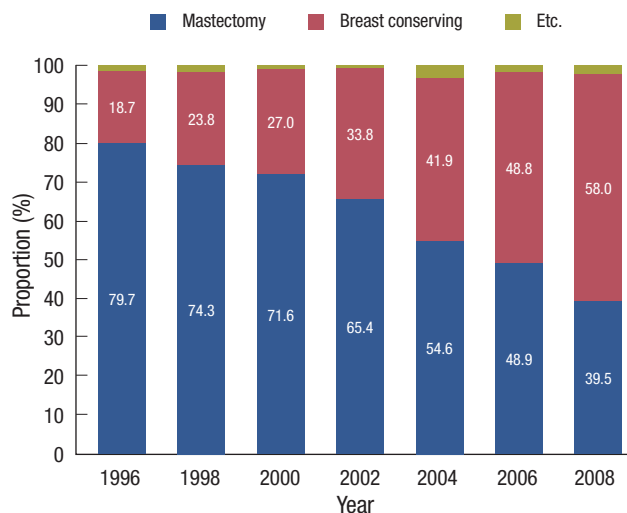


Figure 5. Trend of surgery for breast cancer in Korea.

DISCUSSION

In 1998, the KBCS announced and performed the first national research on breast cancers in Korea based on 1996 data. Since 2000, the society has announced the analytical resources regarding the occurrence and treatment status of breast cancers in Korea every two years. In 2001, in order to establish a national database for breast cancer patients, a special committee for the development of a breast cancer registration project was organized under the society, and an online registration program was developed and is still in use today.

The characteristics of breast cancers in Korea of 2008 indicate a consistent increase in the incidence rate and the ratio of diagnosis through regular screening. At the time of investigation in 1996, there were 3,801 newly discovered breast cancer patients, followed by 4,695 in 1998, 5,401 in 2000, 7,551 in 2002, 9,668 in 2004, 11,275 in 2006, and 13,908 in 2008.

For the last 12 years, the incidences have increased by more than 3.6 times, and by 2.9 times for 10 years after 1998, showing consistent annual increase of greater than ten percent. The crude incidence rate, including carcinoma *in situ*, was 57.3 (infiltrating cancer 50.2) per 100,000, indicating that the rate increased by 2.5 times from 20.3 in 1996. In the USA, the breast cancer incidence increased by 0.5% every year in the past; however, the age-standardized rate (ASR, 2000 US Std Population) of infiltrating breast cancer peaked at 141.2 per 100,000 in 1999, began to slowly decrease ever since, and dramatically dropped to 125.6 in 2003. It was found to be 124.7 per 100,000 in 2007 [7]. The cause of such a decrease has been assumed to be the decreased use of hormone replacement therapy, suggested by the study results of Women's Health Initiative Investigator (WHI)

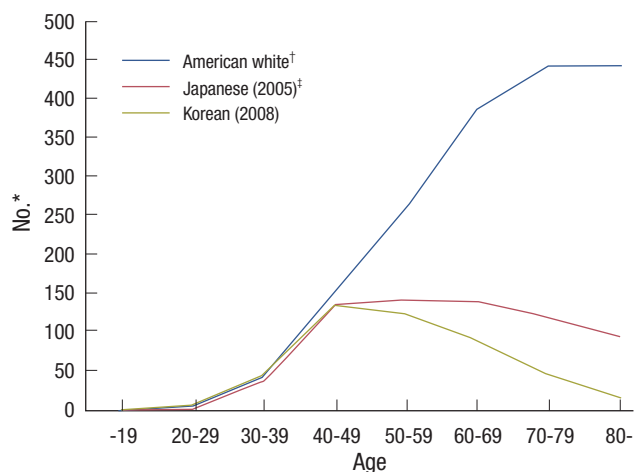


Figure 6. Comparison of age-specific crude incidence rate. *Patients number per 100,000 women; †SEER 17 data (2003-2007); ‡Cancer statistics in Japan (2008).

in 2002 [8,9]. Besides the USA, similar decreasing trends have been observed in the UK, Germany, France, Norway, Denmark, Australia, and New Zealand around the same period [10-14]. Further research is required to determine whether such a change is temporary or long-term, or whether it would occur in Asian countries.

According to GLOBOCAN 2008 [15], about 1.38 million people were diagnosed with breast cancer in 2008, which was in turn responsible for 23% of all cancers in females and 10.9% of all cancers. In Korea, resources from National Cancer Information Center have indicated that breast cancer was responsible for 15.1% of female cancer in 2007, the highest frequency only behind thyroid cancer. In order to objectively compare the cancer incidence rates among countries, the ratio of the world standard population corresponding to each age group should be given as the weighted value, and then converted to the age-standardized incidence rate. The age-standardized incidence rate of breast cancer in Korea in 2008 was 38.9 per 100,000. The country with the highest age-standardized incidence rate during the same period was Belgium (109.4), with the USA at 72 and, Asian countries such as Singapore, Taiwan, and Japan at 59.9, 52.8, and 42.7 [15].

In the Western world, increases in age have been accompanied with increased incidence rates of breast cancer. For example, in USA, the median age of female breast cancer patients during the period between 2003 and 2007 was 61 years, and the age-specific incidence rate for those in their 40s was 153.5 per 100,000 females, 235 for those in their 50s, 371.6 for those in their 60s, and 421.9 for those in their 70s, indicating that the incidence rate increased along with increases in age (Figure 6) [7]. In Korea, however, the median age in 2008 was found to

be 49, which was slightly higher than 46 in 1996, but still more than a decade younger than that in USA. The age-specific incidence rate in Korea was 134.5 per 100,000 for those in their 40s, 123.1 for those in their 50s, 89.2 for those in their 60s, and 44.9 for those in their 70s, again showing a decreasing trend along with the increasing age.

In Japan, the age-group distribution was similar to that of Korea in the past, however recent data showed that the incidence rates in the 50s and 60s had increased, exhibiting a gradual slope from the 40s to the 60s, and then slightly decreasing in the 70s, which was a different from that seen in Korea (Figure 6) [16].

The ratio of pre-menopausal females was maintained at 60% until 2004, however, following 56.9% in 2006, it dropped slightly to 54.9%. Considering the fact that the median age slowly increased and the rate of post-menopausal breast cancer increased over time, it would be plausible to expect similar movement in age groups for Korea as those observed in Japan. As for the discovery of breast cancer, cases without symptoms but only with screening comprised only 6.4% in 1996, but increased by more than 5 times to 32.7% in 2008, indicating that general publicity and vitalization of screening program have been successful to some extent. Furthermore, the stage 0 cancer has constantly increased since 1996 and was 12.4% in 2008, being the highest among all past surveys, showing a positive result. On the other hand, however, the ratio of all early cancers (stages 0, I) in the per-stage classification was 45.2% in 2004, 47.5% in 2006, and 47.2% in 2008 with no significant change. Therefore, the efficacy of breast screening needs to be evaluated in future investigations.

One of the noteworthy characteristics confirmed in the present study was the fact that the ratio of breast conservation surgery surpassed that of mastectomy. This ratio was only 18.7% in 1996; however, it has constantly increased since, reaching 48.8% in 2006 and 58% in 2008, almost 20% higher than mastectomy at 39.5%. According to surgical methods per stage, breast conservation surgery was 59% in stage 0, 70.9% in stage I, 59.3% in stage II, and 44.4% in stage III, showing that the reason for the increase in breast conservation surgery was not simply the increase in the ratio of early breast cancers, but rather the increase in understanding of the surgeons regarding breast conservation surgical techniques, the increase in the desire for quality of life by patients, and the overall change in awareness through accumulated study results.

The KBCS carried out a nation-wide survey regarding Korean breast cancer for 2008 using an offline questionnaire and an online registration program. This study found that the incidence rate was constantly increasing and that the age distribution was similar to that previously reported. On the other hand, me-

dian age, proportion of postmenopausal breast cancer patients, and incidence rate in older age groups increased. With respect to diagnosis and treatment, the detection of the cancer through screening increased markedly and the ratio of breast conservation surgery surpassed that of mastectomy for the first time.

CONFLICTS OF INTEREST

All authors declare no conflicts of interest.

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