INTRODUCTION

In Korea, the incidence of breast cancer has been increasing significantly in recent years and the absolute number of young breast cancer patients less than 40 years of age has also been increasing. Pregnancy and breast cancer have become a significant concern for not only young women but also older women. Breast cancer is the most commonly diagnosed malignancy during pregnancy. The incidence has been reported to be from 130,000 to 130,000 pregnancies and from 0.2% to 3.8% of breast cancer patients whose age was less than 50 years. Pregnancy-associated breast cancer (PABC) is generally defined as breast cancer diagnosed during pregnancy or within the first year after delivery. Recent trends in delaying childbearing may elicit a further increase in the incidence of PABC.

Traditionally pregnancy has been considered to decrease a woman’s lifetime risk of developing breast cancer, but more detailed analyses suggest that pregnancy itself transiently increases the risk of breast cancer. Delay in diagnosis of breast cancer during pregnancy, promotional effects of gestational hormones on tumor, and undetermined aggressive intrinsic tumor biology of PABC make pregnant women with breast cancer presenting with more advanced stage breast cancer, and subsequently show a poorer prognosis. On the contrary, it has been shown that the survival of PABC patients is not significantly different from that of non-PABC patients when the stage of disease was matched. Diagnosis and management of PABC are additional challenges for a clinician because not only the treatment of pregnant woman herself but also the safety of the fetus should be considered. There are many issues to be determined regarding pregnancy and breast cancer in younger women.

The aims of this study were to investigate clinicopathological characteristics and outcomes of PABC compared to those of invasive breast cancer patients aged less than 40 years, and to evaluate whether pregnancy itself is an independent prognostic factor and whether the survival of the patients diagnosed before and after their delivery is different among younger Korean breast cancer patients in association with PABC.

PATIENTS AND METHODS

Study population

Patients were selected from the Yonsei Hospital Breast Cancer Registry Database containing clinicopathological information, treatment modalities, and details of outcomes. A total of 1,106 patients under 40 years of age were treated for breast cancer at the Department of Surgery, Yonsei University College of Medicine, Seoul, Korea, between January 1987 and December 2007, and the exclusion criteria were as follows: (1) pure in situ breast carcinoma, recurrent or metastatic disease, non-PABC patients with special histological types including lobular carcinoma, and tumors of non-epithelial origin such as phyllodes tumor, lymphoma, or sarcoma. PABC was defined as breast cancer diagnosed during pregnancy or during the first postpartum year. A total of 14 patients fulfilled the above criteria. Clinicopathological characteristics, treatment patterns, and survival outcomes were compared to those of 855 invasive ductal carcinoma not otherwise specified (IDC) patients less than 40 years of age. Patients were treated with either total mastectomy or breast-conserving surgery and sentinel lymph node biopsy or axillary lymph node dissection. Sentinel lymph node was detected using radioisotope technique with 18.5 MBq (0.5 mCi) Tc99m Phytate Kit (Gore Atomic Energy Research Institute, Daegun, Korea). After surgery, local radiotherapy or adjuvant systemic treatment was conducted if the patient was able to tolerate it. Among the whole study population, 95 (10.9%) patients with locally advanced breast cancer received preoperative chemotherapy containing anthracycline with or without taxane regimen. Clinical follow-up included history taking, physical examination, laboratory tests, and radiological imaging tests every 6–12 months for detection of relapse. Tumor stage was based on the American Joint Committee on Cancer staging criteria (6th edition). Histological grade was assessed by the modified Bloom–Richardson classification. Tumors with ≥10% nuclear-stained cells were considered positive for estrogen (ER) and progesterone receptors (PR). HER2/neu immunohistochemical staining was scored from 0 to 3+ according to the guidelines for the HercepTest™ (Dako, Glostrup, Denmark). Because fluorescence in situ hybridization (FISH) test had not been performed routinely during most of the study period, HER-2 staining was considered positive when strong (3+) membrane staining was observed, whereas cases of 0 to 2+ were regarded as negative.

Study endpoints and statistics

Locoregional recurrence was defined as tumor recurrence in the ipsilateral breast, chest wall, and regional lymph node. Any recurrence at a distant site including contralateral axillary or supraclavicular lymph nodes was considered as a distant metastasis. Disease-free survival (DFS) was measured from the date of the first curative surgery to the date of the first locoregional or systemic recurrence, or death before type of relapse. Locoregional relapse-free survival (LRFS) was calculated from the date of the first operation to the date of the first locoregional recurrence or death without any type of recurrence. Distant relapse-free survival (DRFS) was...
Pregnancy-Associated Breast Cancer Compared to Invasive Ductal Carcinoma Less Than 40 Year-Old of Age

INTRODUCTION

In Korea, the incidence of breast cancer has been increasing significantly in recent years and the absolute number of young breast cancer patients less than 40 years of age has also been increasing. Pregnancy and breast cancer have become a significant concern for not only young women but also clinicians. Breast cancer is the most commonly diagnosed malignancy during pregnancy. The incidence has been reported to be from 130,000 to 130,000 pregnancies and from 0.2% to 3.8% of breast cancer patients who age less than 50 years. Pregnancy-associated breast cancer (PABC) is generally defined as breast cancer diagnosed during pregnancy or within the first year after delivery. Recent trends in delaying childbirth may elicit a further increase in the incidence of PABC.

Traditionally pregnancy has been considered to decrease a woman’s lifetime risk of developing breast cancer, but more detailed analyses suggest that pregnancy itself transiently increases the risk of breast cancer. Delay in diagnosis of breast cancer during pregnancy, promotional effects of gestational hormones on tumor, and underdiagnosed aggressive intrinsic tumor biology of PABC make pregnant women with breast cancer presenting with more advanced stage breast cancer, and subsequently show a poorer prognosis. On the contrary, it has been shown that the survival of PABC patients is not significantly different from that of non-PABC patients when the stage of disease was matched. Diagnosis and management of PABC are additional challenges for a clinician because not only the treatment of pregnant woman herself but also the safety of the fetus should be considered. There are many issues to be determined regarding pregnancy and breast cancer in younger women.

The aims of this study were to investigate clinicopathological characteristics and outcomes of PABC compared to those of invasive breast cancer patients aged less than 40 years, and to evaluate whether pregnancy itself is an independent prognostic factor and whether the survival of the patients diagnosed before and after their delivery is different among younger Korean breast cancer patients in association with PABC.

PATIENTS AND METHODS

Study population

Patients were selected from the Yonsei Hospital Breast Cancer Registry Database containing clinicopathological information, treatment modalities, and details of outcomes. A total of 1,016 patients under 40 years of age were treated for breast cancer at the Department of Surgery, Yonsei University College of Medicine, Seoul, Korea, between January 1987 and December 2007, and the exclusion criteria were as follows: (a) 55% pure in situ breast carcinoma, recurrent or metastatic disease, non-PABC patients with special histological types including lobular carcinoma, and tumors of non-epithelial origin such as phyllodes tumor, lymphoma, or sarcoma. PABC was defined as breast cancer diagnosed during pregnancy or during the first postpartum year. A total of 14 patients fulfilled the above criteria. Clinicopathological characteristics, treatment patterns, and survival outcomes were compared to those of 855 invasive ductal carcinoma not otherwise specified (IDC) patients less than 40 years of age.

Patients were treated with either total mastectomy or breast-conserving surgery and sentinel lymph node biopsy or axillary lymph node dissection. Sentinel lymph node was detected using radioisotope technique with 18.5 MBq 0.1 mCi Tc99m Phytate Kit (Glory Atomic Energy Research Institute, Daejeon, Korea). After surgery, local radiation or adjuvant systemic treatment was conducted if the patient was able to tolerate it. Among the whole study population, 95 (9.3%) patients with locally advanced breast cancer received preoperative chemotherapy containing anthracycline with or without taxane regimen. Clinical follow-up included history taking, physical examination, laboratory tests, and radiological imaging tests every 6–12 months for detection of relapse. Tumor stage was based on the American Joint Committee on Cancer staging criteria (6th edition). Histological grade was assessed by the modified Bloom-Richardson classification. Tumors with > 10% nuclear-stained cells were considered positive for estrogen (ER) and progesterone receptors (PR). HER2/new immunohistochemical staining was scored from 0 to 3+ according to the guidelines for the HercepTest™ (Daico, Glostrup, Denmark). Because fluorescence in situ hybridization (FISH) test had not been performed routinely during most of the study period, HER-2 staining was considered positive when strong (3+) membrane staining was observed, whereas cases from 0 to 2+ were regarded as negative.

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measured from the date of the first operation to the date of the first distant metastasis or death without any type of recurrence. Overall survival (OS) was calculated from the date of the first surgery to the date of the last follow-up or death from any cause.

The differences between the groups were evaluated by a chi-square test. Fisher’s exact test was used when appropriate. Continuous variable was compared using two-sample t-test. Survival curve was plotted using the Kaplan–Meier method and group differences in survival times were investigated by a log–rank test. A Cox’s proportional hazards model was used to identify the variables that were independently associated with survival. All statistical tests were two-sided and a p-value of 0.05 was considered statistically significant. SPSS for Windows version 18.0 SPSS Inc., Chicago, IL) was used for all statistical analysis.

RESULTS

During the study period, 14 patients were diagnosed with PABC, which constituted 0.3% of all 4,335 IDC patients treated at our institution irrespective of age at diagnosis, 0.6% of 2,541 IDC patients aged less than 50 years, and 1.6% of 869 IDC patients under 40 years. The mean age of the whole study population at diagnosis was 34.6 years (standard deviation: 3.8). The mean follow-up duration was 69.4 months (SD, 45.1). Among 14 patients with PABC, 7 were diagnosed with breast cancer during pregnancy; 3 were in the first trimester of pregnancy and 4 in the third trimester. The 7 rest of the patients (7 of 14 patients) were diagnosed with breast cancer during postpartum period. Thirteen patients showed a chief complaint of breast lump and bloody nipple discharge present in one patient. The mean symptom duration was 7.6 months (SD, 7.1; range: 0.5–24) in 14 patients with PABC. The mean symptom duration of the patients diagnosed during pregnancy and during postpartum period was 3.0 cm (SD, 1.3) and 2.3 cm (SD, 1.2), respectively, which was not significantly different (p=0.331, t-test). Three patients diagnosed during the first trimester underwent therapeutic abortion with simultaneous treatment of breast cancer.

Comparison of clinicopathological characteristics between PABC and IDC under 40 years of age is shown in Table 1. The mean age at diagnosis of PABC and IDC under 40 years of age was 32.6 years (range: 24–39) and 34.6 years (range: 20–39) years, respectively. The patients with PABC were younger at diagnosis than those with IDC less than 40 years old (p=0.044, t-test). All PABCs were ductal carcinoma without lobular or special type. Tumor and node stage was not significantly different between PABC and IDC under 40 years of age. Among the patients with PABC, II (7/22) were in stage II, 2 (4/34) in stage I, and 1 (7/39) in stage III, respectively. No significant difference in histological grade was found between two groups. Among the patients who were available for ER (n=720) and PR (n=705), PABC subgroup showed higher frequency of ER+ and PR-negative tumor, but there was no statistical significance. The patients with PABC were determined to present higher proportion of HER2-positive tumor. However, too many missing values and no FISH analysis make our results subject to be validated using independent dataset.

Treatment modalities of the patients with PABC were compared to those of IDC under 40 years of age (Table 2). Three patients with PABC received neoadjuvant chemotherapy using FAC (fluorouracil, anthracycline, and cyclophosphamide) or AT (anthracycline and taxane) regimens. Seven patients with PABC underwent breast-conserving surgery. Sentinel lymph node biopsy using radiostereotactic and subsequent axillary node dissection were performed in four patients with PABC. Among them, two patients were in the third trimester of pregnancy. After breast surgery with sentinel node biopsy, they delivered a healthy baby. There was no significant difference of treatment patterns including systemic chemotherapy or endocrine therapy between PABC and IDC under 40 years of age. The Kaplan–Meier curves for DFS, LRFS, DDFS, and OS are demonstrated in Fig. 1. Five-year DFS, LRFS, DRFS, and OS of the patients with PABC was 57.1%, 71.3%, 56.4%, and 70.0%, respectively. Survival between PABC and IDC under 40 years of age was not significantly different. In the Cox’s regression models adjusting for age at diagnosis, tumor and node stage, grade, ER, and the use of chemotherapy and endocrine therapy, PABC was not associated with survival outcomes (Table 3). Age at diagnosis, tumor stage, grade status, and the use of chemotherapy were determined to be independent factors for DFS, LRFS, and DDFS.
measured from the date of the first operation to the date of the first distant metastasis or death without any type of recurrence. Overall survival (OS) was calculated from the date of the first surgery to the date of the last follow-up or death from any cause. The differences between the groups were evaluated by a chi-square test. Fisher's exact test was used when appropriate. Continuous variable was compared using two-sample t-test. Survival curve was plotted using the Kaplan-Meier method and group differences in survival times were investigated by a log-rank test. A Cox's proportional hazards model was used to identify the variables that were independently associated with survival. All statistical tests were two-sided and a p-value of 0.05 was considered statistically significant. SPSS for Windows version 18.0 (SPSS Inc., Chicago, IL) was used for all statistical analysis.

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Table 3. Multivariate Analyses for Survival

<table>
<thead>
<tr>
<th></th>
<th>DFS</th>
<th>LRFS</th>
<th>OS</th>
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</thead>
<tbody>
<tr>
<td>HR</td>
<td>95% CI</td>
<td>p-value</td>
<td>HR</td>
</tr>
<tr>
<td>Neoadjuvant therapy</td>
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<td>Age in 50 yr</td>
<td>1.808</td>
<td>1.255-2.520</td>
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<tr>
<td>Tumor size (&gt; 2 cm)</td>
<td>1.752</td>
<td>1.252-2.462</td>
<td>0.001</td>
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<tr>
<td>Node status positive</td>
<td>2.305</td>
<td>1.973-5.851</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Grade (IV)</td>
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<td>0.754-1.719</td>
<td>0.537</td>
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<tr>
<td>ER negative</td>
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<td>0.603-1.539</td>
<td>0.647</td>
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<tr>
<td>Treatment type</td>
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<td>1.313-4.745</td>
<td>0.001</td>
</tr>
<tr>
<td>Treatment intensity</td>
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<td>0.822-1.799</td>
<td>0.397</td>
</tr>
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</table>

Note: DFS, disease-free survival; LRFS, locoregional recurrence-free survival; OS, overall survival; HR, hazard ratios; CI, confidence intervals.

Discussion

The majority of abnormal breast findings during pregnancy or lactation are benign, and a majority of these are associated with infectious complications. It has been widely recognized that the delay in diagnosis is associated with more advanced disease at diagnosis of women with ABC. Therefore, physicians should be vigilant of any suspicious abnormalities during pregnancy or lactation to avoid a delay in the diagnosis of breast cancer. It has been reported that the average age of patients with ABC is 32–38 years and the average delay in diagnosis in pregnant patients is 5–10 months, as compared to 1–4 months in non-pregnant patients. Our mean age at diagnosis and average symptom duration of the patients with ABC was 32.6 years and 7.6 months. In 2006, The Korean Breast Cancer Society reported that 64.5% of newly diagnosed breast cancer patients presented symptom duration of less than 3 months and 15.8% presented symptom duration of 3 to 6 months. These findings suggest that diagnosis of Korean ABC might be delayed similar to the western series.

IBC is the most prevalent histological type of cancer in ABC and these tumors tend to have high grade and lymphovascular invasion. ABC shows typically frequent and larger size axillary node metastasis. Gestational hormones may play an important role for aggressive behavior of ABC. A higher percentage of ABC is ER- and/or PR-negative tumor and increased overexpression of HER2 is also common. ABC frequently presents higher Ki-67 proliferative index. However, the majority of these studies are composed of case series with small sample size. The overall histopathological and immunohistochemical findings of ABC are consistent with young patients with breast cancer. In conclusion, our study, histopathological characteristics and expression of biomarkers are not significantly different between ABC and IDC under 40 years of age.

Under general anesthesia, breast surgery can be safely performed with little risk to the fetus during any stage of pregnancy. Patients with ABC can be treated with mastectomy or breast-conserving surgery. Elective abortion has been found not to improve survival for ABC patients. Therefore, it is not routinely recommended as a therapeutic approach but should be discussed in case of the early pregnancy period. Radiation therapy is contraindicated during pregnancy due to the increased risk of teratogenesis. However, radiation therapy can be delayed up to 12 weeks without increasing the risk of local recurrence and if adjuvant or neoadjuvant chemotherapy is indicated according to the risk evaluation, the delay in breast irradiation up to 6 months may be possible. Recently, the international panel of experts have recommended that even if patients are treated in the first trimester or early second trimester, radiation therapy can be delayed until after delivery, but local failure rate of ABC patients treated with breast-conserving therapy is not clearly defined. Axillary staging by sentinel lymph node biopsy using 99mTc is determined to be safe and accurate in the pregnant women with clinically node-negative disease. However, the use of blue dye is not recommended because of sympathetic, teratogenesis, or unknown effects to the fetus.

The decision to administer systemic chemotherapy in a PABC patient should depend on the risk evaluation such as disease stage and clinicopathological features as in a non-pregnant breast cancer patient. Although most chemotherapeutic agents are used under the U.S. Food and Drug Administration pregnancy FDA category D, namely positive evidence of human fetal risk exists but benefits in certain situations may make use of the acceptable drug despite its risk. Several recent studies have shown that certain chemotherapy regimens including anthracycline can be safely used during the second and third trimester of pregnancy. PABC patients should not receive any chemotherapeutic drugs for at least 3 weeks prior to delivery to allow for correction of myelosuppression in both the mother and fetus. Antiemetic agents such as ondansetron (Zofran) and granisetron (Kytril) are rated pregnancy risk category B and are safely used in pregnant women receiving chemotherapy. The short use of doxorubicin for nausea prophylaxis and granulocyte colony-stimulating factor (G-CSF) for neutropenia prophylaxis also is available. Endocrine therapy using tamoxifen should be initiated after delivery and completion of chemotherapy if PABC is determined as endocrine-responsive tumor. Although no fetal abnormalities has been described, some cases of erythroblastosis or oligohydramnios, which is known to significantly increase the risk of premature delivery, fetal morbidity, and mortality, have been reported by the use of trastuzumab during pregnancy. The safety profile of trastuzumab or lapatinib during pregnancy is supported by very limited data, so, targeted agents are not routinely recommended yet.

It has not been clearly established whether pregnancy itself is an independent predictor for outcomes in PABC. The prognosis of PABC has been known to be poor, partly associated with the delay in diagnosis and treatment, higher stage at diagnosis, more favorable microenvironment created during pregnancy, and BRCA1 and BRCA2 germline mutations. Except for only two patients, our PABC subgroups were diagnosed with stage II disease, although there was no statistical difference between the two groups. However, when pregnant women are age and stage-matched with non-pregnant controls, survival is determined to be equivalent between the two groups. This is further supported by our results of no difference in DFS, LRFS, DRFS, and OS between PABC and IDC less than 40 years of age.

Recently a large population–based study of Swedish women with PABC showed that the elevated mortality among PABC patients varied markedly with timing of diagnosis in relation to delivery. The authors observed nearly 4 times higher peak mortality in women diagnosed...
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<table>
<thead>
<tr>
<th>Event</th>
<th>HR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age ≥ 35 y</td>
<td>1.696</td>
<td>1.255-2.292</td>
</tr>
<tr>
<td>Age &lt; 35 y</td>
<td>1.706</td>
<td>1.230-2.367</td>
</tr>
<tr>
<td>ER (negative)</td>
<td>1.671</td>
<td>1.214-2.190</td>
</tr>
<tr>
<td>Pregnancy-associated (yes)</td>
<td>1.681</td>
<td>1.316-2.166</td>
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</tbody>
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FIG. 2. Disease-free (A) and overall (B) survival of the patients diagnosed before and after delivery.
Solid line represents breast cancer patients diagnosed during antepartum period and dotted line represents those diagnosed during postpartum period.

Discussion

The majority of abnormal breast findings during pregnancy or lactation are benign diseases, including inflammatory complications. This has been widely recognized that the delay in diagnosis is associated with more advanced disease at diagnosis of women with PABC. Patients should be vigilant of any suspicious abnormalities during pregnancy or lactation to avoid a delay in the diagnosis of breast cancer. It has been reported that the average age of patients with PABC is 32–38 years and the average delay in diagnosis in pregnant patients is 5–10 months as compared to 1–4 months in non-pregnant patients. Our mean age at diagnosis and average symptom duration of the patients with PABC was 32.6 years and 7.6 months. In 2006, the Korean Breast Cancer Society reported that 64.5% of newly diagnosed breast cancer patients presented symptom duration of less than 3 months and 15.8% presented symptom duration of 3 to 6 months. These findings suggest that diagnosis of Korean PABC might be delayed similar to the western series. IDC is the most prevalent histological type of cancer in PABC and these tumors tend to have high grade and lymphovascular invasion. PABC shows typically frequent and larger size axillary node metastasis. Gestational hormones may play an important role for aggressive biology of PABC. A higher percentage of PABC is ER- and/or PR-negative tumor and increased overexpression of HER2 is also common. PABC frequently presents higher Ki-67 proliferative index. However, the majority of these studies are composed of case series with small sample size. The overall histopathological and immunohistochemical findings of PABC are consistent with young patients with breast cancer. In conclusion, this study, histopathological characteristics and expression of biomarkers are not significantly different between PABC and IDC under 40 years of age. Under general anesthesia, breast surgery can be safely performed with little risk to the fetus during any stage of pregnancy. Patients with PABC can be treated with mastectomy or breast-conserving surgery. Effective breast cancer treatment may be considered on the basis of the extent of disease, the patient's age, and the potential for fertility restoration. The short use of endocrine therapy for neoadjuvant or adjuvant therapy for young women with PABC is a potential therapeutic option. The authors observed nearly 4 times higher peak mortality in women diagnosed with breast cancer during pregnancy or lactation, who may have been missed in the current data set. It is important to note that the analysis of the current study may be limited by the small number of cases and the lack of detailed obstetric data. Therefore, further research is needed to better understand the impact of pregnancy and lactation on the survival of patients with breast cancer.

Fig. 2. Disease-free (A) and overall (B) survival of the patients diagnosed before and after delivery.
Solid line represents breast cancer patients diagnosed during antepartum period and dotted line represents those diagnosed during postpartum period.

Prognostic factors in our study population of young breast cancer patients. Among the patients with PABC, there was no statistical difference in survival outcomes between the patients diagnosed before and after delivery (Fig. 2).
REFERENCES

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Pregnancy-Associated Breast Cancer Compared to Invasive Ductal Carcinoma Less Than 40 Year-Old of Age

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Ban Seok Yang, Seho Park, So Hee Lee, Hyung Seok Park, Hyewon Hwang, Jun Sang Lee, Si Mon Ko, Seung Il Kim, and Byeong-Woo Park

Abstract
Purpose: The aims of this study were to investigate clinicopathological characteristics and outcomes of pregnancy-associated breast cancer (PABC) and to determine the implications of pregnancy itself on the prognosis of PABC.
Methods: Clinicopathological features, treatment patterns, and survival of 14 PABC patients were compared to those of 855 invasive ductal carcinoma (IDC) patients under 40 years of age, who were treated between 1987 and 2007, using a chi-square test, the Kaplan-Meier method, and Cox’s hazards models. PABC was defined as breast cancer diagnosed during pregnancy or within the first year after delivery.
Results: Among 14 PABCs, 7 were diagnosed during pregnancy and 7, during the first postpartum year. The mean duration of the symptoms was 7.6 months. The mean age at diagnosis of PABC and IDC under 40 years was 32.6 and 34.6 years, respectively. Survival was not significantly different between two groups. In Cox’s models, PABC was not free, locoregional relapse-free, distant relapse-free, and overall survival of PABC was 57.1%, 71.3%, 56.4%, and 70.0%, respectively. Survival was not significantly different between two groups. In Cox’s models, PABC was not associated with survival outcomes. Among PABCs, there was no statistical difference in survival between patients diagnosed before and after delivery.
Conclusion: Pregnancy itself does not increase the risk of poorer outcomes among young breast cancer patients. Vigilant diagnosis and multidisciplinary treatment should be recommended to best manage woman with PABC and her baby.

Key Words: Breast neoplasms, Pregnancy, Prognosis, Survival

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Introduction
Laparoscopic colectomy was introduced by Jacobs et al. in 1991. Since then, many studies reported the benefits and oncologic outcomes of laparoscopic colorectal surgery. In recent years, laparoscopic surgery has been considered as one of the surgical options for colorectal cancer. The application of laparoscopic techniques in colorectal surgery has widened.

The well known advantages of laparoscopy are rapid postoperative recovery, small surgical wound, less postoperative pain, shorter hospital stay, and so on. On the other hand, the widely known disadvantages of laparoscopic surgery are longer operating times, steep learning curve, and the lack of tactile sense. Moreover, oncologic outcomes of laparoscopic surgery especially for rectal cancer remain to be verified.

Pneumoperitoneum is necessary for laparoscopic surgery to get an adequate operative field, and frequently, exaggerated patient’s positions are also required. These have been reported to influence the cardio-pulmonary and renal functions. The elderly colorectal cancer patients tend to have more comorbidity. The physiologic burdens of pneumoperitoneum and other factors during laparoscopic surgery may be disadvantageous to elderly patients, theoretically, and there is a possibility of harmful effects in the elderly compared to the younger patients. On the other hand, less postoperative pain, early activities after operation may be beneficial for preventing postoperative complications. However, the data regarding intraoperative and postoperative complications after colorectal resection in elderly colorectal cancer patients are rare. Nowadays, the proportion of elderly colorectal cancer patients is increasing and is anticipated to increase as life expectancy increases. Thus, we aimed to determine the safety and feasibility of a laparoscopic colonic resection for colorectal cancer in patients older than 80 years of age.

Materials and Methods
Patients
Between 1996 and 2010, 10,148 patients were diagnosed with primary colorectal cancer and among them 9,010 had curative resection at the Department of Surgery, Samsung Medical Center SMS. One hundred ninety two patients older than 80 years of age (2.1%, 92/9,010) were included in this study. Laparoscopic resection was performed in 24 (12.4%) of 192 patients, while open resection was performed in 168 (87.6%) patients.

There was no case converted from laparoscopic to open surgery. One patient who had hybrid-laparoscopic surgery due to additional lateral pelvic lymph node sampling was included in the laparoscopic group.