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Purpose

✓ We evaluated the incidence and outcomes of pregnancy after breast cancer was diagnosed in women of childbearing age

✓ We also evaluated the prognosis of patients who became pregnant after breast cancer, according to the treatment.

Methods

✓ A retrospective cohort study of women aged 20–45 years who were surgically treated for breast cancer (2004-2014)

✓ Korean National Health Insurance database provided information on sex, age, number of parity, surgical method, adjuvant therapy, and date and cause of death.

✓ Exclusion criteria

- Patients who did not undergo breast cancer surgery within 1 year after diagnosis and patients who died within 1 year after diagnosis

- Patients with an unknown state of pregnancy or patients who had been diagnosed with breast cancer during pregnancy or within 1 year after delivery

✓ Six groups according to the treatment received:

(1) no treatment

(2) endocrine therapy-only

(3) chemotherapy-only

(4) endocrine therapy and chemotherapy

(5) chemotherapy and targeted therapy

(6) endocrine therapy, chemotherapy, and targeted therapy.

Results

✓ 49,348 patients aged 20 to 45 years and who had been newly diagnosed with breast cancer (2004-2014)

✓ 2,045 (4.1%) became pregnant after receiving treatment for breast cancer and 47,303 (95.9%) did not.

✓ Median follow-up: 98.1 months (range, 69.2 to 133.6).

✓ The median time from breast cancer diagnosis to pregnancy: 3.1 years (range, 1.9 to 4.8).

- Prognosis after breast cancer by the timing of pregnancy

✓ The pregnant group had a better prognosis and reduced risk of death than the non-pregnant group (HR, 0.41; 95% CI, 0.33 to 0.51, p < 0.001)

✓ The risk of death for patients who became pregnant ≥ 49 months was lower than the patients the who became pregnant 49 months before (HR, 0.17; 95% CI, 0.07 to 0.41, p<0.001) after the diagnosis for breast cancer

Results(2)

- Prognosis after breast cancer according to the treatment

✓ The group who had a live birth had a better prognosis regardless of endocrine therapy than the non-pregnant group

✓ In chemotherapy-only groups and the groups who received endocrine therapy and chemotherapy, women who a live birth had a significantly lower risk of death than those in the non-pregnant group

✓ There was no significant difference among the group who had a live birth, the group who failed to deliver and the non-pregnant group in patients who received endocrine therapy only, chemotherapy and targeted therapy with or without endocrine therapy

Conclusions

✓ Pregnancy after breast cancer is safe, and the risk of death was low in women who became pregnant ≥ 49 months after the diagnosis of breast cancer.

✓ The prognosis of women who became pregnant was better than that of women who did not conceive after breast cancer diagnosis, regardless of endocrine therapy.

✓ The prognosis of pregnant women after the diagnosis of breast cancer was non-inferior to that of non-pregnant women, even in women who received chemotherapy and targeted therapy.

✓ These findings suggest the long-term safety of pregnancy after breast cancer diagnosis regardless of different types of treatment received and provide reassurance to patients with HER2-positive cancer who are considering future pregnancy.

Table 1. Patients' characteristics

	Total (N=49348)	Pregnant (N=2045, 4.1%)	Nonpregnant (N=47303, 95.9%)	P-value
Age				
mean (std)	39.72 (4.56)	32.3 (4.3)	40.1 (4.3)	<.0001
median (q1-q3)	41 (37-43)	32 (29-35)	41 (38-43)	<.0001
Age, n (%)				<.0001
<30	1662 (3.4)	520 (25.4)	1142 (2.4)	
30-34	5208 (10.6)	945 (46.2)	4263 (9.0)	
35-39	12517 (25.4)	453 (22.2)	12064 (25.5)	
40-45	29961 (60.7)	127 (6.2)	29834 (63.1)	
Chemotherapy, n (%)				<.0001
Yes	35635 (72.2)	1381 (67.5)	34254 (72.4)	
No	13713 (27.8)	664 (32.5)	13049 (27.6)	
Endocrine therapy, n (%)				<.0001
Yes	35540 (72.0)	1047 (51.2)	34493 (72.9)	
No	13808 (28.0)	998 (48.8)	12810 (27.1)	
Ovarian Function Suppression n (%)				0.019
Yes	7487 (15.2)	273 (13.4)	7214 (15.2)	
No	41861 (84.8)	1772 (86.7)	40089 (84.8)	
Fertility preservation, n (%)				<.0001
Yes	111 (0.3)	14 (1.0)	97 (0.3)	
No	35524 (99.7)	1367 (99.0)	34157 (99.7)	
Targeted therapy, n (%)				<.0001
Yes	4037 (8.2)	117 (5.7)	3920 (8.3)	
No	45311 (91.8)	1928 (94.3)	43383 (91.7)	
Radiation therapy, n (%)				0.9918
Yes	32558 (66.0)	1349 (66.0)	31209 (66.0)	
No	16790 (34.0)	696 (34.0)	16094 (34.0)	
Surgery (Breast), n (%)				<.0001
Breast Conserving Surgery	7919 (17.1)	427 (22.1)	7492 (16.9)	
Mastectomy	38275 (82.9)	1506 (77.9)	36769 (83.1)	
Subgroup according to the treatment				<.0001
No treatment	2550 (5.2)	273 (13.4)	10719 (22.7)	
Endocrine therapy-only	11110 (22.5)	391 (19.1)	10719 (22.7)	
Chemotherapy-only	9696 (19.6)	633 (32.4)	9063 (19.1)	
Endocrine therapy + chemotherapy	21955 (44.5)	601 (29.4)	21354 (45.1)	
Chemotherapy + targeted therapy	1533 (3.1)	62 (3.0)	1471 (3.1)	
Endocrine therapy + chemotherapy + targeted therapy	2451 (4.9)	55 (2.7)	2396 (5.1)	
Time between surgery and pregnancy (year)				
mean (std)	3.57 (2.16)			
median (q1-q3)	3.12 (1.92-4.82)			

Table 2. Pregnancy outcomes

	Total, N=49348 (%)
Pregnancy, n (%)	
No	47303 (95.9)
Yes	2045 (4.1)
No. of pregnancies	
1	1428 (69.8)
2	438 (21.4)
≥3	179 (8.8)
	Pregnant group, N=2045 (%)
No. of live birth	
1	978 (76.6)
2	288 (22.5)
≥3	15 (1.1)
Live birth, n (%)	1281 (64.2)
Miscarriage, n (%)	622 (31.1)
Abortion, n (%)	93 (4.7)
Pregnancy interval from diagnosis (months), n (%)	
≤ 12 months	138 (6.8)
13-24 months	379 (18.5)
25-48 months	790 (38.6)
≥ 49 months	738 (36.1)

Table 3. Hazard ratio regarding the association between pregnancy and live birth after breast cancer diagnosis and survival

	HR (95% CI)	P-value	P by log rank test
Pregnancy			
No	ref		
Yes	0.41 (0.33, 0.51)	<0.001	<0.001
Birth			
Non-pregnancy	ref		
Live birth	0.26 (0.19, 0.36)	<0.001	<0.001

Table 4. Cox's proportional hazards model for survival in women with breast cancer stratified by time from diagnosis to pregnancy (months)

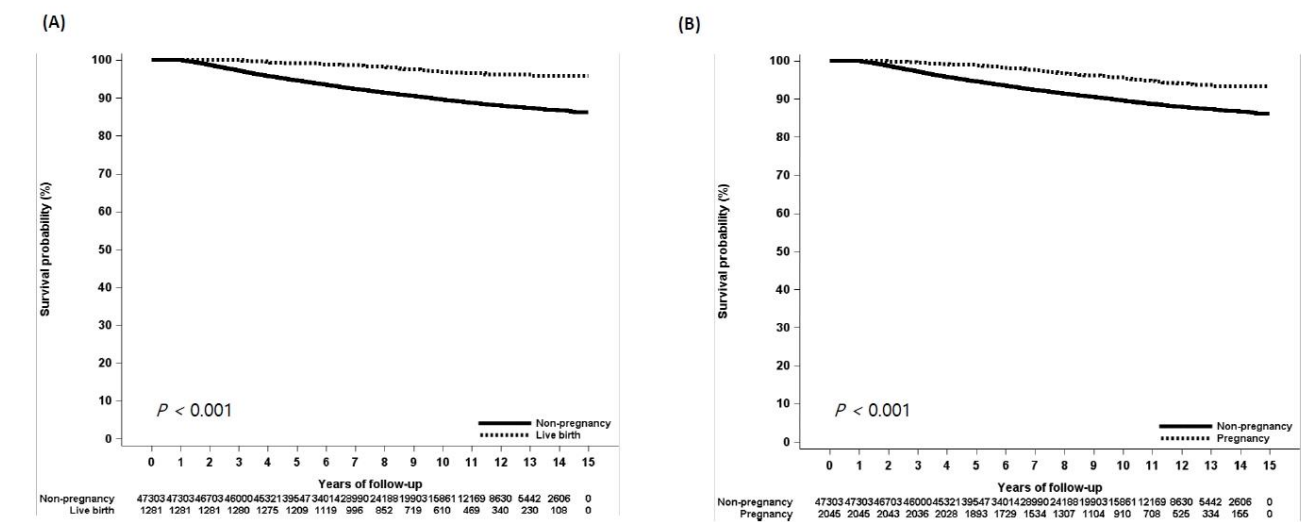|	HR (95% CI)	P-value	P by log rank test
time to subsequent pregnancy			<.0001
≤ 12 months	ref		
13-24 months	1.10 (0.52, 2.33)	0.803	
25-48 months	0.72 (0.35, 1.49)	0.374	
≥ 49 months	0.17 (0.07, 0.41)	<.0001	

Figure 1. Overall survival outcomes in the pregnant and the non-pregnant group. (A) live birth vs non-pregnancy (B) pregnancy vs non-pregnancy
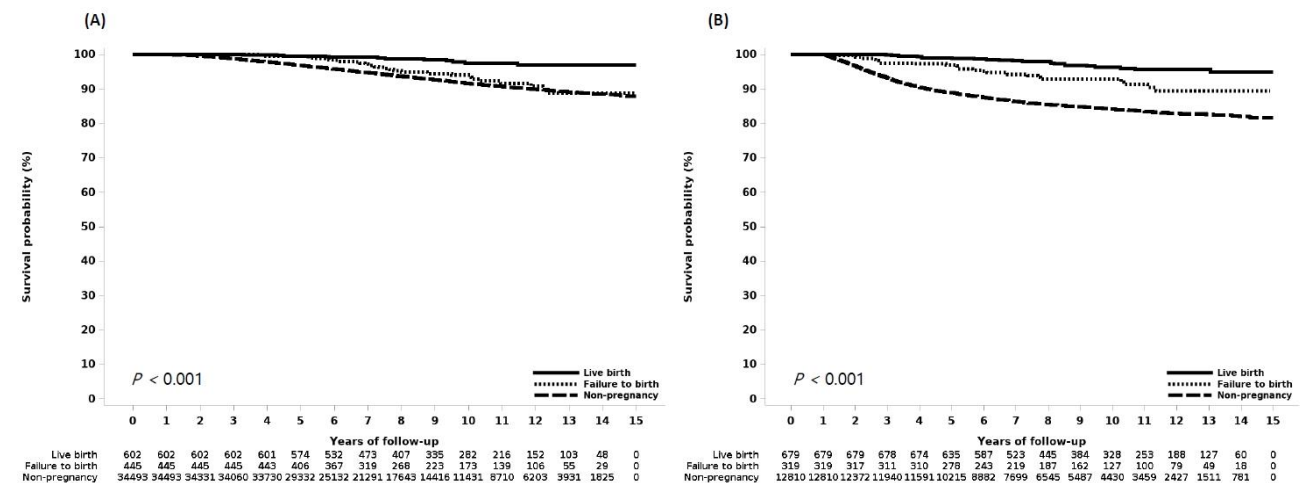

Figure 2. Overall survival outcomes in the pregnant group, group who had a live birth and the non pregnant group. (A) Endocrine therapy group and (B) the non endocrine therapy group
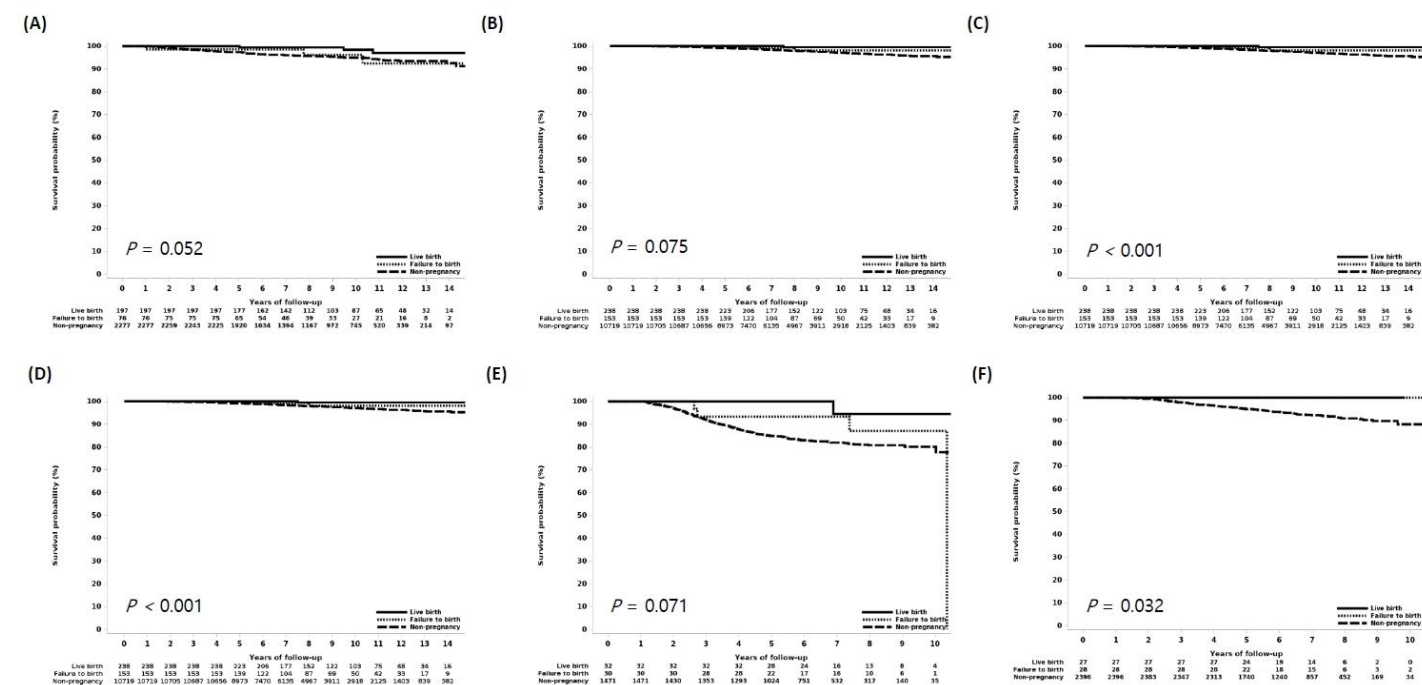

Figure 3. Overall survival outcomes in the pregnant group, group who had a live birth and the non pregnantgroup according to the treatment received. (A) No treatment, (B) Endocrine therapy only, (C) Chemotherapy only, (D) Hormonal therapy + Chemotherapy, (E) Chemotherapy + Target therapy, and (F) Hormonal therapy + Chemotherapy + Target therapy