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REVIEW ARTICLE

Outcome of patients with pregnancy during or after breast cancer: a review of the recent literature

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ABSTRACT

Background

An increasing number of young women are delaying childbearing; hence, more are diagnosed with breast cancer (BCa) before having a family. No clear recommendations are currently available for counselling such a population on the safety of carrying a pregnancy during BCa or becoming pregnant after treatment for BCa.

Methods

Using a Web-based search of PubMed we reviewed the recent literature about BCa and pregnancy. Our objective was to report outcomes for patients diagnosed with BCa during pregnancy, comparing them with outcomes for non-pregnant women, and to evaluate prognosis in women diagnosed with and treated for BCa who subsequently became pregnant.

Results

"Pregnancy and BCa" should be divided into two entities. Pregnancy-associated BCa tends to be more aggressive and advanced in stage at diagnosis than BCa in control groups; hence, it has a poorer prognosis. With respect to pregnancy after BCa, there is, despite the bias in reported studies and meta-analyses, no clear evidence for a different or worse disease outcome in BCa patients who become pregnant after treatment compared with those who do not.

Conclusions

Pregnancy-associated BCa should be treated as aggressively as and according to the standards applicable in nonpregnant women; pregnancy after BCa does not jeopardize outcome. The guidelines addressing risks connected to pregnancy and BCa lack a high level of evidence for better counselling young women about pregnancy considerations and preventing unnecessary abortions. Ideally, evidence from large prospective randomized trials would set better guidelines, and yet the complexity of such studies limits their feasibility.

KEY WORDS

Breast cancer, pregnancy, outcomes, abortion

1. INTRODUCTION

With advances in local and systemic treatments, recurrence rates and risk of death secondary to breast cancer (BCa) have been in continuous decline[1]. Breast cancer is among the malignancies most commonly encountered during pregnancy[2,3]: 0.2%–3.8% of cases are diagnosed during pregnancy and lactation[4]. The frequency increases with younger patient age: among women less than 30 years of age, 10%–20% of BCa cases are diagnosed during pregnancy or within 1 year after delivery[5]. Since the early 2000s, women delaying childbearing has been an increasing trend[6]. More patients with BCa inquire about fertility-related issues and whether a subsequent pregnancy might alter their risk of disease recurrence after adjuvant treatment[7]. Approximately 50% of women with a history of BCa might wish for a subsequent pregnancy[8], but only 4%–7% manage to become pregnant[9]. Potential explanations are damaged fertility and fear on the part of both the patient and her physician of a negative impact of pregnancy on the evolution of BCa. Physicians have often assumed that pregnancy after BCa increases the risk of cancer recurrence; they advise up to 35% of women who become pregnant after BCa to have an abortion[10,11]. Understanding the risks of pregnancy during and after BCa has become more important as more women delay childbearing. Few studies have looked at these issues, emphasizing the need to improve the quality of the available evidence so as to better counsel the women involved.

The objective of the present review was to report and discuss the guidelines currently used to treat women diagnosed with BCa during pregnancy and to counsel women who seek to become pregnant after BCa. This update to the current Canadian guidelines (last updated in 2002) sought to determine whether major changes in current daily practice were required.

2. METHODS

A manual and electronic Web-based search of MEDLINE and PubMed retrieved all articles concerning BCa and pregnancy published in the English language since the early 1990s, including cohort studies, reviews, mini-reviews, systematic reviews, and meta-analyses. All recent guidelines on pregnancy and BCa reported and used by oncology societies were also retrieved. The search used combinations of these phrases or key words: "breast cancer during pregnancy," "pregnancy after breast cancer," "pregnancy following breast cancer," "breast cancer after pregnancy," "pregnancy associated breast cancer," "breast carcinoma/cancer and pregnant women," "childbearing after breast cancer/carcinoma." We reviewed all articles addressing survival outcomes in patients who were diagnosed with BCa during pregnancy or who became pregnant after being treated for BCa. We focused mainly on any recently reported meta-analyses. The guidelines described and discussed in the present work came from the American Society of Clinical Oncology, the U.S. National Comprehensive Cancer Network, the European Society for Medical Oncology, and the Society of Obstetricians and Gynaecologists of Canada.

3. RESULTS

Our review identified two separate pregnancy and BCa entities that should be approached and treated differently:

- Women diagnosed with BCa during pregnancy or within 1 year of delivery, known as pregnancy-associated BCa (PABCa)
- Women who had been treated for early BCa and were subsequently seeking to become pregnant, known as pregnancy after BCa (PAFBCa)

Of 3459 articles initially retrieved, only fifty-eight studies, reviews, and meta-analyses met the search and eligibility criteria. We retained and analyzed all fifty-eight manuscripts that studied outcomes (survival) in patients diagnosed with BCa during pregnancy and patients treated for BCa who then became pregnant and compared those outcomes with outcomes in nonpregnant patients. We identified nineteen reviews, twenty studies of BCa, and fifteen studies of PAFBCa. Most of the recent studies were retrospective; one large meta-analysis addressed BCa, and three addressed PAFBCa. Figure 1 presents the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart for our search. Tables I and II summarize all studies meeting our search criteria and reported in the literature since the early 1990s for BCa and PAFBCa respectively.

3.1 PABCa

3.1.1 Epidemiology and Clinicopathologic Features

The incidence of PABCa is 1.3 in 10,000 births[46]. The disease is usually associated with an advanced-stage bulky primary tumour and nodal disease. It is diagnosed as stage II–III in 65%–90% of cases, in contrast to the 45%–66% for non-pregnancy-associated BCa[47,48]. Diagnosis is almost always delayed (because of gestational physiologic alterations in the breast) and occurs at a younger age[15,48]. A delay of 1 month in diagnosis translates into a 0.9% increase in the odds of lymph node metastases[49]. Pregnancy-associated BCa also has unfavourable biologic features related to poor prognostic outcome: high tumour grade, low hormone receptors, increased expression of HER2 (human epidermal growth factor receptor 2), and high levels of Ki-67 nuclear antigen[47,50].

3.1.2 Outcome and Management

In the early twentieth century, BCa was considered to have such a poor prognosis that treatment was deemed futile. There was a persistent belief that BCa accompanied by pregnancy portended poor survival[51,52]. Therapeutic abortion was a response to the belief that the hormonal milieu of pregnancy resulted in the poor outcome. Some studies indicate that prognosis in advanced-stage cancer is worse in the pregnancy-associated group than in a stage-matched nonpregnant group[15,48], especially for women more than 35 years of age and for those diagnosed within 1 year postpartum[20,21,24,28,53].

In a recent meta-analysis, the risk of death was more than 40% higher in women with PABCa than in those with non-PABCa[54]. However, although increased mortality was observed among women diagnosed with PABCa, the difference became less pronounced after adjustment for age at diagnosis. Further adjustment for stage lowered the risk only slightly, suggesting that age, rather than stage, represents the principal driver of the increased mortality observed in women with PABCa. This meta-analysis remains the largest work studying outcome in PABCa and shows a clear trend of worse outcome especially for women diagnosed postpartum[54].

Other studies show that prognosis in PABCa is similar to that in BCa unrelated to pregnancy when matched for age and disease stage[15,21,55]. Recently Amant *et al.*[29] reported the largest cohort study to date on prognosis in PABCa (311 women diagnosed and treated during pregnancy). After adjustment for known prognostic factors, those authors found

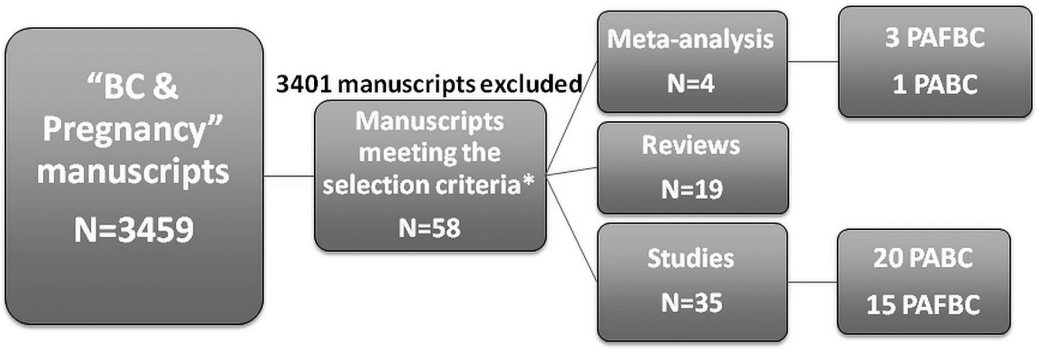

FIGURE 1 *PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart for the literature review.*

TABLE I Summary of studies examining pregnancy-associated breast cancer, 1994–2014

Reference	*Pts (n)*	*Study type*	*Statistics*	*Results*	*Treatment (%)*
Chang *et al.*, 1994[12]	21	Retrospective	p=NS	No difference in survival	
Guinee *et al.*, 1994[13]	407	Retrospective	HR: 3.26 95% CI: 1.81 to 5.87 p=0.0004	Worse survival in pregnant women	Surgery: 94 Radiation therapy: 58 Chemotherapy: 53 Hormonal therapy: 14
Ezzat *et al.*, 1996[14]	28	Retrospective	p=0.86	No difference in survival	Surgery: 100 Radiation therapy: 65 Chemotherapy: 57
Bonnier *et al.*, 1997[15]	154	Retrospective	p=0.001	Worse survival in pregnant women	Mastectomy: 41 Radiation therapy: 76.6 Chemotherapy: 63.6 Oophorectomy: 25.3 Tamoxifen: 17.5
Ibrahim *et al.*, 2000[16]	72	Retrospective	p=0.79	No difference in survival	Surgery: 65 Chemotherapy: 50 Radiation therapy: 86
Aziz *et al.*, 2003[17]	24	Prospective	p>0.05	No difference in survival	Surgery: 100 Radiation therapy: 21 Chemotherapy: 88 Hormonal therapy: 75
Zhang *et al.*, 2003[18]	88	Retrospective	p=0.0536	No difference in survival	
Mathelin *et al.*, 2008[19]	40	Prospective	p=0.0001	Worse survival in pregnant women	Surgery: 100 Radiation therapy: 77.5 Chemotherapy: 82.5 Hormonal therapy: 45
Rodriguez *et al.*, 2008[20]	797	Retrospective	p=0.002	Worse survival in pregnant women	Surgery: 94 Radiation therapy: 39 Chemotherapy: 70

TABLE I Continued

Reference	*Pts (n)*	*Study type*	*Statistics*	*Results*	*Treatment (%)*
Beadle *et al.*, 2009[21]	208	Retrospective	p=0.068	No difference in survival	Surgery: 89 Radiation therapy: 46 Chemotherapy: 93 Hormonal therapy: 27
Halaska *et al.*, 2009[22]	32	Retrospective	p=0.449	No difference in survival	Surgery: 94 Chemotherapy: 100 Radiation therapy: 37.5 Hormonal therapy: 19
Makgasa *et al.*, 2009[23]	12	Retrospective	p=0.005 (disease-free survival)	Worse survival in pregnant women	Surgery: 100 Chemotherapy: 58
Moreira *et al.*, 2010[24]	87	Retrospective	95% CI: 19.4 to 40.9 months p=0.005	Worse survival in pregnant women	Not reported
Johansson *et al.*, 2011[25]	1110	Retrospective	HR: 3.8 95% CI: 2.4 to 5.9	Worse survival in pregnant women	Not reported
Ali *et al.*, 2012[26]	40	Retrospective	p=0.02	Worse survival in pregnant women	Surgery: 95 Radiation therapy: 80 Chemotherapy: 90
Azim *et al.*, 2012[27]	65	Retrospective	HR: 2.6 95% CI: 1.0 to 6.5	Worse survival in pregnant women	Surgery: 100 Radiation therapy: 78.5 Adjuvant chemotherapy: 67.7 Neoadjuvant chemotherapy: 11 Hormonal therapy: 70.8
Murphy *et al.*, 2012[28]	99	Retrospective	p=0.131	No difference in survival	Surgery: 100 Radiation therapy: 49.5 Chemotherapy: 97 Hormonal therapy: 63
Amant *et al.*, 2013[29]	311	Retrospective	HR: 1.19 95% CI: 0.73 to 1.93 p=0.51	No difference in survival	Surgery: 93 Radiation therapy: 73 Chemotherapy: 99 Hormonal therapy: 41.5
Johansson *et al.*, 2013[30]	317	Retrospective	HR: 1.22 95% CI: 0.84 to 1.78	Worse survival in pregnant women	Not reported
Litton *et al.*, 2013[31]	75	Retrospective	HR: 1.87 95% CI: 1.04 to 3.36 p=0.037	Better survival in pregnant women	Surgery: 96 Radiation therapy: 65 Neoadjuvant chemotherapy: 53 Adjuvant chemotherapy: 60 Hormonal therapy: 25

Pts = patients; NS = nonsignificant; HR = hazard ratio; CI = confidence interval.

TABLE II Summaries of studies examining pregnancy after breast cancer, 1994–2014

Reference	*Pts (n)*	*Study type*	*Statistics*	*Results*	*Notes*	*Treatment (%)*
Sankila *et al.*, 1994[32]	91	Retrospective	Relative risk: 4.8	Better survival in pregnant women		
Dow *et al.*, 1994[33]	23	Retrospective	p=NS	No difference in survival		
von Schoultz *et al.*, 1995[34]	50	Retrospective	HR: 0.48 p=0.14	No difference in survival	Women pregnant before BCA also studied	Not reported
Lethaby *et al.*, 1996[35]	14	Retrospective	p=NS	No difference in survival	Pregnant women with BCA also studied	Not reported
Gelber *et al.*, 2001[10]	94	Retrospective	Risk ratio: 0.44 95% CI: 0.21 to 0.96 p=0.04	Better survival in pregnant women		Mastectomy: 68 Breast-conserving surgery: 22.6 Radiation therapy: 28 Chemotherapy: 59
Mueller *et al.*, 2003[36]	438	Retrospective	Relative risk: 0.54 95% CI: 0.41 to 0.71	Better survival in pregnant women		Radiation therapy: 26 Chemotherapy: 31
Blakely *et al.*, 2004[37]	47	Retrospective	HR: 0.7 p=NS	No difference in survival		Not reported
Ives *et al.*, 2007[38]	62	Retrospective	HR: 0.59 95% CI: 0.37 to 0.95	Better survival if conceiving more than 2 years from BCA; no survival difference if conceiving more than 6 months from BCA		Surgery: 100 Radiation therapy: 43 Chemotherapy: 41
Kroman *et al.*, 2008[39]	371	Retrospective	Relative risk: 0.73 95% CI: 0.54 to 0.99	Better survival in pregnant women		Not reported
Rippy *et al.*, 2009[40]	18	Retrospective	p=0.225	No difference in survival		Not reported

TABLE II Continued

Reference	*Pts (n)*	*Study type*	*Statistics*	*Results*	*Notes*	*Treatment (%)*
Largillier *et al.*, 2009[41]	Before: 105 After: 118	Retrospective	$p<0.001$	No survival difference before pregnancy; better survival after pregnancy	Pregnant patients before and after BCA	Pregnancy during preceding year: Surgery, 59; radiation therapy, 40; chemotherapy, 74 Pregnancy after treatment: Surgery, 67; radiation therapy, 49; chemotherapy, 65
Kranick *et al.*, 2010[42]	107	Retrospective	HR: 1.0 95% CI: 0.6 to 1.9	No difference in survival		Surgery: 100 Radiation therapy: 32.1 Chemotherapy: 38.7 Hormonal therapy: 2.8
Córdoba *et al.*, 2012[43]	18	Retrospective	$p=0.009$	Better survival for pregnant women	Women pregnant before BCA also studied	Mastectomy: 61 Radiation therapy: 52.9 Chemotherapy: 89.9 Hormonal therapy: 38.9
Azim *et al.*, 2013[44]	333	Retrospective	Disease-free survival: ER+ HR, 0.91; 95% CI, 0.67 to 1.24; $p=0.55$; ER– HR, 0.75; 95% CI, 0.51 to 1.08; $p=0.12$ Overall survival: HR, 0.72; 95% CI, 0.54 to 0.97; $p=0.03$	Same disease-free survival, better overall survival for pregnant women		Surgery: 100 Chemotherapy: 79 Hormonal therapy: 26
Valentini *et al.*, 2013[45]	128	Retrospective	HR: 0.76 95% CI: 0.31 to 1.91 $p=0.56$	No difference in survival	*BRCA1/2* carriers, pregnancy during and after BCA included	Surgery: 99.6 Radiation therapy: 52.8 Chemotherapy: 83.5 Tamoxifen: 17

Pts = patients; NS = nonsignificant; HR = hazard ratio; BCA = breast cancer; CI = confidence interval; ER+ = estrogen receptor–positive; ER– = estrogen receptor–negative.

no differences in disease-free (DFS) or overall survival (OS) based on pregnancy at the time of the BCa diagnosis. Multivariable methods confirmed that pregnancy was not a factor in recurrence or death risk for the pregnant population examined. Another recent study showed that patients treated with chemotherapy during pregnancy experience survival that is comparable to, if not better than, that in nonpregnant patients. The authors concluded that PABCa patients in their second or third trimester should be appropriately treated using the established standard of care[31].

Data from the literature are therefore not consistent, and the level of evidence from the reported results is low. The worse prognosis described for PABCa might be only partly explained by the delay in diagnosis. The effect of pregnancy on prognosis because of an influence on the biology of the disease remains to be confirmed, especially given that PABCa patients could potentially be undertreated.

3.2 PAFBCa

3.2.1 Preclinical Studies

Some biologic hypotheses have suggested a protective effect of pregnancy after BCa. Preclinical models show that a high estrogen level after estrogen deprivation induces apoptosis in estrogen receptor (ER)–positive BCa cell lines[56]. In addition, fetal microchimerism has been suggested to act as an immunologic boost for patients previously exposed to tumour-associated antigens—for example, MUC1[57].

3.2.2 Clinical Studies and Outcome Cohort Studies:

Several studies have addressed the safety of pregnancy after a BCa diagnosis. Some suggested that pregnancy is associated with a better prognosis: that is, compared with women who did not become pregnant after a BCa diagnosis, those who did become pregnant experienced a significant improvement in OS. Mueller *et al.*[36] found that pregnancy after BCa treatment lowered the risk for death (relative risk: 0.54), which was statistically lower in women who were less than 35 years of age, who were of white ethnicity, and who had a tumour larger than 2 cm in size. In another study, an age- and stage-adjusted analysis revealed a lower relative risk for death (0.8) with pregnancy after BCa treatment[58]. Blakely *et al.*[37] showed that, in 370 women less than 35 years of age with BCa, 47 became pregnant after adjuvant chemotherapy, and pregnancy did not increase the risk of recurrence or death. Ives *et al.*[38] also found that pregnancy after BCa treatment did not adversely affect survival, but that survival rates were better in women who delayed pregnancy for 24 months or more after the end of BCa treatment.

Meta-analysis: A large meta-analysis (fourteen studies) found that pregnancy after a BCa diagnosis reduced the risk of death by 41%[59]. However, that reduced risk is likely confounded by a selection bias known as the "healthy mother effect"[32]. In a multicentre retrospective study, the same group studied the prognostic impact of pregnancy after BCa by hormone receptor (ER) status. Among patients with ER-positive BCa, those who became pregnant experienced the same DFS as a matched nonpregnant group. The same observation was reported when the analysis was restricted to ER-negative patients or when it considered all patients regardless of ER status. Furthermore, the pregnant group experienced better OS, with no interaction by ER status being observed[44]. There was no difference in DFS between the patients who became pregnant 2 years or more from their BCa diagnosis and the matched group. However, those who became pregnant within 2 years of the BCa diagnosis experienced a better DFS[44]. Another large meta-analysis addressed the same subject and tried to overcome the bias of the healthy mother effect. After considering the potential for such a bias in the matched controls, ten studies were eligible, and nine contained data appropriate for analysis. Overall survival was statistically higher among patients who became pregnant than among those who did not, showing that pregnancy occurring at least 10 months after a BCa diagnosis does not jeopardize prognosis and might even confer a significant survival benefit[60]. The same results were also recently reported in a third meta-analysis studying the safety of pregnancy after surgical treatment for BCa. No increase in the BCa recurrence rate was observed, and a probable improvement in outcome (OS) was also reported[61].

Overall, the literature is reassuring and does not show a worse outcome for women with previously diagnosed and treated BCa who seek to become pregnant afterward. Some data even suggest a better survival outcome. Those findings should bring comfort to physicians and to women with a previous BCa diagnosis.

4. CURRENT INTERNATIONAL GUIDELINES

No current guideline is based on randomized prospective studies; hence, no level 1 evidence yet exists.

The National Comprehensive Cancer Network guideline does not recommend medical abortion for either situation (PABCa and PAFBCa), especially for women with early BCa. In case of metastasis, the treatment plan might be altered, influencing the patient's decision about maintenance of pregnancy. Such alterations should be discussed in a multidisciplinary setting and also with the patient[42,62].

The European Society for Medical Oncology also considers that evidence about any difference in prognosis between pregnant and nonpregnant women with BCa is lacking, and it does not recommend pregnancy termination in that setting[63,64] regardless of the ER status of the tumour.

Recommendations from the Society of Obstetricians and Gynaecologists of Canada date to 2002. Because rates of survival tend to be the same in PABCa and nonpregnant BCa patients when the women are matched for age and stage, there is no strong evidence to recommend abortion for PABCa. The available evidence for PAFBCa shows no detrimental effect on survival. With a low level of evidence, the society therefore recommends that women wait at least 3 years before attempting pregnancy (5 years if they have nodal involvement)[65]. Those timeframes might be unrealistic in terms of fertility maintenance after BCa treatment.

Table III summarizes the three foregoing guidelines.

With respect to management and treatment, most guidelines recommend multidisciplinary decisions. Early diagnosis of PABCa is crucial, and treatment, especially surgery, should not be delayed. Mastectomy and breast-conserving surgery are both acceptable options provided that the patient will, in the latter case, receive radiation treatment after delivery. Chemotherapy can be safely used during the 2nd and 3rd trimesters. Anthracyclines and cyclophosphamide can be given safely; data on the use of taxanes are limited. Radiation treatment, targeted therapies, and endocrine treatment should be initiated after delivery[62,63,64].

5. DISCUSSION AND RECOMMENDATIONS

5.1 PABCa

Rates of pregnancy are usually lower in women who are cancer survivors than in the general female population; in women diagnosed with BCa, the rate is nearly 70% lower[64]. As detailed earlier, the level of evidence is too low to conclude that outcomes are worse in patients with PABCa than in nonpregnant patients diagnosed with BCa of the same stage at the same age. In line with that understanding, most trials offered the study group (pregnant women) treatments (presented in Table I) that were not different from the treatments offered to the control group (nonpregnant women), showing that the pregnant patients were not undertreated. However, one meta-analysis reported worse outcomes for pregnant patients, especially the postpartum group, with significant heterogeneity between trials[54]. Hence, patients with PABCa should be treated appropriately and as aggressively as nonpregnant patients. Choices and therapeutic sequences should be considered during a multidisciplinary meeting involving gynecologists, obstetricians, radiologists, oncologists, and pediatricians. No strong evidence supports a recommendation of pregnancy interruption or medical abortion in such cases.

5.2 PAFBCa

Pregnancy after BCa can be considered safe in women with a history of BCa. Some groups consider that a minimum period of 2 years after a BCa diagnosis should pass before any attempt at pregnancy, both because of the reassuring results in patients who became pregnant more than 2 years after their BCa diagnosis and because of the possible adverse effects of pregnancy and a high incidence of tumour recurrence during the first 2 years[66]. In addition, because of poorer prognosis and a higher recurrence rate, young women (<35 years of age) have been advised to wait at least 3 years and, in the presence of node-positive disease, at least 5 years before becoming pregnant[67]. The suggested delay might also allow patients to recover from chemotherapy-induced ovarian toxicity (even though there are no guarantees—especially given that, after chemotherapy, the ovarian reserve is diminished and more waiting time can be detrimental).

For patients with a history of ER-positive breast cancer, 5–10 years of adjuvant hormonal therapy remains the current standard of care (10 years based on the ATTOM and ATLAS trials[68,69]). Recommending that women complete their treatment period and then consider becoming pregnant presents a challenge for

TABLE III International guidelines pertaining to breast cancer and pregnancy

Guideline	*Pregnancy-associated breast cancer*	*Pregnancy after breast cancer*
ESMO 2013[63,64]	No recommendation for abortion (lack of evidence)	No recommendation against pregnancy[a]
NCCN 2014[42,62]	No recommendation for medical abortion (discussion in a multidisciplinary setting, discussion with patient)	No recommendation against pregnancy
SOGC 2002[65]	No recommendation for abortion[b]	No recommendation against pregnancy (no detrimental effect)[c]

[a] "Do not discourage pregnancy following breast cancer diagnosis irrespective of the [estrogen receptor] status."

[b] "In early pregnancy, the patient should be counseled regarding the effect of proposed therapy on the fetus and on overall maternal prognosis. Termination of pregnancy should be discussed, but the patient should be counseled that prognosis is not altered by termination of pregnancy."

[c] "Woman treated for [breast cancer], who wish to become pregnant should be counseled that pregnancy is possible and does not seem to be associated with a worse prognosis. However, they should be made aware that the evidence to support such advice is relatively poor."

ESMO = European Society for Medical Oncology; NCCN = National Comprehensive Cancer Network; SOGC = The Society of Obstetricians and Gynaecologists of Canada.

most patients, because their chances of pregnancy could be low after 5–10 years of tamoxifen[70]. A conflict always remains for women with ER-positive disease who are willing to interrupt their endocrine treatment to become pregnant. These women should be counselled that interruption of hormonal therapy could be detrimental to their BCa outcome. In women willing to consider the risk, interruption after 2–3 years of tamoxifen could be considered to allow for a pregnancy, with resumption of tamoxifen after delivery.

Going further, the type of treatment given did not differ for the study group (PABCa) compared with the control group (nonpregnant women) in most trials (Table II). Consequently, counselling women against pregnancy remains unjustified. In addition, current data do not suggest an increased risk of birth defects or genetic diseases in infants delivered by women previously treated with chemotherapy[71]. However, increased incidences of birth complications (cesarean section, preterm birth, babies with low birth weight) are reported[72].Close monitoring of pregnancy in women previously treated for cancer is therefore highly recommended.

More effort must be directed toward preserving the fertility of young women who are willing to consider pregnancy after completion of their chemotherapy. Patient preferences with respect to future fertility and the desire to have a biologic child should be critical factors during the decision-making process[73]. As emphasized in the recommendations from the American Society of Clinical Oncology, oncologists dealing with young women diagnosed with BCa should be aware of infertility concerns and should address fertility issues early in the disease course[74]. Unfortunately, no strong evidence has as yet been developed to help clinicians advise patients about the optimal time to become pregnant after a BCa diagnosis. Time of therapy completion, risk of relapse, and age and ovarian function of the patient should be taken into consideration. Postponing pregnancy for 2 years after diagnosis might be reasonable to allow for resumption of adequate ovarian function and to bypass the period associated with a relatively high risk of recurrence.

6. CONCLUSIONS

Given that no level 1 evidence has been developed addressing pregnancy and BCa risk, young women who are diagnosed with BCa during pregnancy or who are seeking to achieve pregnancy after BCa treatment should receive a carefully coordinated multidisciplinary approach. Women diagnosed with BCa during pregnancy should be treated as aggressively as their nonpregnant counterparts. The proscription against pregnancy after BCa treatment because of concerns about cancer recurrence and death from BCa is not supported by current data. Stronger and better guidelines supporting the conclusions and recommendations outlined here should ideally be developed from large randomized prospective trials conducted for validation, and yet we recognize the complexity of conducting such trials in this setting. To assess patient and pregnancy outcomes, a global prospective study by the Breast International Group and the North American Breast Cancer Group is prospectively collecting data about young women with early BCa who desire pregnancy[75].

7. CONFLICT OF INTEREST DISCLOSURES

We have read and understood *Current Oncology*'s policy on disclosing conflicts of interest, and we declare that we have none.

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