Many women of childbearing age are diagnosed with cancer in the United States each year. Improved survival rates can give many time to still have their own families if they choose. Although cancer treatments can dramatically increase survivorship, they also can negatively affect future fertility. Women newly diagnosed with cancer may not be aware of the possible damage to their future fertility as their main concern is survival. Women who may have their fertility compromised by cytotoxic treatments should be counseled and referred to reproductive specialists to explore their options. Although receiving a diagnosis of cancer is overwhelming, fertility counseling should be initiated as early as possible so that sufficient time exists to preserve fertility before ovarian damage occurs. Many fertility preservation options, including egg, embryo, and ovarian tissue freezing, can be done in a short period of time so as not to delay the start of cancer treatment. To educate and support women with cancer of childbearing age, oncology nurses should be aware of fertility preservation options and work closely with infertility nurses.

M.B. was a 35-year-old woman initially diagnosed with right breast cancer in April 2009. During a routine self-breast examination, M.B. palpated a small lump and contacted her gynecologist for evaluation. Based on M.B.’s age and lack of family history for breast cancer, M.B. and her gynecologist were optimistic that the lump was benign. A digital mammogram, ultrasound, and a subsequent magnetic resonance image confirmed that the lump looked highly suspicious. A core biopsy revealed invasive ductal carcinoma and M.B. underwent a right lumpectomy and sentinel lymph node biopsy. The pathology report indicated a 2.4 cm poorly differentiated (grade 3) tumor with ductal and lobular features, no lymphovascular invasion identified, and right sentinel lymph nodes negative for malignancy. Receptor status analysis showed the tumor was estrogen-receptor positive and progesterone-receptor positive. HER2-neu was 2+ by fluorescent in situ hybridization testing. Subsequent BRCA1 and BRCA2 testing were negative.

The recommended course of treatment by M.B.’s oncology team was four rounds of taxotere and carboplatin plus one year of herceptin treatment followed by five years of tamoxifen. The potential damaging effects of chemotherapy on M.B.’s fertility were an immediate concern to M.B. and her fiancé, who were planning a June 2009 wedding and children in the future. M.B. was counseled that her planned regimen would cause damage to her oocytes (eggs) and accelerate the aging of her ovaries, possibly resulting in premature menopause. These effects would significantly diminish her chances of becoming pregnant with her own eggs and having a child in the future. During the five years of tamoxifen therapy, M.B. would be advised not to attempt pregnancy because tamoxifen is a pregnancy Category D drug.

Based on M.B.’s desire to have children in the future and the potential damaging effects of the chemotherapy on her fertility, M.B.’s oncology team referred her to a reproductive endocrinologist to explore her options for fertility preservation before her cytotoxic treatment was initiated. During consultation with the reproductive specialist, M.B. was evaluated and informed about reproductive biology and the normal process of ovarian aging.

**Patient Assessment**

Ovarian reserve is the term used to describe the ability of a woman’s ovaries to produce eggs that will ultimately produce a baby. To access her ovarian reserve, M.B. had an ultrasound to see the number of follicles on each ovary. Her hormones levels, including estradiol, follicle-stimulating hormone, and antimullerian hormone, also were measured. The tests helped to determine the dose of hormones and fertility treatment protocol M.B. would need to stimulate her ovaries to achieve the maximum number of quality eggs. Because of the planned oncology treatment schedule of chemotherapy followed by five years of tamoxifen, M.B. would not be able to attempt pregnancy until she was older than age 40; however, pregnancy and live birth rates for women older than age 40 are lower than for younger women (Ventura, Abma, Mosher, & Henshaw, 2009). In addition, M.B.’s ovaries would be damaged by the chemotherapy regimen, thereby causing her ovaries to act

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much older than her chronological age. Therefore, the chances of M.B. conceiving with her own eggs after chemotherapy were very low. To improve her chances of having her own biological child, M.B. decided to be proactive in preserving her fertility before treatment.

Etiology

M.B. is one of the 692,000 women diagnosed with cancer each year, 10% of which are of childbearing age (younger than 45 years old) (American Cancer Society [ACS], 2008). Early detection and improved outcomes for many types of cancer have made survivorship issues even more prevalent. Chemotherapy, radiation, and bone marrow transplantation all can accelerate the loss of eggs and affect the quality of eggs which, in turn, can lead to infertility.

A girl is born with about 1.5 million eggs in her ovaries and no new eggs will develop after birth. During a woman’s lifetime, the quantity and quality of the eggs decline. About 400–500 eggs are released (ovulate) during reproductive years, and the rest gradually degenerate (Speroff & Fritz, 2005). Until the eggs are released, they are dormant and susceptible to damage from age and cancer treatments. Normal female fertility significantly declines after the age of 35 and the addition of chemotherapy and/or radiation can speed up the process dramatically.

Women newly diagnosed with cancer are, of course, overwhelmed and concerned with the issue of survival, but this also is the time when they should be informed that the recommended treatment may damage their fertility (Davis, 2006). The literature has shown that women diagnosed with cancer are highly interested in fertility intervention; however, many oncologists are either not providing the necessary information to these women and their families or are doing so suboptimally (Lee et al., 2006). Patients who are concerned about future fertility should be referred to a reproductive specialist to explore their options. The current options available include freezing (cryopreservation) of oocytes, embryos, or ovarian tissue (see Table 1). Surgical options to preserve fertility include ovarian transposition (strategically moving the ovaries out of the field of radiation therapy) and fertility-sparing surgeries for gynecologic malignancies. A glossary of commonly used terms in reproductive endocrinology has been provided in Figure 1.

Management

Because M.B. had a partner, she was advised that her best chance of preserving her fertility would be to undergo an in vitro fertilization (IVF) cycle and cryopreserve the embryos. IVF is the technique used to obtain eggs from the ovaries. It involves pretreatment with hormone injections to get as many eggs to maturity as possible. Once these eggs are mature (the process may take 8–12 days), they are retrieved during a transvaginal surgical procedure.

Because of the importance M.B.’s oncology team placed on starting her chemotherapy as soon as possible, her IVF cycle needed to start immediately after oncology clearance was obtained. After consultation with the doctor, M.B. met with an infertility nurse coordinator who educated M.B. on how an IVF cycle works and the medications and timing that would be involved. In addition, the nurse worked as a liaison for M.B. with her insurance company to appeal for coverage and referred her to the patient advocacy group, Fertile Hope (www.fertilehope.org), to apply for donated injectable hormone medications (gonadotropins). The nurse also coordinated communication between the oncology team and the IVF teams to ensure that all parties were aware of M.B.’s progress.

To stimulate her ovaries, M.B. would need to inject herself subcutaneously with the required hormones on a daily basis for 10–14 days. The nurse provided injection training to M.B. and her partner to ensure they were comfortable administering the hormone injections at home. The nurse also informed M.B. and her partner that these hormones can result in markedly elevated estradiol levels during an IVF cycle. In estrogen-sensitive cancers, some concern exists about the effect the exposure of these elevated levels may have on a patient’s cancer (ACS, 2009). Letrozole, an aromatase inhibitor, is given to maintain lower estradiol levels while still allowing follicular growth. M.B. was counseled that the effects of ovarian stimulation on her cancer have not been well studied and ovarian stimulation may propagate her cancer cells and interfere with the outcome of the cancer treatment, leading to reduced longevity or cancer recurrence.

### Table 1. Options for Fertility Preservation in Women

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embryo cryopreservation</td>
<td>Proven technology</td>
<td>Requires that patient has reached puberty</td>
<td>Frozen cycle: 25%–34% pregnancy rate</td>
</tr>
<tr>
<td></td>
<td>Widely available</td>
<td>Requires 2–4 weeks to complete cycle</td>
<td>Fresh cycle: 28%–45% pregnancy rate</td>
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<tr>
<td></td>
<td></td>
<td>Sperm source required</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Hormone injections</td>
<td></td>
</tr>
<tr>
<td>Oocyte cryopreservation</td>
<td>No sperm source required</td>
<td>Considered research and experimental</td>
<td>Slow freezing method: 10%–20% pregnancy rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower egg survival rate</td>
<td>Vitrification method: 21%–45% pregnancy rate per cycle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requires 2–4 weeks to complete cycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hormone injections</td>
<td></td>
</tr>
<tr>
<td>Ovarian tissue cryopreserva-</td>
<td>No sperm source required</td>
<td>Requires two surgical procedures</td>
<td>Five reported live births to date</td>
</tr>
<tr>
<td>tion</td>
<td>No hormone injections required</td>
<td>Experimental</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short time frame</td>
<td>Risk of reintroducing malignant cells</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Can be done in prepubescent females</td>
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</tbody>
</table>

* Results are for women 40 years of age or younger.

Note. Based on information from Anderson et al., 2006; Chen et al., 2003; Demeestere et al., 2009; Gidoni et al., 2008; Kuohung et al., 2008; Oktay et al., 2006; Society for Assisted Reproductive Technology, 2007; Statcheck, 2006.
**Outcome**

After 10 days of ovarian stimulation, M.B. was set up for vaginal oocyte retrieval. The oocytes were then fertilized with M.B.’s partner’s sperm in the embryology laboratory and the resulting embryos were cryopreserved for future use. M.B. was able to complete two IVF cycles before her scheduled chemotherapy start date one week later. During this time, M.B. completed her testing for the upcoming treatment regimen (electrocardiogram, echocardiogram, multigated acquisition scan), worked full-time, and planned her wedding for June 2009. Fortunately, careful and strategic coordination among her oncology team, her reproductive endocrinology team, and her family and friends allowed M.B. to continue to work, undergo two IVF cycles, and be a bride as well.

M.B.’s nurse was instrumental in making sure that she was able to maintain as much normalcy as possible during this very stressful time and provided emotional support throughout the process. M.B. was able to bank embryos, which provided her with a reasonable chance of having a family in the future.

**Conclusion**

As cancer survival rates increase, the issue of fertility preservation for women is of growing importance. Because many cancer treatments can pose a threat to future fertility, patients should be informed of their options prior to damage being done. If a patient’s treatment may pose a threat to her fertility, proper informed consent would require that the oncology team discuss this risk. Patients should be referred to a reproductive specialist at the earliest possible time to learn about their options (Lee et al., 2006). Oncology nurses, in many settings, can play an integral role in educating patients about their options and providing them with referrals. Communication between these two advancing fields is vital for the education and support of women diagnosed with cancer who are concerned about their future fertility.

The author takes full responsibility for the content of the article. The author is a reproductive health nurse speaker for EMD Serono, Inc. The author did not receive honoraria for this work. No financial relationships relevant to the content of this article have been disclosed by the editorial staff.

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