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What Is the Best Risk-Reducing Decision for Breast Cancer Patients With BRCA1/2 Mutation?

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One of the most significant findings of the 1990s was the discovery of the *BRCA* gene mutation, which was a major advancement in the prevention of breast cancer. Since the *BRCA* breakthrough, screening for breast cancer susceptibility genes has become of great interest to high-risk patients and their family members.[1,2] *BRCA1* and *BRCA2* are two major genes responsible for about 5% to 10% of all breast cancer cases and 10% to 18% of ovarian cancer cases. Carriers of *BRCA1/2* mutation could have an elevated risk of 69% to 72% for breast cancer compared with the average-risk women (12%). The risk of ovarian cancer incidence is also much higher in women with a *BRCA1/2* mutation than in the normal population (17%-44% vs 1.5%).[3] Today, female carriers of a *BRCA1* or *BRCA2* mutation (both affected and unaffected) are offered various choices of lifesaving preventive care, including prophylactic surgery, chemoprevention, and intensive surveillance, aimed at reducing their risk of developing breast or ovarian cancer.[4]Nonetheless, in reality, finding the right choice is far more complicated.

The limitation in risk quantification is one of the key areas of challenge. Currently, carriers of *BRCA* mutation variants known as "definitely pathogenic" are commonly offered full high-risk surveillance, whereas decision making for carriers of variants with little or unknown risk for breast cancer remains unanswered.[5,6]

Bilateral prophylactic mastectomy, which is known as the single most effective preventive option, reduces the risk of breast cancer by about 90%.[7] Similarly, prophylactic bilateral salpingo-oophorectomy (PBSO) has been estimated to substantially decrease the risk of ovarian cancer in *BRCA* carriers.[8] However, age is very critical for prophylactic surgery. It has been demonstrated that unaffected carriers younger than 50 years gain more benefit from prophylactic procedures such as mastectomy than the others.[9] Also, it has been estimated that PBSO in premenopausal *BRCA* carriers may reduce their risk of breast cancer by 50%.[4,10]

The effect of the inherited mutation on the overall survival of a breast cancer patient is also a challenging issue. While many studies have shown that prophylactic procedures will be beneficial and increase the long-term survival, a recent study called POSH (Prospective Outcomes in Sporadic versus Hereditary breast cancer) did indicate that there was no significant difference in survival between BRCA1/2 carriers and non-carriers with young age at onset and at the time points of 2, 5, and 10 years after the first diagnosis and concluded that immediate bilateral mastectomy had no advantage in the overall survival of patients in at least 10 years' time period from the first diagnosis.[11] Another study showed that *BRCA* carriers undergoing breast-conserving therapy had a higher risk of local recurrence after 5, 10, and 15 years compared with the carriers who underwent a mastectomy.[12] A cohort study also showed that early-stage (I or II) breast cancer patients with a *BRCA* mutation who received bilateral mastectomy had longer survival rates compared with those undergoing unilateral mastectomy.[13]

None of the risk-reducing strategies is fully eliminating the risk of developing cancer and yet comes with potential complications. Risk-reducing surgeries of a woman who is within her childbearing time period have implications for her fertility or breastfeeding and also body image. Oophorectomy also causes early menopause and imposes several issues including gain weight, osteoporosis and heart diseases.[6,14]

Intensive surveillance has been designed to facilitate early detection of breast cancer in high-risk

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women, however, adherence is commonly required which may impose regular expenditure. The false positive test result is also another issue coming with psychological costs adding more distress to the individual.[7]

Chemoprevention by estrogen modulators tamoxifen and raloxifene decreased the risk of breast cancer by up to 70% and 76%, respectively, but had no effects on estrogen-negative breast cancer patients.[15] While other chemoprevention agents are yet to be approved, existing cancer medications exert adverse effects including increased risk of endometrial cancer and venous thrombosis.[7]

Given these considerations, there is no straight-forward task as the best risk-reducing practice for a *BRCA* mutation carrier. What is clear is that the risk of cancer in mutation carriers increases over time, but this does not mean to push patients to act immediately. Recent findings are emphasizing that carriers who have a pathogenic germline mutation in a susceptibility gene benefit from prophylactic surgeries; however, the best practice should be individualized and taken in to account according to each patient's type of mutation, age, tumor prognosis, consideration of the short-term and long-term risks, as well as the patient preferences.

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