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Hereditary breast cancer: molecular biology and management update

Hiroko Yamashita[1]

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Introduction

For *BRCA1* and *BRCA2* carriers, lifetime estimates of breast cancer risk range from 49% to 88%, whereas the risk of ovarian cancer ranges from 40% to 59%, and from 18% to 35%, for *BRCA1* or *BRCA2* carriers, respectively [1, 2]. Approximately 5% of unselected patients with breast cancer carry a germline *BRCA* mutation. The identification of *BRCA1* and *BRCA2* mutations permits the implementation of prevention strategies, including screening by magnetic resonance imaging or risk-reducing surgeries. As tumor suppressor genes, *BRCA1* and *BRCA2* encode proteins involved in the repair of DNA double-strand breaks by way of a homologous recombination repair pathway. Members of the poly (ADP-ribose) polymerase (PARP) family of enzymes are central to the repair of DNA single-strand breaks. Consequently, the oral PARP inhibitor, olaparib, is approved for the treatment of patients with recurrent ovarian cancer and a *BRCA* mutation. Moreover, olaparib has also been shown to have significant benefits compared with standard therapy in patients with metastatic breast cancer and a germline *BRCA* mutation [3]. In addition, since the initial discovery that pathogenic germline alterations in *BRCA1* and *BRCA2* genes increase susceptibility to breast and ovarian cancers, many genes have subsequently been discovered that also increase breast cancer risk [4]. Advances in technology have resulted in the ability to test for multiple genes associated with a hereditary predisposition to breast cancer.

The invited review articles present an overview of the current status of the molecular biology and management of hereditary breast cancer. In the first invited article, Professor Yoshio Miki, who cloned the *BRCA1* gene in 1994 [5], highlights basic aspects of the function and deficiencies of the *BRCA1* gene. In the second invited article, Dr. Hideko Yamauchi describes the management of hereditary breast cancer and discusses important issues in caring for patients and families in Japan with a *BRCA* mutation.

Compliance with ethical standards

Conflict of interest The author has no conflict of interest.

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✉ Hiroko Yamashita
hirokoy@huhp.hokudai.ac.jp

[1] Department of Breast Surgery, Hokkaido University Hospital, Kita 14 Nishi 5, Kita-ku, Sapporo 060-8648, Japan