

Timely Genetic Testing and Therapy Management in Patients With *gBRCA*-Mutated Metastatic Breast Cancer Receiving Talazoparib

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Authors' disclosures of conflicts of interest are found at the end of this article.

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Abstract

Talazoparib is a poly(ADP-ribose) polymerase (PARP) inhibitor that has demonstrated strong efficacy with manageable side effects for patients with germline breast cancer susceptibility genes 1 or 2 (*gBRCA1/2*)-mutated, human epidermal growth factor receptor 2-negative, locally advanced or metastatic breast cancer (mBC) in the EMBRACA and ABRAZO trials. The NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Breast Cancer recommend genetic testing for all patients with recurrent or metastatic BC to identify those with a *gBRCA1/2* mutation who would benefit from treatment with a PARP inhibitor. However, many patients who meet these criteria do not receive genetic testing for a variety of reasons. Advanced practitioners (APs) can play a key role in the care of these patients by guiding them through the genetic testing process and explaining how the results impact treatment choices. A hypothetical case study highlighting a 42-year-old woman who received a diagnosis of triple-negative mBC provides an example of genetic testing strategies, as well as management considerations, with the use of talazoparib that can be implemented by APs. The efficacy and safety of talazoparib are reviewed along with practical guidance on its use (i.e., managing adverse events and drug interactions) to optimize patient outcomes. The patient case described in this publication is fictional and does not represent actual events or a response from an actual patient. The authors developed this fictional case for educational purposes only.

CASE STUDY

Rozina is a 42-year-old premenopausal woman who presented to her primary care physician with worsening back pain over a few months

that did not abate following physical therapy (Table 1). Her initial workup included an MRI of the thoracic spine that discovered a suspicious lesion at T6. The primary care physician then referred the patient to an oncology clinic where a bone biopsy revealed metastatic carcinoma of breast origin. This led to a bilateral diagnostic mammogram that showed a spiculated mass in the upper aspect of the right breast and a few prominent nodes in the right axilla. Ultrasound revealed an irregular hypoechoic

nodule with spiculated border measuring at least 16 × 13 × 16 mm; an ultrasound-guided core biopsy of the right breast revealed grade 3 invasive ductal carcinoma that was estrogen receptor (ER)-negative/progesterone receptor (PR)-negative/human epidermal growth factor receptor 2 (HER2)-negative. A PET/CT scan was then performed, which showed a hypermetabolic right breast mass and hypermetabolic right axillary lymphadenopathy, as well as a hypermetabolic lesion at T6.

Table 1. Hypothetical Case Study: Rozina

Patient

- Rozina, age 42, of Ethiopian descent is married with 1 child (age 3 years). Works as an IT analyst with the same employer for > 10 years

Presentation

- Worsening back pain over several months despite physical therapy

Initial workup and findings

- MRI of thoracic spine led to referral to oncology for further workup

Oncology consultation

- Oncologist orders bone biopsy, finding metastatic carcinoma consistent with a breast primary that was ER-/PR-/HER2-
- Bilateral diagnostic mammogram revealed a spiculated mass measuring up to 1.6 cm in the upper aspect of the right breast at the 12-1 o'clock region and a few prominent nodes in the right axilla
- Ultrasound revealed an irregular hypoechoic nodule with spiculated borders measuring at least 16 × 13 × 16 mm. An ultrasound-guided core biopsy of right breast mass revealed grade 3 invasive ductal carcinoma, ER 0%, PR 0%, HER2 0%, Ki-67 33%
- PET/CT scan showed a hypermetabolic right breast mass and hypermetabolic right axillary lymphadenopathy, as well as hypermetabolic lesion at T6

Family history

- She has 4 sisters, ages 33–45 years, and 1 brother, age 41 years
- Mother, age 72 years, is alive and in good health
- Neither her mother nor her siblings have ever been diagnosed with cancer
- Father, age 76 years, is currently being treated for prostate cancer
- Extended family history is unknown

Medical history

- Recently diagnosed with *Helicobacter pylori*; treatment was delayed in light of the new diagnosis of mBC

Genetic counseling

- Breast/ovarian cancer panel, consisting of 21 genes with hereditary breast and/or ovarian cancer association and available targeted treatments, was ordered; results revealed a germline *BRCA1* mutation

Treatment plan

- Palliative radiation to the thoracic spine (5 fraction) initiated while waiting for the results of germline testing
- Talazoparib 1 mg po daily initiated once results were returned that she was *BRCA1*-positive
- Zoledronic acid 4 mg IV every 4 weeks
- Calcium supplement 500 mg po daily
- Vitamin D 400 IU po daily
- Treatment for *H. pylori* for 14 days
 - » Omeprazole 20 mg po twice daily
 - » Bismuth subcitrate 300 mg po 4 times daily
 - » Doxycycline 100 mg po twice daily
 - » Metronidazole 250 mg po 4 times daily

Note. *BRCA* = breast cancer susceptibility genes; ER- = estrogen receptor negative; HER2- = human epidermal growth factor receptor 2 negative; IT = information technology; IV = intravenous; mBC = metastatic breast cancer; po = orally; PR- = progesterone receptor negative.

Approximately 170,000 metastatic breast cancer (mBC) cases in the United States were projected for 2020. In a systematic review, the prevalence of germline breast cancer susceptibility genes 1 or 2 (*gBRCA1/2*) mutations was 2.7% to 4.3% in patients with mBC and 9.3% to 15.4% in patients with triple-negative BC (Armstrong et al., 2019). Germline *BRCA1/2* mutations increase the average lifetime breast cancer risk for US females from 12% for noncarriers to between approximately 60% to 85% for those with either mutation depending on the population studied (Armstrong et al., 2000; Lukong, 2017).

Two poly(ADP-ribose) polymerase (PARP) inhibitors are approved by the US Food and Drug Administration (FDA) for HER2-negative *gBRCA*-mutated mBC treatment. Olaparib (Lynparza) is indicated for adult patients with deleterious or suspected deleterious *gBRCA*-mutated HER2-negative mBC previously treated with chemotherapy in the neoadjuvant, adjuvant, or metastatic setting. Patients with hormone receptor-positive mBC should have received prior endocrine therapy or be considered inappropriate for endocrine therapy (US Food and Drug Administration [FDA], 2021a). Talazoparib (Talzenna) is indicated for adult patients with deleterious or suspected deleterious *gBRCA*-mutated HER2-negative locally advanced or metastatic BC (Pfizer Inc., 2021). Two other PARP inhibitors, rucaparib (Rubraca) and niraparib (Zejula), are approved for advanced ovarian cancer and advanced epithelial ovarian, fallopian tube, and primary peritoneal cancers, respectively (FDA, 2020, 2021b).

The NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines[®]) for Breast Cancer (Version 2.2022) recommend *gBRCA1/2* mutation testing for all patients with recurrent or metastatic BC to identify candidates for PARP inhibitor therapy (i.e., olaparib and talazoparib). Although olaparib and talazoparib are approved by the FDA for use in HER2-negative disease, NCCN Guidelines support their use in any breast cancer subtype with a *gBRCA1/2* mutation (NCCN, 2022a). Genetic testing is also recommended for male breast cancer and triple-negative BC at any age, and high-risk, HER2-negative early BC to aid in treatment decision-making (NCCN, 2022b). Results from the recent OlympiA trial, which demonstrated significantly

longer survival without invasive disease recurrence, distant disease, and death, for patients with high-risk, HER2-negative early BC and *gBRCA1/2* mutations treated with adjuvant olaparib vs. placebo, emphasize the importance of genetic testing in making treatment decisions (Tutt et al., 2021).

Many women with a history of breast cancer do not undergo genetic testing. In an analysis of pooled cross-sectional data, 36% of women with a history of breast cancer met one or more eligibility criteria for genetic testing. Of these, only 29% discussed genetic testing with their health-care professional, 20% were advised to undergo testing, and 15% completed testing (Childers et al., 2017). In a US population-based study of 77,085 women ≥ 20 years of age who were diagnosed with breast cancer, only 24.1% had genetic testing results, of which $> 99\%$ were tested for *BRCA1* and *BRCA2* (Kurian et al., 2019).

Genetic testing is increasingly important because treatments such as PARP inhibitors are especially effective when certain genetic mutations are present. Advanced practitioners (APs) can play an important role in recognizing the need for genetic evaluation and referring a patient for appropriate counseling and testing. While not all practices have on-site genetic counselors, clinical staff may have the required training to deliver the appropriate counseling. It is reported that patients are satisfied with genetic counseling provided by specialist nurses (Percival et al., 2016; Scott et al., 2020). Indeed, the existing rapport between nurses and patients, and the often close provider/patient relationship following cancer diagnosis, may facilitate the genetic counseling process (Percival et al., 2016). Additionally, the inclusion of nurses with appropriate genetic counseling training within the clinical team may reduce the wait time for patients to receive genetic test results (Scott et al., 2020). Advanced practitioners with specialized training in clinical cancer genetics can also be effective at providing genetic counseling and education (Lancaster et al., 2015), since they often see patients during their visits and develop trusting relationships (Stahlke et al., 2017).

Although the incidence of *gBRCA*-mutated mBC is relatively low, it is still important for APs to understand the appropriate use of targeted therapies, such as PARP inhibitors, and how best to support the ongoing care of patients who receive

these treatments. This hypothetical case study will provide information for APs on the management of an adult patient receiving talazoparib for *gBRCA*-mutated, HER2-negative mBC. Information on genetic counseling, monitoring and management of adverse events (AEs) associated with talazoparib administration, and other clinical considerations for care will be highlighted.

CASE STUDY CONTINUED

Genetic Testing Plan

In this hypothetical case, Rozina's oncologist ordered germline testing according to recommendations from the NCCN Guidelines for breast cancer and the genetic/familial high-risk assessment for breast, ovarian, and pancreatic cancers (NCCN, 2022a, 2022b). With a diagnosis of mBC, the recommendation was made for Rozina to be assessed for *gBRCA1/2* mutations to determine if she was a candidate for PARP inhibitor therapy (NCCN, 2022a, 2022b). Beyond that basic recommendation, other factors that qualified her for genetic testing included triple-negative BC and a diagnosis of BC at ≤ 45 years of age regardless of ER/PR/HER2 status (NCCN, 2022b).

Because no genetic counselor was on staff, the nurse practitioner who was overseeing her care and who had training in genetics and genomics/biomarker testing advised Rozina about what to expect regarding genetic testing. After genetic assessment, including family history, she was told of the possibility of identifying a mutation or variant of uncertain significance (VUS) in any of the analyzed genes, as well as the possibility of identifying a mutation and/or VUS in multiple genes. She was also made aware of the potential to pass on a possible genetic mutation to her children if her results were positive. In addition, there was a possibility that no mutations would be identified. While she waited for the results of germline testing, Rozina received 5 fractions of palliative radiation to her thoracic spine over 9 days, and her pain resolved. Rozina's genetic testing results showed a *gBRCA1* mutation with no other abnormalities. A biopsy of her breast tissue was also sent for PD-L1 testing; the results were negative.

Course of Treatment

Rozina, together with her health-care team, decided to initiate treatment with talazoparib 1 mg

orally (po) daily. She and her team felt this option was especially suitable for her because she had no prior treatments (prior therapy is a prerequisite of olaparib) and was a busy mother of a young child, so the once-daily oral dosing of talazoparib was appealing. In addition, zoledronic acid, along with an oral calcium supplement and vitamin D, was recommended for Rozina to address her bone metastases.

Talazoparib is indicated for *gBRCA*-mutated HER2-negative locally advanced and metastatic BC and is an inhibitor of PARP1 and PARP2. Studies with cancer cell lines containing defects in DNA repair genes, including *BRCA1* and *BRCA2*, have shown that talazoparib results in DNA damage, decreased cell proliferation, and increased apoptosis (Pfizer Inc., 2021). The efficacy and safety of talazoparib have been demonstrated in patients with *gBRCA1/2*-mutated locally advanced or metastatic BC (Litton et al., 2018). The EMBRACA trial (NCT01945775) was a randomized, open-label, phase III trial that compared talazoparib 1 mg po once daily with the standard single-agent therapy of physicians' choice (capecitabine, eribulin, gemcitabine, or vinorelbine) in continuous 21-day cycles (Litton et al., 2018). Talazoparib-treated patients had significantly longer median progression-free survival vs. standard therapy (8.6 vs. 5.6 months, respectively; hazard ratio for disease progression or death, 0.54; 95% confidence interval [CI] = 0.41–0.71; $p < .001$; Litton et al., 2018). The hazard ratio for overall survival was not statistically significant at 0.85 (95% CI = 0.67–1.07; $p = .17$; Litton et al., 2020). The overall objective response rate was significantly higher in patients treated with talazoparib vs. standard treatment (62.6% vs. 27.2%; odds ratio [95% CI] 5.0 [2.9–8.8]; $p < .001$; Litton et al., 2018). Talazoparib-treated patients had a median duration of response of 5.4 months vs. 3.1 months in the standard treatment group (Litton et al., 2018).

Significant improvements from baseline in patient-reported global health status and quality of life (i.e., European Organization for Research and Treatment of Cancer [EORTC] Quality of Life Questionnaire [QLQ-C30]) and breast symptoms (i.e., EORTC QLQ-BR23) were observed in talazoparib-treated patients (Litton et al., 2018). The most common hematologic AEs of any grade ($\geq 20\%$ of patients) with talazoparib were anemia (53%), neutropenia (35%), and thrombocytopenia (27%).

Common nonhematologic AEs of any grade ($\geq 30\%$ of patients) were fatigue (50%), nausea (49%), and headache (33%; Table 2; Litton et al., 2018).

Before initiation of talazoparib, potential side effects were explained to Rozina, and she was advised to report any adverse effects to her health-care team. In addition to the most common AEs seen in clinical trials, Rozina was informed about the rare (0.3%) risk of myelodysplastic syndrome/acute myeloid leukemia reported in solid tumor patients treated in clinical studies and the potential for embryo-fetal toxicity (Pfizer Inc., 2021). She agreed to be cautious and use two forms of birth control for pregnancy

prevention during treatment. In addition, she was instructed to ensure her young child did not have access to the talazoparib capsules, as is important for all medication.

Baseline laboratory work included a complete blood count (CBC) with differential, liver function, renal function, and electrolyte values; all were within normal range. These were repeated every 2 weeks for 2 months. Of note, monthly monitoring of the CBC is recommended for patients receiving talazoparib (Pfizer Inc., 2021).

The clinical pharmacist reviewed Rozina's current medication list and found no potential drug-drug interactions. However, Rozina was recently

Table 2. Adverse Events Experienced by Patients Receiving Talazoparib in the EMBRACA Trial

N = 286	Any grade, n (%)	Grade 3/4, n (%)
<i>Hematologic events^a</i>		
Patients with ≥ 1 event	194 (67.8)	157 (54.9)
Anemia ^b	151 (52.8)	112 (39.2)
Neutropenia ^c	99 (34.6)	60 (20.9)
Thrombocytopenia ^d	77 (26.9)	42 (14.7)
Leukopenia	49 (17.1)	19 (6.6)
Lymphopenia	21 (7.3)	9 (3.1)
Febrile neutropenia	1 (0.3)	0
<i>Nonhematologic events^e</i>		
Patients with ≥ 1 event	282 (98.6)	91 (31.8)
Fatigue	144 (50.3)	5 (1.7)
Nausea	139 (48.6)	1 (0.3)
Headache	93 (32.5)	5 (1.7)
Alopecia	72 (25.2)	NA
Vomiting	71 (24.8)	7 (2.4)
Diarrhea	63 (22.0)	2 (0.7)
Constipation	63 (22.0)	1 (0.3)
Decreased appetite	61 (21.3)	1 (0.3)
Back pain	60 (21.0)	7 (2.4)

Note. NA = not applicable. Information from Litton et al. (2018). From *The New England Journal of Medicine*, Litton, J. K., Rugo, H. S., Ettl, J., Hurvitz, S. A., Gonçalves, A., Lee, K. H., Fehrenbacher, L., Yerushalmi, R., Mina, L. A., Martin, M., Roché, H., Im, Y. H., Quek, R., Markova, D., Tudor, I. C., Hannah, A. L., Eiermann, W., & Blum, J. L., Talazoparib in Patients with Advanced Breast Cancer and a Germline BRCA Mutation, Volume 379, Page S12. Copyright © (2018) Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.

^aNo cases of acute myeloid leukemia or myelodysplastic syndrome were reported in the talazoparib group.

^bIncludes anemia and decreased hemoglobin level.

^cIncludes neutropenia, decreased neutrophil count, and neutropenic sepsis.

^dIncludes thrombocytopenia and decreased platelet count.

^eNonhematologic adverse events were all adverse events that occurred in at least 20% of patients or grade 3-4 adverse events that occurred in at least 2.4% of patients.

diagnosed with *Helicobacter pylori* infection, and her primary care physician recommended that she start eradication therapy as soon as possible. Clarithromycin, one of the first-line antibiotics used to treat *H. pylori*, has the potential to increase the serum concentration of talazoparib (Chey et al., 2017; Pfizer Inc., 2021), so a combination of omeprazole, bismuth subcitrate, doxycycline, and metronidazole was ordered for 14 days. Co-administration of talazoparib with P-glycoprotein inhibitors (i.e., clarithromycin, amiodarone, carvedilol, itraconazole, and verapamil) is not recommended because these drugs increase talazoparib exposure. However, if P-glycoprotein inhibitors cannot be avoided, then the dose of talazoparib should be reduced (Elmeliegy et al., 2020; Pfizer Inc., 2021). Unlike the PARP inhibitors rucaparib and olaparib, talazoparib does not inhibit cytochrome P450 enzymes (LaFargue et al., 2019; Pfizer Inc., 2021).

Ongoing Monitoring

Two weeks after initiating talazoparib, Rozina returned to the clinic for her first assessment and laboratory review. She complained of mild nausea in the morning shortly after taking her daily dose of talazoparib. She was prescribed ondansetron, which she felt controlled the nausea. In addition, she was instructed to take talazoparib with food. Although there is no specific requirement to take talazoparib with or without food, a light meal about an hour beforehand may help mitigate nausea associated with PARP inhibitors (LaFargue et al., 2019; Pfizer Inc., 2021).

Follow-up at week 4 showed mild (grade 1) declines in Rozina's hemoglobin (10.5 g/dL) and platelet count (95,000/ μ L). She denied any active signs or symptoms of bleeding, shortness of breath, or chest pain, but was more fatigued than what she

experienced pretreatment and found herself using more energy to keep up with her young child. Since the effects on her hemoglobin and platelet values were mild (grade 1), no dose adjustment was made at this time (Table 3). At week 6, Rozina's platelet count decreased to 79,000/ μ L (grade 1) and her hemoglobin decreased to 7.6 g/dL (grade 3); however, she did not feel symptomatically different than previous weeks. As recommended in the US label, talazoparib was held until her hemoglobin rose to ≥ 9 g/dL, which occurred after 1 week (Table 3; Pfizer Inc., 2021). She was instructed to take additional care and stand up slowly, get plenty of rest, and eat a well-balanced diet. She was educated about the signs and symptoms of worsening anemia and was instructed to call if symptoms worsened, or if she experienced active bleeding. By week 7, Rozina's hemoglobin and platelet count had increased to 9.2 g/dL (grade 2) and 90,000/ μ L (grade 1), respectively, and talazoparib was resumed at 0.75 mg once daily (dose reduction recommended in the US label for talazoparib; Table 4; Pfizer Inc., 2021). Her hemoglobin and platelet count remained stable at week 8. She felt well, other than some continued fatigue and a loss of appetite. She was encouraged to increase her activity level and to eat smaller, more frequent meals to maintain her weight.

As with any antineoplastic agent, managing side effects is an important part of the overall care plan. In a detailed analysis of safety data from the EMBRACA trial, hematologic AEs occurred in 68.2% of talazoparib-treated patients, with anemia occurring in 52.8% of patients, of which 39.2% were grade 3 or 4. They most often occurred within the first 3 to 4 months of treatment and were controlled with dose modifications and supportive care with growth factors and transfusions. In this study, the duration of grade 3 to 4 anemia was approximately

Table 3. Talazoparib Dose Modifications and Management

Adverse reaction	Withhold talazoparib until levels resolve to	Resume talazoparib
Hemoglobin < 8 g/dL	≥ 9 g/dL	Resume talazoparib at a reduced dose
Platelet count < 50,000/ μ L	$\geq 75,000/\mu$ L	Resume talazoparib at a reduced dose
Neutrophil count < 1,000/ μ L	$\geq 1,500/\mu$ L	Resume talazoparib at a reduced dose
Nonhematologic: grade 3 or grade 4	\leq grade 1	Consider resuming talazoparib at a reduced dose or discontinue

Note. Information from Pfizer Inc. (2021).

7 days. Treatment with talazoparib was also associated with other infrequent overlapping grade 3 to 4 hematologic AEs, as seen in Table 2. Discontinuation of talazoparib due to hematologic toxicity occurred in < 2% of patients (Hurvitz et al., 2020).

Because Rozina was doing well, follow-up visits were reduced to every 4 weeks after the first 2 months. A restaging PET/CT scan was performed at week 12 that revealed decreased uptake in the T6 vertebral bodies, as well as in the breast and axillary nodes. Rozina remained adherent to talazoparib with no missed doses. She continued on talazoparib 0.75 mg daily with manageable fatigue, minimal nausea, and a stable weight since her week 8 visit. Her CBC revealed a stable hemoglobin (9.7 g/dL; grade 1) and platelet count (95,000/ μ L; grade 1), with no active bleeding.

Oral treatment with talazoparib was an attractive option for Rozina. She was the mother of a young child and her treatment could be conveniently taken at home, once a day, without frequent visits to the clinic or hospital for infusions. Patients often prefer treatment with oral medications; however, adherence to oral regimens can be variable (Liu et al., 1997; Partridge et al., 2002). Factors that influence adherence include lack of patient understanding, lack of support, or treatment-related side effects (Partridge et al., 2002; Schneider et al., 2011). The oncology treatment team members, including oncologists, APs, nurses, and pharmacists, provide critical education, open communication, and recommend interventions that encourage patient adherence to their treatment regimens (Paolella et al., 2018; Schneider et al., 2014). Optimal adherence can positively impact patient outcomes and the overall survival of patients with cancer (Ganesan et al., 2011; Given et al., 2011). With support from her AP and pharmacist, Rozina was able to adhere to her prescribed treatment regimen, including when her dose was modified.

CONCLUSION

The cancer treatment landscape is rapidly changing, and the role of APs remains critical in caring for patients with breast cancer, including those subtypes with a lower incidence and prevalence, such as gBRCA-mutated mBC. This hypothetical case study describes the clinical course of a patient with HER2-negative gBRCA-mutated mBC who

Table 4. Talazoparib Dose Reduction Levels for Adverse Reactions

Dose level	Dose
Recommended starting dose	1 mg once daily
First dose reduction	0.75 mg once daily
Second dose reduction	0.5 mg once daily
Third dose reduction ^a	0.25 mg once daily

Note. Information from Pfizer Inc. (2021).

^aTreatment with talazoparib should be discontinued if more than three dose reductions are required.

underwent germline testing and was treated with talazoparib. As demonstrated here, APs can facilitate genetic testing and help patients understand its importance and implications in determining treatment options. Patient education on potential adverse effects and how to report them can aid in their early identification and intervention. Effective and timely communication between APs and patients can positively contribute to oral therapy adherence and enable patients to actively participate in their treatment with the goal of achieving optimal patient outcomes. ●

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