INTRODUCTION

Improvements in human immunodeficiency virus (HIV) treatment modalities have led to drastic increases in the lifespan of HIV-positive individuals, resulting in higher rates of non-AIDS-defining cancers. We describe our postoperative outcomes in HIV+ breast cancer (BC) patients, highlighting our multidisciplinary experience with this high-risk population.

Methods: A 7-year multi-institutional retrospective review of all HIV+ BC patients who underwent surgical intervention was performed. Patient demographics, therapeutic interventions, and treatment outcomes were collected.

Results: Twenty-four patients were identified, including one male patient (4.2%). Most patients were African American (83.3%). Mean age was 52.1 ± 9.7 years at the time of diagnosis in HIV+ BC patients. Surgical interventions included lumpectomy (n = 16, 66.7%), simple mastectomy (n = 3, 12.5%), and skin-sparing mastectomy (n = 5, 20.8%). All patients were on antiretroviral therapy, and 81.3% had undetectable viral loads at the time of operation. Seventeen patients (70.8%) underwent breast reconstruction, with three (17.7%) undergoing delayed reconstruction. Thirty-day postoperative complications occurred in three patients (17.6%), including flap necrosis (11.8%), infection (11.8%), dehiscence (5.9%), and return to OR (11.8%). Three patients (12.5%) experienced recurrence at a median of 18 months since operation. Mean follow-up was 51.4 ± 33.3 months since BC diagnosis.

Conclusions: While postoperative complication rates in HIV+ patients trended higher (17.6%) compared with the existing data on breast reconstruction patients overall (10.1%), HIV+ patients did not exhibit increased risk of BC recurrence (12.5%) compared with BC patients overall (12-27%). This highlights the importance of a combined multidisciplinary approach involving infectious disease, breast surgery, and plastic and reconstructive surgery to optimize surgical and oncologic outcomes in these high-risk patients. (Plast Reconstr Surg Glob Open 2022;10:e4552; doi: 10.1097/GOX.0000000000004552; Published online 28 September 2022.)

Disclosure: The authors have no financial interest to declare in relation to the content of this article.
6.4 kg/m². Patients were predom-

inantly African American (n = 20, 83.3%). Twelve patients

 underwent prior surgical interventions at outside institutions, were

lost to follow-up, or were diagnosed with HIV after the

onset of their breast cancer. All qualifying patients had an HIV
diagnosis that preceded their breast cancer
diagnosis and treatment. Using the electronic medical
record, patient demographics, HIV and breast cancer
history, operative details, and postoperative outcomes
were collected. All qualifying patients were followed up
by an oncology team regularly. Documentation regarding
additional specialties seen (eg, oncology, infectious
disease) were also recorded to address the MDT aspect
of care.

Descriptive statistics were used to describe study sub-
jects. Continuous variables were described by mean and
SD or median and interquartile range (IQR) as deter-
mined by the Shapiro-Wilk test of normality. Categorical
variables were described by frequencies and percent-
ages. Statistical analysis was performed using STATA v.17
(StataCorp, College Station, Tex.).

RESULTS

Twenty-four HIV-positive BC patients were identified,
including one male patient (4.2%; Table 1). Mean age at
the time of BC diagnosis was 52.1 ± 9.7 years, with a mean
body mass index of 29.3 ± 6.4 kg/m². Patients were predom-
nantly African American (n = 20, 83.3%). Twelve patients
(50.0%) had a smoking history.

The average time elapsed from HIV diagnosis to breast
cancer diagnosis was 13.9 ± 1.1 years (Table 2). One patient
experienced bilateral BC (4.2%). The most common
cancer histology was invasive ductal carcinoma (n = 17,
70.8%), with most exhibiting estrogen receptor (ER; n = 16,
66.7%) and progesterone receptor (n = 14, 58.3%)
positivity. Four patients experienced triple-negative BC
(TNBC; n = 14, 16.7%). The majority of cancers were
high-grade at the time of diagnosis (n = 12, 54.6%), with a
mean tumor size of 1.5 ± 0.8 cm². Regarding therapy, most
did not undergo chemotherapy (n = 10, 41.7%) or hor-
mon therapy (n = 14, 58.3%), with most receiving adju-
dvant radiation therapy (n = 16, 66.7%).

Among patients with reported modes of HIV transmis-
sion (n = 11), sexual transmission was most commonly
cited (n = 7, 63.6%; Table 3), followed by sexual assault
(n = 2, 18.2%), intravenous drug use (n = 1, 9.1%), and
dental procedures (n = 1, 9.1%). All patients were on anti-
retroviral therapy at the time of oncologic procedure (n = 24).
Mean CD4 count within 6 months of oncologic procedure
was 518.8 ± 288.2 cells per mm (n = 12), with 81.3% of
patients having an undetectable viral load (<20 copies/mL; n = 13). Two patients progressed to AIDS before
oncologic surgery (8.3%).

Median time from BC diagnosis to oncologic surgery was
2.4 months (IQR: 1.6, 4.1; Table 4). Most patients underwent
lumpectomy (n = 16, 66.7%). The next most common proce-
dures were skin-sparing mastectomy (n=5, 20.8%) and simple
mastectomy (n = 3, 12.5%). Twenty patients underwent lymph-
atic surgery, of which 18 (90%) underwent sentinel lymph node
dissection and two (10%) underwent axillary dissection.
The majority of patients underwent breast reconstruction (n =
17, 70.8%), most frequently immediate (n = 14, 82.4%). Most
patients opted for an oncoplastic-based reconstruction (n =
10, 58.8%), followed by implant-based reconstruction (IBR;
 n = 6, 35.3%), with only one patient opting for autologous-
based reconstruction (5.9%). Of the patients who chose to
Table 2. Breast Cancer Characteristics

| Variable                   | Value, % |
|----------------------------|----------|
| Time from HIV diagnosis to BC diagnosis (yr) | 13.0 ± 9.1 |
| Occurrence                 |          |
| Primary                    | 25 (95.8) |
| Recurrence                 | 1 (4.2)  |
| Laterality                 |          |
| Unilateral                 | 23 (95.8) |
| Bilateral                  | 1 (4.2)  |
| Cancer histology           |          |
| DCIS                       | 4 (16.7) |
| Invasive ductal CA         | 17 (70.8) |
| Invasive lobular CA        | 1 (4.2)  |
| Other                      | 2 (8.3)  |
| BC types                   |          |
| ER-positive                | 16 (66.7) |
| PR-positive                | 14 (58.3) |
| HER2-positive              | 3 (13.6)  |
| Triple negative            | 4 (16.7)  |
| Tumor size (cm²)           | 1.5 ± 0.8 |
| Tumor grade (n = 22)       |          |
| Low                        | 4 (18.2) |
| Moderate                   | 6 (27.3) |
| High                       | 12 (54.6) |
| Tumor stage                |          |
| 0                          | 5 (22.7) |
| 1                          | 8 (36.4) |
| 2                          | 6 (27.3) |
| 3                          | 3 (13.6) |
| Chemotherapy               |          |
| None                       | 10 (41.7) |
| Neoadjuvant                | 6 (25.0) |
| Adjuvant                   | 8 (33.3) |
| Radiation                  |          |
| None                       | 8 (33.3) |
| Neoadjuvant                | 0 (0.0)  |
| Adjuvant                   | 16 (66.7) |
| Hormone therapy            |          |
| None                       | 14 (58.3) |
| Neoadjuvant                | 2 (8.3)  |
| Adjuvant                   | 8 (33.3) |

Abbreviations: BC, breast cancer; CA, carcinoma; DCIS, ductal carcinoma in situ; ER, estrogen receptor; HER2, human epidermal growth factor receptor 2; PR, progesterone receptor.

Table 3. HIV Details

| Variable                               | Value, % |
|----------------------------------------|----------|
| Year of diagnosis (n = 18)             |          |
| 1990–1999                              | 6 (33.3) |
| 2000–2009                              | 7 (38.9) |
| 2010–2019                              | 5 (27.8) |
| HIV transmission (n = 11)              |          |
| Sexual transmission                    | 7 (63.6) |
| Sexual assault                         | 2 (18.2) |
| IVDU                                    | 1 (9.1)  |
| Dental procedure                       | 1 (9.1)  |
| Antiretroviral therapy                 | 24 (100.0) |
| CD4 count (mean, cells/mm³)            | 518.8 ± 288.2 |
| Viral load (copies/mL) (n = 16)        |          |
| Undetectable (<20)                     | 13 (81.3) |
| Detectable                              | 3 (18.8) |
| Progression to AIDS before surgery     | 2 (8.3)  |

*Within 6 months of oncologic breast surgery.

Abbreviations: AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency virus; IVDU, intravenous drug use.

DISCUSSION

This study reviews postoperative outcomes in HIV+ BC patients who underwent oncologic surgery with or without reconstruction. Our institution is in the unique position of being located in Washington, D.C., a city with one of the highest HIV rates in the United States. We therefore encounter a higher proportion of HIV-positive patients, including those who may experience BC. The majority of our patients (70.8%) underwent breast reconstruction at a rate higher than the national average (42%) for all BC patients undergoing mastectomy. The majority of HIV-positive patients undergoing reconstruction experienced higher rates of complications (17.6%) compared with the existing data on patients undergoing breast reconstruction overall (10.1%). However, HIV+ patients did not exhibit an increased risk of BC recurrence (12.5%) compared with BC patients overall (12–27%). The majority of patients received multidisciplinary care (91.7%), with common specialties in addition to breast surgery including primary care, plastic surgery, infectious disease, oncology, and psychiatry. The two patients who did not receive MDT care experienced poorer outcomes, with one patient progressing to AIDS and both patients dying within the study period. The multifaceted nature of disease in patients experiencing concomitant HIV infection and breast cancer requires the application of a combined multidisciplinary approach involving the coordination of multiple specialties to optimize outcomes in these high-risk patients.

Multidisciplinary Team Composition

The MDT model of HIV care evolved from necessity due to the diverse characteristics and disease course in HIV-positive patients and is now accepted as the international standard of care for management of HIV disease. With the added component of breast cancer positivity in these complex patients, a discussion regarding the MDT implementation within an academic institution is warranted. We review the organizational framework regarding the team composition and roles.

The team should be composed of both a core and adjunct group of specialists (Fig. 1). Although the
composition can vary between institutions, we propose that the core group consist of breast surgery, infectious disease, and oncology. This team should work closely with an adjunct group of specialists, which can include plastic surgery, psychiatry, internal medicine, primary care, social work, palliative, nurse practitioners, physician assistants, dieticians, and other essential personnel (Table 5).

### Core Member Roles

**Breast Surgery:** Provides therapeutic cancer resection, either via breast-conserving surgery or mastectomy. Coordinates timing of the procedure closely with oncology to determine if surgery should be primary or occur following neoadjuvant chemotherapy.

**Oncology:** Coordinates chemotherapy, radiation therapy, and hormone therapy in the management of cancer.

**Infectious Disease (ID):** Provides medical management, evaluates drug interactions, and maintains viral load.

### Adjunct Member Roles

**Plastic and Reconstructive Surgery (PRS):** This offers delayed or immediate breast reconstruction in the form of oncoplasty, autologous-based reconstruction, or implant-based reconstruction.

**Psychiatry:** This offers provision of therapy or medical management for psychological conditions resulting from HIV+ and/or BC diagnosis and medical course.

**Internal Medicine (IM):** Additional patient comorbidities should be managed by IM to prevent further complications in these high-risk patients (eg, cardiac or pulmonary conditions).

**Primary Care:** Close coordination with primary care helps ensure patients receive preventive care (eg, immunizations, risk assessments, screenings), and are managed for additional comorbidities or life changes (eg, pregnancy, employment change, travel) to prevent additional burden or complications.

**Social Work:** Social workers play a critical role in assisting patients in gaining access to services, understanding service guidelines, and applying for financial and care assistance.

### Figure 1. The multidisciplinary breast cancer care team.

### Table 4. Operative Details and Outcomes

| Variable                                      | Value, % |
|-----------------------------------------------|----------|
| **Operative details**                         |          |
| Time from BC diagnosis to oncologic surgery (mo)* | 2.4 (1.6, 4.1) |
| Lymphatic surgery                             |          |
| None                                          | 4 (16.7) |
| Sentinel lymph node dissection                 | 18 (75.0) |
| Axillary dissection                            | 2 (8.3)  |
| **Oncologic surgery**                         |          |
| Lumpectomy                                     | 16 (66.7) |
| Simple mastectomy                              | 3 (12.5)  |
| Skin-sparing mastectomy                        | 5 (20.8)  |
| Breast reconstruction                          | 17/24 (70.8) |
| ABR                                           | 1 (5.9)  |
| IBR                                           | 6 (35.3)  |
| Oncoplasty                                     | 10 (38.8) |
| **Timing of reconstruction**                  |          |
| Immediate                                     | 14 (82.4) |
| Delayed                                       | 3 (17.7)  |
| **Postoperative reconstruction outcomes**     |          |
| 30-day complications†                         | 3/17 (17.6) |
| Infection                                     | 1 (5.9)  |
| Dehiscence                                    | 1 (5.9)  |
| Flap necrosis                                 | 2 (11.8)  |
| Seroma                                        | 0 (0.0)  |
| Hematoma                                      | 0 (0.0)  |
| **30-day return to OR**                       | 2/17 (11.8) |
| **Oncologic outcomes**                        |          |
| Recurrence                                    |          |
| Local                                         | 1 (4.2)  |
| Distant                                       | 2 (8.3)  |
| **Time to recurrence (mo)***                  | 18 (12.7, 17.6) |
| Mortality (n = 23)                             | 5 (21.7)  |
| Follow-up (mo)                                 | 51.4 + 33.3 |

*Median, IQR.
†n = total number of patients experiencing complications within 30d.

Abbreviations: ABR, autologous-based reconstruction; BC, breast cancer; IBR, implant-based reconstruction; mo, months; OR, operating room.

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### Table 5. Composition of Core and Adjunct Multi-disciplinary Teams

| Specialty                           | Role                              |
|-------------------------------------|-----------------------------------|
| **Core members**                    |                                   |
| Breast surgery                      | Cancer resection, champions        |
|                                    | communication within MDT team      |
| Oncology                            | Coordination of chemotherapy,      |
|                                    | radiation therapy, and hormone     |
|                                    | therapy                           |
| Infectious disease                  | Management of HAART and drug-drug |
|                                    | interactions                      |
| **Adjunct members**                 |                                   |
| Plastic and reconstructive surgery  | Breast reconstruction             |
| Psychiatry                          | Management of psychiatric comorbidities |
| Internal medicine                   | Management of medical comorbidities |
| Primary care                        | Preventive care                   |
| Social work                         | Coordinating access to services    |
|                                    | and financial care assistance.     |

Abbreviations: HAART, highly active antiretroviral therapy.
that can contribute equally to patient care. With responsibility of the patient distributed among all team members, a team encompassing various combinations of these specialties helps ensure that our patients received individualized care tailored to their unique medical situations. A key principle of MDT care involves an individual whose role is to champion communication between members of the multidisciplinary care team, pose innovative ideas, and serve as the overarching champion fostering collaboration between the team’s many members. Although one member should champion the effort, it is essential to recognize that all members should be fully committed to the overarching goal and mission of the group.

**Multidisciplinary Approach to Primary Prevention**

Since the advent of highly active antiretroviral therapy (HAART), HIV-positive patients have experienced significant improvements in morbidity and mortality, with expected life spans free of opportunistic disease approaching those of persons living without HIV. The use of effective antiretroviral therapies has resulted in a large HIV-positive population susceptible to non-AIDS-defining malignancies, such as breast cancer. A resulting shift in causes of mortality in HIV patients warrants close coordination with primary care to ensure these patients undergo proper preventive care, including scheduled cancer screenings. The most recent 2020 primary care guidance for HIV-positive patients recommended BC screenings follow standard USPSTF guidelines: mammography performed every two years for women aged 50–75 years. While BC does not occur at an increased prevalence in HIV-positive women, it has been reported to have unusual clinical presentations and a rapid progressive nature, suggesting a more aggressive form of BC in these patients. This necessitates close follow-up by primary care and early detection of BC to augment its aggressive course.

**Breast Cancer Management Pathway: Multidisciplinary Framework**

Immediately following recognition and confirmation of a breast neoplasm, the patient should be referred to the multidisciplinary team, most commonly through the outpatient setting. The initial visit should ideally occur with members of each specialty of the core team being present: breast surgery, oncology, and ID. Their availability ensures comprehensive discussions surrounding the unique aspects of BC care in HIV-positive patients, resulting in the appropriate therapeutic processes not being delayed. Completion of this first visit is reliant on the presence of a well-established referral system and coordination between providers. Upon culmination of the visit, a specialty should adopt a leadership role to champion multidisciplinary care by overseeing and coordinating future care for the patient. In our experience, the breast surgery team, which provides close patient follow-up, can help coordinate care.

Oncology and ID play a collaborative role in the management of HIV patients, through careful medication management to balance HIV-associated immunosuppression with cancer therapy-associated immunosuppression. HAART is associated with improved cancer outcomes through maintenance and reduction of viral loads but has also been associated with increased adverse events during BC treatment, possibly due to drug-drug interactions with chemotherapy. Prior studies have also reported possible delays in treatment initiation and reduction in chemotherapy and hormone therapy dosage due to possible toxicity and no standardized guidelines for care. This requires close coordination between oncology and ID, and an emphasis on adherence to HAART in HIV-positive patients to augment the BC course.

This initial assessment should be followed by further addressing factors that may affect care. Extensive discussion with the patient should involve (1) HIV disease course and antiretroviral regimen; (2) barriers to care such as transportation, insurance, and home support; (3) additional medical or psychiatric comorbidities; and (4) establishment of a shared decision-making process to optimize care. Following this, core team members should meet to discuss whether the patient intake dictates involvement of additional adjunct team members.

Most patients (54.7%) in the current series had a prior history of psychiatric disease (eg, major depressive disorder, anxiety, bipolar disorder), with three patients developing posttraumatic stress disorder following HIV transmission through sexual assault. Psychiatric comorbidity is common with HIV infection, with reported rates of 50% or greater in HIV-positive patients. This is further compounded by the psychological distress experienced by patients with a BC diagnosis (30–75% of patients). The combination of disease processes may exacerbate underlying mental illness, which, if left untreated, could impact compliance and follow-up of care. Consultation with a psychiatrist would therefore be warranted in patients with a prior history of psychiatric disease or in patients who develop a need for psychiatric care during their BC course.

Additional adjunct members who may be consulted include PRS. Given the improved emotional and physical quality of life afforded through reconstruction, PRS consultations should be provided to all HIV+ BC patients. Due to the risk for increased postoperative complications, special considerations should be made for these high-risk patients to help minimize reconstruction-related outcomes.

Based on a careful assessment of patient needs, an individualized care plan is created and executed with the goal of optimizing BC therapy while minimizing complications that could arise from other aspects of the patient’s history (eg, HIV, comorbidities, barriers to accessing care). The patient should be followed up closely during the primary treatment course; upon BC eradication, they should receive continued follow-up to ensure disease-free survival. In the event of a recurrence, the patient will already have an established care team knowledgeable in their unique history and prepared to treat the recurrence.

Additional attention should be paid to ensuring patients have access to care. Socioeconomic status greatly impacts chances of HIV contraction, availability of treatment, and therapeutic outcomes. With the majority of patients in our series being African American, it is important to address racial disparities existing in access to HIV-related healthcare utilization and the socioeconomic barriers these patients may face.
experience. The National Health Disparities Report found HIV-positive African Americans to be less likely to receive standard HIV care, including antiretroviral therapy, monitoring of immune function, and outpatient appointments when compared to White patients. Among HIV-positive individuals, access to care is impacted by psychological, social, and economic factors. The role of an in-house social worker therefore becomes increasingly crucial as they can assist patients in these aspects of care. Given the financial stresses and immense cost of treatment, patients can be assisted through referrals to community resources, financial assistance plans, and legal aid as needed. Social workers can aid in discharge planning to arrange for in-home care, ensure suitable follow-up times when patients have availability from work, and provide accessible transportation options as needed. By meeting these needs, the team enables access to close follow-up to optimize care in these complex patients.

**LIMITATIONS**

Inherent limitations of this study include a relatively small sample size of qualifying patients (n = 24), the largest we were able to glean from our hospital network. We were also limited by the retrospective chart review study design, which was dependent on the quality of data reported within patients’ medical records. Additionally, while this study reported complications related to breast reconstruction, those resulting directly from oncologic surgery (eg, lumpectomy or mastectomy) were not included. Many treatment-related details and outcomes were less available in patient medical records, possibly due to specialists being seen who were outside of our hospital network. The social stigma and emotional stress of an HIV diagnosis could additionally lessen the likelihood to report, follow up, or provide medical information to physicians without prompting.

**CONCLUSIONS**

While postoperative complication rates in HIV-positive patients trended higher (17.6%) compared with existing data on patients undergoing breast reconstruction overall (10.1%), HIV-positive patients did not exhibit an increased risk of BC recurrence (12.5%) compared with BC patients overall (12–27%). We highlight the importance of a combined multidisciplinary approach involving infectious disease, breast, and plastic and reconstructive surgery to optimize both surgical and oncologic outcomes in these high-risk patients. A multidisciplinary team consisting of a core group of breast surgery, oncology, and infectious disease and an adjunct group consisting of, but not limited to, internal medicine, primary care, social work, psychiatry, and plastic and reconstructive surgery can optimize outcomes in HIV-positive patients with breast cancer.

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