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## **Patterns of Metastatic Disease Sites in Breast Cancer: Implications for Availability of Fresh Tumor Tissue for Personalized Cancer Treatment Planning in Metastatic Disease**

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### **Background:**

Personalized treatments for breast cancer patients may avoid ineffective therapies. Although archival pathology tissue is available in all patients, fresh current tumor cell testing of molecular, immunohistochemical, and chemosensitivity characteristics may be more relevant to optimal treatment planning than tissues obtained before previous therapies and/or diagnosis of metastases. In addition, archival tissue is inadequate for cell culture information. This study was performed to determine the availability of fresh tumor tissue for personalized treatment planning in a multi-site community cancer center.

### **Methods:**

All successive patients seen over 22 months were evaluated. Diagnoses were reviewed, and patient clinical characteristics were evaluated to determine the prevalence of metastases by site, and feasibility of different types of tumor biopsy by location of metastases. A biopsy algorithm for tissue biopsy was developed and quantified.

### **Results:**

26,794 successive patients were evaluated. Breast cancer was present in 2043 (7.6%). Median age was 61 (range 27 to 98). Metastases were present in only 174 (8.5% of breast cancer patients) who had 266 sites involved (1.53 sites per patient). 68% of patients had multiple sites involved. Of patients with multiple sites, 96 (81%) had 2, 16 (14%) had 3, and 6 (5%) had 4 sites involved. Single site was the pattern in only 9% of liver, 7% of lung, 32% of bone, 0% of adrenal 6% of skin, but 71% of brain metastases. The most frequent sites of metastases were bone (50%), lung (31%), liver (26%), brain (10%), skin or soft tissue (11%), and lymph node (6%). In order to theoretically obtain fresh tissue for development of a personalized treatment plan based on a sequential preference biopsy algorithm of local excision, over para/thoracentesis, over non-osseous needle biopsy, over video-assisted tissue biopsy, over osseous needle biopsy, 18% of patients would have had a local excision, 10% para/thoracentesis, 23% liver biopsy, 19% lung biopsy, 17% bone biopsy, and 12% would not have had a biopsy because of brain-only metastases. 28% of patients would have simple, 50% mildly invasive, and 33% highly invasive procedures for tissue acquisition.

### **Conclusions:**

This analysis demonstrates that most breast cancer patients are being followed for locoregional disease. Of those with metastases, most have multiple sites of breast cancer involvement. Tumor tissue is available for 88% of cancer patients with metastases for personalized treatment planning, and in most of those patients the biopsy is simple and non-invasive. However, tissue culture techniques would necessitate a more invasive video-assisted biopsy in 33% of patients and would not be possible in 29%. Physicians should consider additional biopsy to personalize cancer treatments when appropriate for improving outcomes. For patients in whom tumor biopsy is not possible, other technologies must be developed to obtain cancer cells for molecular, immunohistochemical, or cell culture predictive testing.

