Chapter 5

SENTINEL LYMPH NODE MAPPING IN COLON AND RECTAL CANCER:
ITS IMPACT ON STAGING, LIMITATIONS, AND PITFALLS

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Abstract: Sentinel lymph node (SLN) mapping has been widely applied in the staging of solid neoplasms including colon and rectal cancer. Since the first reported feasibility study in 1997, there have been numerous publications validating SLN mapping as a highly accurate and powerful upstaging technique for colon and rectal cancer. In addition to refining the technical aspects of this procedure, these studies have investigated the use of other tracers and operative techniques, while determining the indications, limitations, and pitfalls of SLN mapping in patients with colorectal cancers. This chapter reviews the rationale for performing SLN mapping for the accurate staging of colon and rectal cancers, and provides a brief review of the historical background of the development of the procedure. Landmark publications, which have contributed to the current status of the technique, are discussed. We will focus on the technical details of the procedure, and on the pathological evaluation of the specimen and the SLNs. The various tracers and techniques of SLN mapping in colon and rectal cancer will be discussed. We have performed SLN mapping in more than 240 consecutive patients over the past 7 years. The success rates for identifying at least one SLN for colon and rectal cancer were 100\% and 90.6\%, respectively. The accuracy rates were 95.8\% and 100\%, respectively. In terms of upstaging, 32.3\% of colon cancer patients with nodal metastases and 16.7\% of rectal patients with nodal metastases were upstaged by the detection of micrometastases found in the SLNs only. Finally, we will also discuss the current role as well as the future research directions for SLN mapping in colon and rectal cancer.
INTRODUCTION

Colorectal cancer remains one of the major causes of morbidity and mortality from gastrointestinal malignancies, with the last published account of 783,000 new cases and approximately 437,000 deaths globally in 1990. It is the third most common malignancy in the United States with an estimated 147,500 new cases and is the third leading cause of cancer-related deaths with approximately 57,100 deaths in the year 2003. As with most other solid malignancies, the stage of the tumor at the time of initial diagnosis remains the most important prognostic factor for predicting survival in colorectal cancer. Although surgery alone is considered curative in patients in whom the disease is confined within the bowel wall (AJCC stages I and II), the survival decreases dramatically by about 25–35% once the disease has spread beyond the bowel wall and into the draining lymph nodes (AJCC stage III). The addition of adjuvant chemotherapy following surgical resection has been shown to be curative in more than one third of patients with nodal metastasis. Therefore, the diagnostic accuracy of nodal metastasis remains essential and critical for the proper prediction of survival as well as for appropriate therapeutic planning. About 10–25% of patients with presumed localized disease (AJCC stage I and II) will develop progression of their disease and will ultimately succumb to distant metastases within 5 years of having potentially “curative surgery.” Although the causes of such systemic failure may be multifactorial, it is reasonable to assume that many of these patients indeed had occult nodal micrometastases, which remained undetected by conventional pathological examination of the lymph nodes. This subset of patients is the basis of our estimation of the 10–20% rate of understaging found in colorectal cancer patients when conventional surgery without SLN mapping and conventional pathological methods are employed. Various pathological methods have been developed to enhance the detection rates of such nodal micrometastases. These include serial sectioning, immunohistochemistry (IHC) using cytokeratin, and most recently, reverse transcriptase polymerase chain reaction (RT-PCR). These technical advances have indeed increased the rate of detection of nodal metastases in colorectal cancer but with an enormous burden to the pathologist in terms of time, cost, and labor intensity. It is therefore impractical to apply such advanced techniques arbitrarily to just any or all lymph nodes within a specimen.

The identification of an adequate number of lymph nodes within a specimen by the pathologist also remains a major obstacle in the accurate staging of colon and rectal cancer. This problem is augmented by the fact that most histologically positive lymph nodes are less than 5 mm in size and are therefore difficult to identify. While pathological methods such as fat