Invited Commentary | Surgery

Clinical Advantage of Image-Guided Navigation for Locally Advanced Primary and Recurrent Rectal Cancer

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Rectal cancer care has undergone a major paradigm shift during the past 40 years. Beginning with the teachings of Richard J. (Bill) Heald and subsequently including the works of many other individuals, total mesorectal excision has become the globally accepted standard for the optimal radical resection of rectal cancer.1,2 Variability in rectal cancer care in the United States and worldwide led to a collaboration among 8 professional societies to create the National Accreditation Program for Rectal Cancer of the American College of Surgeons Commission on Cancer.3 One of the fundamental principles underlying the National Accreditation Program for Rectal Cancer is performing preoperative imaging to enable a multidisciplinary team to reach consensus on the use of neoadjuvant chemoradiotherapy compared with a surgeon ultimately obtaining a tumor-free circumferential resection margin (CRM).4 Tumors that threaten the intended CRM by encroaching within 1 mm (or 2 mm) of the edge of the mesorectal envelope are generally deemed appropriate candidates for preoperative neoadjuvant chemoradiotherapy.5

Patients with such tumors certainly constitute the most challenging group, given that microscopic CRM tumor involvement has an association with increased rates of local recurrence and decreased survival.6 Unfortunately, despite international acceptance of the importance of obtaining a complete total mesorectal excision with a tumor-free CRM, the rates of CRM involvement, at least in the United States, hover in the vicinity of 16.9%.7 Some of these local recurrences may be amenable to attempted subsequent curative resection. Therefore, 2 of the most challenging groups are the group of patients in whom, despite neoadjuvant chemoradiotherapy, the CRM is still threatened and the group of patients in whom a resection has been performed but who have developed locally recurrent disease. Traditional surgical approaches in both of these groups are unfortunately, but perhaps not unexpectedly, suboptimal.

Kok and colleagues8 are to be commended for trying to improve on these results by evaluating the use of navigation during resection. Specifically, in their study, the authors created 3-dimensional models based on preoperative computed tomography and magnetic resonance imaging along with an intraoperative tracking system linked to the 3-dimensional model to guide the surgical procedure. Kok and colleagues8 compared the results of 33 patients, 14 with primary tumors with threatened CRMs and 19 with recurrent rectal cancer. The historical cohort of the study included 101 patients in whom a primary resection had been undertaken and 41 patients who had undergone a resection for a recurrent rectal cancer. The historical cohort of the study included 101 patients in whom a primary resection had been undertaken and 41 patients who had undergone a resection for a recurrent rectal cancer. Using the image-guided navigation system, the authors successfully demonstrated improvement in obtaining an R0 resection, defined by the authors as achieving a tumor-free specimen with less than 1 mm CRM free of tumor. With this intervention, the rate of R0 resection had increased from 48.8% in the historic cohort to 78.9% in the navigation cohort. Unfortunately, the navigation system did not deliver the same improvement in patients with locally advanced primary rectal cancer, as the R0 resection was 84.2% in the historic group and 92.9% in the navigation group. Thus, Kok et al8 have shown that image-guided navigation offers a potential advantage to patients who are undergoing attempted curative major extirpative procedures for recurrent rectal carcinoma.

However, several additional issues need to be addressed before any widespread adoption of a navigation system. First, even in the authors' presumably high-volume tertiary referral hospital, only 28.9% of patients in the historical group had undergone surgical resection for recurrent rectal cancer.
carcinoma. Therefore, the indications and potential applicability may be limited. Second, the authors did not describe their learning curve, the number of hours or days spent learning the platform, or the use of the navigation system in patients with benign disease and/or in cadavers before its use in patients for whom a curative extirpative surgical intervention was planned. The first issue has implications for the second issue: if the learning curve is steep and/or requires special instrumentation, major time commitments, simulation, and/or practice on patients with benign diseases and/or on cadavers, the applicability of the navigation system may be limited. Third, the authors did not address the amount of time required to perform the navigation-based resection or the cost of the system. Regardless of the cost of the computed tomography, magnetic resonance imaging, and 3-dimensional reconstruction facets of the project, additional time in the operating room is an expensive commodity; it may be difficult to justify any additional time or cost to use the navigation system. Again, the system performed better in patients with recurrent than with primary cancer. Despite these limitations, Kok and colleagues have enhanced awareness of the potential of navigation to achieve R0 resection in patients with recurrent rectal cancer.

I hope that with help from programs such as the National Accreditation Program for Rectal Cancer, the rate of CRM involvement by primary rectal cancer will substantially decrease, reducing the incidence of recurrent rectal cancer and therefore limiting the need for surgical resection with or without a navigation system.

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REFERENCES