Prostate cancer is the third most commonly diagnosed cancer in the United States, with metastatic disease present in approximately 17% of patients at initial staging (1). Although screening for prostate cancer by using serum prostate-specific antigen remains controversial, the work-up for diagnosis is traditionally prompted by elevated prostate-specific antigen and followed by a physical examination and systematic transrectal US-guided biopsy to validate the presence of cancer. Later, additional noninvasive imaging tests may be incorporated for further staging, restaging, or diagnosing recurrence, as well as for therapeutic monitoring (1).

Multiparametric MRI has been shown to address some of the limitations of conventional noninvasive imaging tests and is now recommended for assessing men suspected of having prostate cancer but with negative results at transrectal US-guided biopsy (1–5).

Limitations of these conventional noninvasive imaging tests cannot adequately address a variety of relevant clinical issues, including risk stratification of the patients before initiation of the therapy, reliable staging of therapy-naïve patients who are at risk for pelvic lymph node metastases or systemic disease, and detection of biochemical recurrence at low prostate-specific antigen levels in patients previously treated for prostate cancer with curative intent (6). To alleviate these limitations, several molecular imaging agents have been developed for the management of prostate cancer, which could be grouped as agents that target cell metabolism, hormone receptors, and membrane proteins. These agents could be labeled with several PET radiotracers including carbon 11 choline, gallium 68 ($^{68}$Ga), or fluorine 18 fluorocholine ($^{18}$F), all suitable for PET, or hybrid devices such as PET with CT or PET with MRI (1,6).

For example, the $^{68}$Ga- or $^{18}$F-labeled prostate-specific membrane antigen (PSMA) agents are transmembrane glycoproteins associated with tumor progression and disease recurrence, which are overexpressed in prostate cancer cells (1,6,7). These PSMA agents have shown improved diagnostic accuracy for detection of recurrent disease compared with cross-sectional imaging alone because molecular imaging of prostate cancer can provide a whole-body evaluation of tumor biology.

To provide anatomic localization of PSMA-avid foci and to compensate for the depth of the centrally located tissue activities, PET images are typically coregistered with CT, which improves the diagnostic accuracy of the PET images (1). There is an increasing number of studies using PSMA agents labeled with PET radiotracers that have demonstrated improved detection rates of PET/CT studies for intraprostatic tumor, with sensitivities ranging from 67% to 97% (1).

In this issue of Radiology, the study by Hicks et al, and previously Eiber et al, elegantly demonstrates that using a $^{68}$Ga-PSMA PET portion of the PET/MRI studies improved cancer localization of intraprostatic local disease or disease elsewhere when compared with multiparametric MRI sequences interpreted alone (1,8). These reports intuitively suggest that $^{68}$Ga- (or $^{18}$F-) labeled PSMA PET/MRI studies would be more accurate in localizing intraprostatic local disease or disease elsewhere when compared with PET and multiparametric MRI studies alone. Such additional improvements in sensitivity and perhaps accuracy are most likely due to the synergistic effect of each of the components (modalities) of the hybrid PET/MRI device.

Combining the functional information from $^{68}$Ga-PSMA PET with the well-established powerful technique of multiparametric MRI results in more accurate diagnostic power.

The limitation of the study by Hicks et al was that although the findings of their cohort were obtained by using hybrid PET/MRI equipment, they separated the results obtained from each modality, that is, $^{68}$Ga-PSMA PET portion of the PET/MRI and the multiparametric MRI for comparison purposes, as they were obtained separately. Yet their findings indicated that $^{68}$Ga-PSMA-PET improves sensitivity for detection of prostate cancer compared with multiparametric MRI. Tangible advantage of the use of hybrid PET/MRI in the clinic is that both modality images become available for review instantaneously, and this technique provides most precise registration of the image data sets for lesion localization and identification when compared with the images obtained at different time points.

The excellent specificity and sensitivity provided by existing PSMA PET radiotracers and the discovery of newer radiotracers, as well as the advances occurring in hardware technologies of both modalities, will further enhance the ability of independent $^{68}$Ga-PSMA PET interpretation. Based on available preliminary data, one might conclude that at least similar improvements in diagnostic accuracy of...
prostate cancer could also be achieved by the use of hybrid PET/MRI devices and radiolabeled PSMA PET.

One would anticipate that PSMA-targeted imaging by using hybrid PET/MRI will be incorporated routinely into the evaluation and management of patients with prostate cancer.

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**References**