Clinical Review Criteria

Image Fusion

- CT/MR
- Hybrid PET/CT
- PET/MR

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Criteria

For Medicare Members
See NCD for PET Scans (220.6), NCD for Computerized Tomography (220.1), and NCD for Magnetic Resonance Imaging (MRI) (220.2)

For Non-Medicare Members
Hybrid PET/CT or PET/MR: Covered when criteria for PET Scans are met.

CT/MR: There is insufficient evidence in the published medical literature to show that this service/therapy is as safe as standard services/therapies and/or provides better long term outcomes than current standard services/therapies.

The following information was used in the development of this document and is provided as background only. It is not to be used as coverage criteria. Please only refer to the criteria listed above for coverage determinations.

Background

Modern imaging technologies visualize different aspects of disease in non-invasive ways. Computed tomography (CT) and magnetic resonance (MR) are primarily used for imaging anatomical changes associated with an underlying pathology, whereas the molecular imaging techniques of positron emission tomography (PET) and single photon emission computed tomography (SPECT) capture functional or metabolic changes associated with the pathology. To identify a change in function without knowing accurately where it is localized, or to know there is an anatomical change without understanding the nature of the underlying cause, may compromise the clinical efficacy of both the anatomical and functional imaging techniques.

In an attempt to diagnose and stage disease processes, patients often undergo a number of different image studies and the images are usually viewed separately on different computer stations. Image data sets, however can be aligned retrospectively and presented as fused images thus allowing the interpretation of the two modalities to be correlated. In recent years there has been considerable progress in the development of fusion software to co-register different image modalities particularly for imaging the brain. One goal of fusion software is to align anatomical and functional images and allow improved spatial localization of abnormalities. The resulting correlation of the anatomical and functional images may clarify the nature of the abnormality and help diagnose or stage the underlying disease. Whereas successful image fusion software has been developed for the brain, the success achieved for imaging other parts of the body is still limited.

With the increasing importance of PET for diagnosis and staging in oncology, the combination of PET with an anatomical modality as CT or MR could actually improve the accuracy of each technique used separately. Combining PET with CT is a technologically less challenging than combining it with MR in view of the extensive restrictions placed on the imaging environment by the strong magnetic field. It is challenging to develop PET detectors that can operate inside a MR scanner without causing significant artifacts in the MR images, and which can operate in a high and fluctuating magnetic field and radiofrequency. Commercial PET/CT scanners are now available, while the combined PET/MR scanners for human studies are not yet available.
The prototype combined PET/CT scanner was designed and built in collaboration between the University of Pittsburgh and CTI PET Systems, Inc. (Knoxville, TN). The system was operational from May 1998 until August 2001, and was used to scan more than 300 oncology patients. The first combined PET/CT tomograph approved by the FDA in August 2000 was manufactured by CTI PET Systems (Knoxville, USA) and was first presented at the 2000 Society of Nuclear Medicine Meeting in St. Louis. This is now distributed through Siemens and CTI. Later in 2000 GE Medical Systems (GEMS) also introduced a combined CT/PET system named the Discovery LS. Both dual modalities represent extension of the prototype design aiming at higher performance of both the CT and PET components without seeking necessarily a closer integration of the hardware scanner components. The level of physical integration of these commercial scanners is actually less than that of the original prototype.

There are several issues and challenges related to the hybrid devices including the risk of exposing the patients to additional radiation, longer examination time, and the cost of the device. Moreover, the transverse field of view of the CT tomograph is smaller than that of the PET component, which may result in lack of complete anatomical framework in very large patients. Another challenge for the hybrid device is to compensate for the effect of respiratory motion during both the CT and the PET. While standard CT exams are performed in breath-hold with full inspiration, the combined CT/PET exam should be performed with the patient breathing shallowly. This may lead to misalignment of the two images and a bias in the reconstructed emission activity distribution (Beyer 2002). The performance level of the device and its value in staging and follow-up of specific neoplasms and in specific anatomic regions also need to be evaluated.

Medical Technology Assessment Committee (MTAC)

Image Fusion
10/09/2002: MTAC REVIEW

Evidence Conclusion: There is insufficient published evidence on which to base a conclusion about the effect of using the hybrid CT/PET on health outcomes.

Articles: The literature search yielded and 5 for CT and MR hybrid. The majority were opinion pieces, reviews, or dealing with technical aspects of the hybrid devices. There were three empirical articles on hybrid CT and PET, and one on hybrid MR and PET. Three of these four studies had very small sample sizes, and the fourth did not have clinically important outcomes. None of the articles revealed was suitable for critical appraisal.

The use of image fusion in the evaluation of illness and identification of pathology does not meet the Group Health Medical Technology Assessment Criteria.

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MDCRPC Medical Director Clinical Review and Policy Committee
MPC Medical Policy Committee

Revision History

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Codes
CPT: 78814, 78815, 78816