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Perspective

Advances in Precision Interventional Radiology

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ABOUT THE STUDY

Interventional radiology, a rapidly growing medical discipline, is quickly overtaking internal medicine and surgery to become the third clinical branch. Since its inception in the 1960s, interventional radiology has grown to encompass a wide range of diseases and body systems. Interventional radiology encompasses a wide range of subspecialties, including neurological, digestive, hepatobiliary, vascular, and oncological interventions. It has evolved into a necessary discipline in clinical medicine.

Precision Interventional Radiology (PIR) is a concept proposed with the development of precision medicine. In contrast to the narrow concept of PIR, which focuses on anatomical location via Ultrasound (US), Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Digital Subtraction Angiography (DSA), the broad concept of PIR emphasizes disease heterogeneity. It aims to improve the accuracy and specificity of diagnosis and focuses on the efficacy of interventional therapies. Furthermore, one of the primary goals of PIR is to avoid unnecessary medical treatment and clinical resource waste. We outline the concept of PIR in detail here and provide future perspectives on interventional radiology.

PIR has been proposed as part of the precision medicine concept. Prior to that, interventional radiology was defined as a minimally invasive procedure utilizing image-guided techniques such as US, CT, MRI, and DSA. Interventional radiology uses interventional devices such as puncture needles, catheters, and wires to provide safer alternatives to various traditional medical and surgical therapies. This is the narrow definition of PIR, which emphasizes the precise anatomical location for percutaneous puncture, intravascular, or non-intravascular therapy. Currently, the concept of PIR focuses not only on the accuracy of anatomical location, but also on the comprehensive evaluation of interventional procedures in terms of preoperative evaluation and prognosis prediction.

Precision diagnosis is thought to be a prerequisite for interventional therapy. Multiple factors at the gene, protein, metabolism, and pathology, laboratory, and radiology levels contribute to the biological behaviors of diseases. These also serve as a foundation for individualized and systematic disease treatment. The concept of PIR embodies a comprehensive evaluation of patient selection, the efficacy and safety of interventional techniques, as well as their prognosis. The combination of interventional therapies and medical or surgical treatment, in particular, has broadened its application. PIR becomes sophisticated when it addresses who should receive the combination therapy, as well as when and how it should be administered. As a result, PIR emphasizes disease management rather than interventional therapy.

More attention has been paid to the precise application and development of interventional techniques. The choice of drugs and embolic materials for intravascular embolization has a significant impact on its outcome. For decades, interventionists have struggled to determine the best rate, range, or degree of embolization. PIR also considers the implantation and release of stents, filters, and coils, as well as the best combination of these interventional techniques. The PIR has advanced due to the development of new materials, drugs, equipment, and techniques. Thus, PIR is an important component of precision medicine and a medical activity centered on interventional technology. PIR's ultimate goal is to maximize patients' benefits while minimizing their harm.

Puncture needle or catheter may be precisely positioned into lesions using US, CT, MR, and DSA guidance. These procedures give diagnostic information for a variety of disorders by performing biopsies or angiography. Lesions on the surface are plainly visible on US imaging, but not on the interbody. CT may produce two-dimensional pictures of lesions. CT scans, in particular, reveal the size, shape, and location of the lesions. The near link between lesions and their surrounding regions, both on the surface and within the body, may be clearly seen. MRI, a non-radiation technology, provides a high spatial resolution for soft tissues. MRI can track heat temperature and be used to guide radiofrequency or microwave ablation.

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