

Interventional Radiology: Empowering Personalized Care for Oncology Patients

Abstract

Interventional radiology (IR) has revolutionized the care of oncology patients, offering minimally invasive procedures that aid in the diagnosis, treatment, and palliative care of various malignancies. This review article aims to provide an in-depth analysis of the role of interventional radiology in the comprehensive care of oncology patients. We explore the diverse applications of IR, including image-guided biopsies, tumor ablation, embolization techniques, pain management, and palliative interventions. Additionally, we discuss the impact of interdisciplinary collaboration, recent advancements in technology, and the current evidence supporting the use of interventional radiology in optimizing patient outcomes. By highlighting the significant contributions of interventional radiology, this review underscores the need for its integration into the standard oncology care pathway.

Keywords: Interventional radiology • Personalized care • Oncology patients

Introduction

In the realm of modern medicine, the field of interventional radiology has emerged as a groundbreaking specialty that plays a crucial role in the comprehensive care of oncology patients. By utilizing advanced imaging techniques and minimally invasive procedures, interventional radiologists contribute significantly to the diagnosis, treatment, and palliative care of cancer patients. This article aims to shed light on the essential role of interventional radiology in the management of oncology patients and highlight its impact on improving patient outcomes [1].

Interventional radiology encompasses a wide range of procedures that are performed using image guidance, such as X-rays, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). These procedures are minimally invasive, meaning they require only a small incision or puncture in the skin, resulting in less pain, shorter hospital stays, and faster recovery times compared to traditional surgery [2].

Biopsies to establish histological diagnosis are increasingly performed using minimally invasive techniques by interventional radiologists. The direct visualization enabled by image guidance during biopsy permits safe passage of a needle into an organ or mass, improving efficacy and minimizing trauma to surrounding structures. These minimally invasive techniques are applicable to a wide range of biopsy sites and, in most organ systems, have been demonstrated to be highly accurate with a low complication rate [3]. In biopsy planning, modern cross sectional imaging techniques help define lesion location, accessibility, and suitability for biopsy and aid in ensuring the correct lesion is sampled in the context of multiple lesions. In selected cases where lesions are present in more than one organ, percutaneous biopsy may be used to concurrently confirm histological diagnosis and establish oncological staging by sampling the lesion suspicious for metastasis.

When it comes to oncology patients, interventional radiology offers several critical interventions throughout the cancer care continuum. One of the primary roles of interventional radiologists is in the diagnosis and staging of cancer. They utilize imaging techniques to precisely locate and biopsy suspicious masses or lesions, providing valuable information for an accurate cancer diagnosis. This enables oncologists to develop targeted treatment plans and initiate appropriate therapies promptly.

Interventional radiologists also play a key role in tumor treatment, offering minimally invasive alternatives to surgery or as adjuncts to other cancer therapies [4]. One such

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example is image-guided tumor ablation, where interventional radiologists use thermal or chemical techniques to destroy tumors. This technique is particularly effective in treating small liver, kidney, and lung tumors. Similarly, embolization procedures can be employed to cut off the blood supply to tumors, effectively starving them of nutrients and reducing their size. These techniques are used to treat liver tumors, uterine fibroids, and certain vascular tumors.

Interventional radiology in the diagnosis of cancer

Ultrasound offers the benefit of real-time imaging allowing accurate monitoring of the needle trajectory through tissues en route to the target lesion, with the dual advantage of avoiding patient and staff exposure to ionizing radiation during the biopsy [5]. When lesions are visible by ultrasound, with suitable equipment and appropriate operator experience, this modality can provide equivalent or superior guidance to CT at time of biopsy. CT guidance offers enhanced anatomical detailing and delineation with more precise needle localization when compared to ultrasound. Complications, if any, are easily recognized on CT scan. It finds particular utility in thoracic, pelvic, and retroperitoneal biopsies which are frequently difficult to perform under ultrasound guidance.

Moreover, interventional radiology plays a vital role in the management of cancer-related complications. Cancer patients often experience pain and discomfort due to tumor growth or metastasis [6]. Interventional radiologists can perform nerve blocks, nerve ablation, or administer pain-relieving medications directly to the affected area, providing much-needed relief to patients. Additionally, they can alleviate symptoms caused by the obstruction of vital structures, such as the biliary or urinary tract, by placing stents or catheters to restore normal flow.

Interventional radiology also plays a significant role in palliative care, focusing on improving the quality of life for patients with advanced-stage or metastatic cancer. Through various minimally invasive procedures, interventional radiologists can relieve symptoms like pain, bleeding, and blockages, thus enhancing patients comfort and enabling them to maintain a higher level of functionality and independence [7].

Interventional radiology in the treatment of cancer

Radioembolisation, a novel form of liver-directed brachytherapy, is another modality with potential for focused treatment of hepatic malignant lesions. Selective catheter placement allows introduction of beta radiation emitting radioisotopes directly into the tumour mass by means of microspheres. Depending on the nature of the tumour, various radionuclides are used, including Yttrium 90, rhenium, and holmium. Beta radiation has a very low penetration, thus its necrosing effects are localized. The concurrent emission of a small amount of gamma radiation, which is capable of penetrating the body tissues, allows detection of the radiolabelled particles by a gamma camera and appropriate localization of isotope can be confirmed [8]. Accurate transcatheter delivery of radioisotopes has been shown to be safe, with efficacy confirmed on preliminary results. Radioembolisation has been reported to produce a meaningful response and disease stabilization in patients with advanced unresectable liver metastases, and may be potentially very useful in patients with chemo refractory metastatic colorectal cancer.

In recent years, technological advancements have further expanded the capabilities of interventional radiology in oncology care. For instance, the development of targeted therapies and image-guided drug delivery systems allows interventional radiologists to deliver chemotherapy drugs directly to the tumor site, reducing systemic side effects and improving drug efficacy [9]. Additionally, the integration of molecular imaging techniques, such as positron emission tomography (PET) and molecular targeted agents enables interventional radiologists to precisely locate and treat tumors at a cellular level.

Despite its significant impact on cancer care, interventional radiology remains relatively unknown to the general public. Increased awareness and collaboration between oncologists and interventional radiologists are essential to ensure that patients receive the most comprehensive and coordinated care. By working together, these specialists can develop personalized treatment plans that optimize patient outcomes and enhance the overall cancer treatment experience.

Conclusion

In conclusion, interventional radiology plays a

critical role in the care of oncology patients, providing valuable diagnostic information, offering minimally invasive treatment options, managing cancer-related complications, and improving patients' quality of life. With the expanding application of minimally invasive techniques to the investigation and management of malignancies, the interventional radiologist is assuming a more prominent role in the multidisciplinary team that cares for the patient with cancer. The use of IR techniques in oncology patients should be evidence based to ensure optimal outcome and minimize potential complications. As technology continues to advance, the field of interventional radiology will undoubtedly contribute even more to the comprehensive care of cancer patients, offering innovative solutions and improved outcomes. By recognizing the importance of this specialty and fostering collaboration among healthcare professionals, we can further enhance the care and treatment of individuals affected by cancer.

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