

# Complementary Role of Intervention Radiology in Palliative Care in Oncology Setting

Ekta Dhamija, Ashwin Deshmukh, Pankaj Meena, Mukesh Kumar, Sushma Bhatnagar<sup>1</sup>, Sanjay Thulkar

Departments of Radiodiagnosis and <sup>1</sup>Onco-Anaesthesia and Palliative Medicine, All India Institute of Medical Sciences, New Delhi, India

## Abstract

Owing to advances in treatment of cancer, there has been increase in life expectancy. Palliative care aims at improving quality of life of patients suffering from malignancy and is now recognized as a separate subspecialty. Management of cancer patients needs a multidisciplinary approach, and radiology has a key role to play at every step of it. Interventional radiology has broadened its scope immensely over the last decade with development of newer and less invasive applications useful in oncology and palliative care. The role of interventional radiologists begins from obtaining tissue for histopathological examination and extends to controlling disease spread with ablation or chemoembolization, to managing the tumor-related complications and relieving stressful symptoms such as dyspnea and pain. This article aims to review the interventional radiologist's arsenal in managing patients with malignancies with a special emphasis on palliative care, providing a more holistic approach in improving the quality of life of cancer patients.

**Keywords:** Fluid drainage, intervention radiology, neurolytic blocks, palliative care

## INTRODUCTION

Imaging is an integral and indispensable part of workup of any cancer patient. It encompasses diagnosis, staging, tissue sampling, treatment strategies, and follow-up for response assessment. A component of imaging which extends beyond routine cross-sectional imaging done for staging and response assessment is interventional radiology (IR). The role of latter is crucial and much needed at multiple stages of patient management starting from image guide tissue sampling to executing interventional procedures with curative or palliative intent. Likewise, palliative care is another important front in oncology. It aims at improving quality of life of patients not only physically but also spiritually and emotionally. Both intervention radiology and palliative care work hand-in-hand in more fronts than looked upon commonly.

This article aims at elaborating the scope of IR in oncology and palliative care [Table 1].

## MANAGEMENT OF MALIGNANCY OR METASTASES

### Percutaneous ablation

IR-mediated tumor ablation causes tumor necrosis by deposition of energy in the tissue by means of radiofrequency

ablation (RFA), microwave, ultrasound, laser-induced thermotherapy, cryotherapy, and irreversible electroporation. RFA is considered to be safe, with a mortality rate of 0.3% and a major complication rate of 2.2%.<sup>[1]</sup> In RFA, electromagnetic energy is administered in a radiofrequency range to the target tissue causing tissue temperature to rise above 60°C with resultant thermal damage and cell death. RFA has gained popularity and is now considered the treatment modality of choice in appropriate liver tumors (hepatocellular carcinoma [HCC]).<sup>[2]</sup> Few authors have suggested RFA as first treatment option in single liver lesions that are 2 cm or smaller in size.<sup>[3,4]</sup> RFA has also been successfully used in unresectable and potentially resectable liver metastases from colorectal cancer<sup>[5,6]</sup> [Figure 1]. In palliative care, RFA is used for treatment of painful bone metastases refractory to palliative radiotherapy.<sup>[7]</sup>

**Address for correspondence:** Dr. Ekta Dhamija,

Room Number 137, First Floor, Department of Radiodiagnosis,  
Dr. BR Ambedkar Institute Rotary Cancer Hospital, All India Institute of  
Medical Sciences, New Delhi - 110 029, India.  
E-mail: drektadhamija.aiims@gmail.com

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### Transarterial chemoembolization

Transarterial chemoembolization (TACE) is used in the treatment of HCCs, where selective hepatic artery cannulation is done and a chemotherapy agent is directly infused in tumor bed followed by an embolic agent that occludes the flow through the catheterized artery. Ischemia produced by the embolic agent makes the tumor cells susceptible to damage by the cytotoxic agents. The advantage of TACE over systemic chemotherapy is that delivery of the chemotherapeutic agent is targeted at the lesion allowing a higher local concentration of the agent and lower systemic doses. The liver tolerates TACE procedure due to its dual blood supply. TACE is the standard treatment in Barcelona clinic liver cancer stage B (intermediate HCC) tumors and is performed with palliative intent in larger unresectable tumors. Overall survival rates for the combination therapy (ablation and chemoembolization) are found to be higher.<sup>[8]</sup>

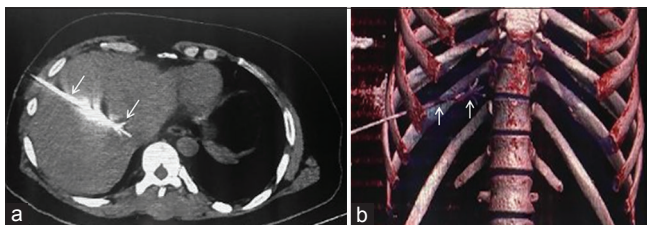
## MANAGEMENT OF COMPLICATIONS

### Drainage of fluid

Fluid accumulation in pleural, peritoneal, or pericardial cavity can lead to significant deterioration in patient's general condition. Malignancies are the third most common cause of pleural effusion and the second most common cause of ascites after cirrhosis.<sup>[9,10]</sup> These are among the most debilitating complications of malignancy leading to worsening of quality of life. Drainage of these fluid collections hence becomes important whether it is one-time aspiration or placement of percutaneous catheter.<sup>[11]</sup>

**Table 1: Image-guided palliative care interventions in oncology**

Management of primary malignancy or metastases
Percutaneous ablation
TACE
Management of complications
Drainage
Obstruction (PCN, PTBD, gastrostomy, cholecystostomy, etc.)
Embolization to achieve hemostasis
Pain management
Miscellaneous: Establishing venous access
TACE: Transarterial chemoembolization, PCN: Percutaneous nephrostomy, PTBD: Percutaneous transhepatic biliary drainage



**Figure 1:** Radiofrequency ablation of metastatic lesion in liver from colorectal cancer: (a) Axial CT and volume rendered coronal reformatted image (b) showing the course of radiofrequency ablation probe and its expanded prongs *in situ*

Malignant pleural effusions are significant cause of morbidity in the oncology patient, presenting with dyspnea, cough, and chest pain. Prevention of recurrent pleural effusions can be achieved by chemical pleurodesis. Before pleurodesis, large effusions require drainage to optimize success rates of pleurodesis and to prevent accumulation of therapeutic agents within the pleural space. Compared to pleurodesis, placement of tunneled pleural catheters has been shown to be feasible and shown to have lower morbidity, lower rates of hospital stay,<sup>[12]</sup> reduced rates of repeat intervention,<sup>[13]</sup> and reduction in dyspnea in patients with failed pleurodesis<sup>[14]</sup> [Figure 2].

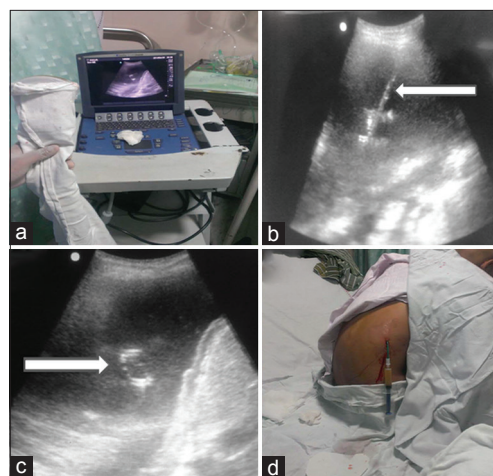
Tunneled peritoneal catheters for patients with peritoneal carcinomatosis and refractory ascites have been shown to be safe, cost-effective, and well-tolerated with close to 100% technical success rate.<sup>[15]</sup> These catheters may also be used to instill chemotherapy without an increase in the rate of infections.<sup>[16]</sup>

Peritoneovenous shunt (PVS) transfers fluid from the peritoneal cavity into the central venous system through the subclavian or the jugular vein. PVS placement offers several advantages over tunneled catheters. There is no loss of nutrients through drainage of the fluid. Patients may experience a better quality of life as there is no external tube extending out of the patient. It is especially beneficial in chylous ascites following retroperitoneal lymph node dissection, as it may provide complete resolution of ascites.<sup>[17,18]</sup>

Percutaneous interventions in malignant pericardial infusions include pericardiocentesis and catheter drainage, pericardial instillation of sclerosing agents, and placement of a pericardial balloon catheter.<sup>[19]</sup>

### Management of obstructions (hepatobiliary, gastrointestinal, and urinary)

Majority of the patients presenting with malignant biliary obstruction have an underlying carcinoma of the pancreas or

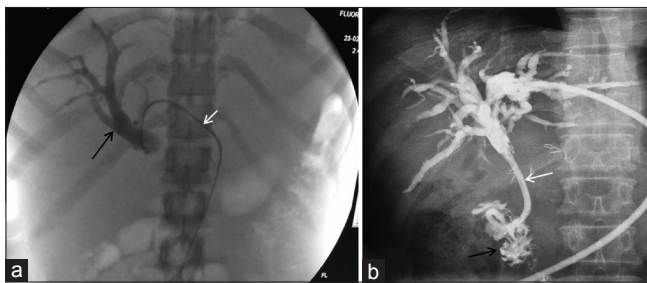


**Figure 2:** Drainage of pleural effusion: (a) Ultrasound screen and convex probe wrapped and duly covered using aseptic precautions. (b) Ultrasonography image showing echogenic needle within the pleural fluid (arrow). Subsequently deployed pigtail catheter is seen *in situ* as it forms loop (arrow in c). The patient sits comfortably after pigtail insertion till the catheter is sutured to skin (d)

gallbladder. Metastatic nodes at hepatic hilar or peripancreatic location may also cause extrinsic compression of proximal part of common bile duct with resultant biliary obstruction. Patients suffer from primary malignancy as well as the severe pruritus caused due to obstruction of the route of biliary drainage. This can be relieved with percutaneous biliary interventions which are preferred in high biliary obstruction whereas endoscopic techniques are preferred in lower biliary duct obstructions. Percutaneous techniques may be indicated in low biliary obstruction when the patient has undergone pancreaticoduodenectomy and in whom endoscopic interventions may be technically challenging.<sup>[20]</sup> Percutaneous transhepatic biliary drainage involves selective cannulation of the biliary tree with catheter manipulation followed by placement of a catheter or stent to facilitate internal or external drainage of bile and cause slow biliary decompression [Figure 3]. Complications of biliary drainage include cholangitis, hemorrhage, and pericatheter leakage.<sup>[21]</sup> The likelihood of developing an infection increases with increasing duration of external drain.<sup>[22]</sup> The ultimate goal of biliary interventions is to provide an internal drainage by stenting, for which self-expandable metallic stents are used.

Patients with head, neck, or esophageal malignant lesions are frequently unable to tolerate adequate oral intake due to luminal obstruction or swallow impairment and require nutritional support, often by gastrostomy or gastrojejunostomy.<sup>[23]</sup> Percutaneous image-guided placement of feeding tubes has demonstrated higher technical success rates and is considered safer than endoscopic or surgical placement.<sup>[24]</sup> Early complications of gastrostomy insertion are infection and mild discomfort on feeding.<sup>[25]</sup> Tube dislodgement is relatively uncommon; however, if the tract is established for more than 2 weeks, it is frequently possible to access the tract and reinsert the tube without the need for repuncture of the stomach. Nasojejunal tubes can be placed under fluoroscopic guidance and have shown to have an advantage over nasogastric tubes in ill patients.<sup>[26]</sup>

Decompressive cecostomy can be done under fluoroscopic guidance in cancer patients with large bowel obstruction. It prevents perforation and also provides symptomatic



**Figure 3:** Percutaneous transhepatic biliary drainage: (a) Fluoroscopic image showing dilated biliary ducts (black arrow) opacified by iodinated contrast injected through the catheter *in situ* (white arrow). (b) Ring biliary catheter (white arrow) placed with tip in duodenum (black arrow) enabling internal drainage of the bile

relief.<sup>[27]</sup> They may also be used as a bridge to more definitive treatment.<sup>[28]</sup> Colonic stent placement may be done under fluoroscopic guidance alone in patients with unresectable colonic carcinoma or as a bridge to elective surgery with favorable results.<sup>[29]</sup>

The urinary tract obstruction occurs most commonly at the level of ureters due to pelvic or retroperitoneal malignancies. Image-guided urinary decompression, by means of percutaneous nephrostomy (PCN), is indicated in cases of deteriorating renal function or electrolyte disturbances such as hyperkalemia and metabolic acidosis, pyonephrosis.<sup>[30]</sup> Image guidance may be provided with fluoroscopy, ultrasound, or often a combination of both modalities.<sup>[31]</sup> In a study by Wong *et al.*, with malignant ureteral obstruction (bilateral in 68% cases), initial management with PCN achieved successful decompression of the system in 94% of cases.<sup>[32]</sup> Degree of dilatation of collecting system and the patient's body habitus was the main determinant of the rate of successful completion of PCN in oncology.<sup>[33]</sup>

#### Embolization to achieve hemostasis

Approximately 10% patients with lung cancer may have massive hemoptysis. Bronchial artery embolization can be beneficial in these patients. Similarly, embolization can be successfully used in ruptured HCCs, retroperitoneal tumors such as angiomyolipomas and renal cell carcinomas, and severe hemorrhagic cystitis (cyclophosphamide, RT induced) refractory to conservative management.<sup>[34,35]</sup>

#### Pain management

Pain is a significant source of cancer-related morbidity, particularly in advanced cancer, in which inadequately controlled pain can have a profound impact on the quality of life. Strong analgesics like opiates with considerable side effect profile remain the mainstay of treatment and are used to manage pain in majority of the cancer patients according to the principles of the World Health Organization analgesic ladder.<sup>[36-38]</sup> Neuropathic pain associated with upper abdominal visceral tumors is frequently poorly responsive to analgesic therapy. Celiac ganglion neurolysis and nerve block can achieve successful palliation of pain in the majority of patients, who are refractory to analgesics with pancreatic, gastric, esophageal, and biliary malignancies.<sup>[39]</sup> It can be performed using fluoroscopic guidance, ultrasonography (USG), or computed tomography (CT) guidance depending on operator's experience. Where fluoroscopy is based on anatomical landmarks, USG provides real-time visualization of needle and CT confirms the location of needle tip in relation to surrounding structures [Figure 4]. Reported minor complications include transient diarrhea in 73% and orthostatic hypotension in 12%.<sup>[40]</sup> Similarly, peripheral nerve blocks can be used to provide pain relief in various other malignancies.<sup>[41-45]</sup>

Analgesics, bisphosphonates, chemotherapy, and radiation have been traditionally used to manage metastatic bone pain. Radiotherapy provides partial pain relief in 70% patients while complete pain relief may be seen in up to one-third of





**Figure 4:** Computed tomography-guided celiac plexus neurolysis: Needle is placed at the level of celiac axis (arrow) under computed tomography guidance. Uniform spread of contrast-mixed neurolytic agent is seen (arrowheads)

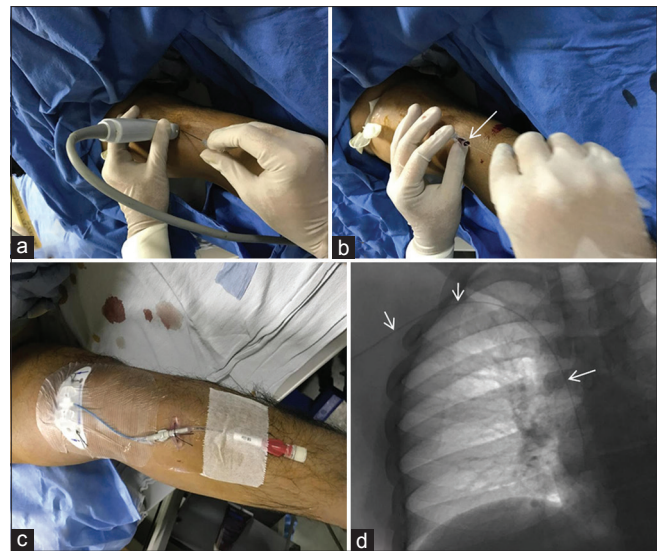
patients.<sup>[46,47]</sup> Up to one-third of patients may have refractory pain.<sup>[48]</sup> According to the latest NCCN guidelines concerning adult cancer pain (v2, 2016), percutaneous ablation for metastatic bone pain may be considered when pharmacologic therapy is inadequate and radiation therapy is contraindicated or not desired by the patient in cases without an oncologic emergency (e.g., pathologic fracture or epidural disease).<sup>[49]</sup>

Percutaneous cementoplasty provides not only stability but also analgesic effect in painful lytic or mixed bone metastases.<sup>[50]</sup> It has been reported to provide palliation in extraspinal lytic bone metastases.<sup>[51]</sup> High-intensity focused ultrasound has been shown to be safe and effective for primary pain palliation and local tumor control.<sup>[52]</sup>

## MISCELLANEOUS

### Central venous access and other venous interventions

Cancer patients often require long-term venous access for administration of drugs as well as repeated blood sampling. Permanent venous access is most commonly obtained through the internal jugular vein. “Landmark method” is used to be employed traditionally to locate and puncture the venous sites. Blind or surface marking-guided central venous catheter (CVC) insertions are associated with number of potential complications including pneumothorax, inadvertent injury to arteries, and nerves. USG-guided CVC access has been proven to not only reduce the number of attempts but also reduce arterial puncture and bloodstream infections.<sup>[53]</sup> There is 4–6 times increased risk of thrombosis in oncology patients as compared with the general population, which is further increased by placement of a CVC.<sup>[54,55]</sup> Peripherally inserted central catheters (PICC) were introduced with the presumed benefit in terms of decreasing these complications. Typically, the cephalic or basilic vein is used as the access site, and the PICC line is advanced into the central veins with its tip lying in the superior vena cava (SVC) or at the cavoatrial junction under US and fluoroscopic guidance [Figure 5].



**Figure 5:** Peripherally inserted central venous catheter: (a) Venous puncture under ultrasonography guidance is performed followed by establishing access using guidewire (arrow in b). (c) Central venous catheter is placed over the guidewire and position confirmed on radiograph or fluoroscopy spot image (arrows, d)

Malignancy accounts for up to 70% cases of SVC syndrome. Other causes include thrombosis from CVCs and pacemaker leads.<sup>[56,57]</sup> Although no scientific evidence exists, endovascular treatment has been proposed as a first-line treatment for malignant SVC obstruction.<sup>[58,59]</sup> Similarly, obstruction of inferior vena cava (IVC) may result in pedal edema, venous ulcers, renal vein thrombosis, and/or renal insufficiency (when IVC obstruction is at or above the level of renal veins) and Budd–Chiari syndrome (when IVC obstruction is at the level of hepatic veins).<sup>[60,61]</sup> IVC occlusion can be treated successfully using endovascular techniques, and a study by Razavi *et al.* has reported to have a primary patency rate of 80% at 19 months.<sup>[60,62,63]</sup> The generally accepted indications of IVC filter placement include failure, contraindication, and complications of anticoagulation.<sup>[64]</sup> Cancer patients are at an increased risk of venous thrombosis as well as bleeding when on anticoagulation.<sup>[65]</sup> Placement of IVC filters is an option in these patients for preventing pulmonary embolism.

## CONCLUSION

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.

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### Conflicts of interest

There are no conflicts of interest.

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