rest may require interventions such as thrombolysis or percutaneous coronary angiography and stenting. Whether the efficacy of these interventions is affected by induced hypothermia is not known. Although data on the use of induced hypothermia is incomplete in these cases, optimal cerebral outcomes must be considered, and induced hypothermia should not be delayed for the institution of other interventions.

Conclusion

Induced hypothermia should be considered for cardiac arrest survivors, and cooling instituted expediently.

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Clinical Vistas

Interventional radiology in palliative care

A 41-year-old woman presented to the emergency department with pain in the lower right quadrant that was presumed to be caused by appendicitis. During surgery, a mass was found that was confirmed by pathology to be a moderately differentiated invasive endometrioid adenocarcinoma arising from extraovarian endometriosis. Chemotherapy was administered peripherally for several months; however, venous access became a problem. The patient was referred to interventional radiology for port insertion in order to continue chemotherapy.

Two weeks later, the patient began to show symptoms of a bowel obstruction. A spiral CT scan of the abdomen showed a right pelvic mass that was obstructing the sigmoid colon and the distal right ureter, with associated hydronephrosis. A self-expanding metallic colonic stent was inserted by an

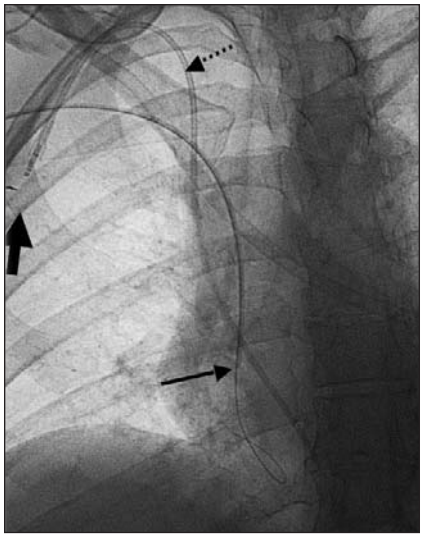

Fig. 1: Radiograph showing the plastic reservoir of the subcutaneous port (fat arrow). The catheter tip is positioned deep within the right atrium (dotted arrow), and the tip of the peripherally inserted central catheter line is in the mid right atrium (arrow).

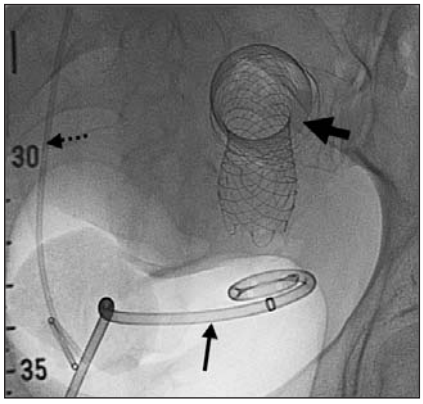

Fig. 2: Radiograph showing the catheter inserted percutaneously to drain the pelvic abscess (arrow), the right ureteric stent (dotted arrow) and the self-expandable metallic colonic stent (fat arrow) within the sigmoid colon.

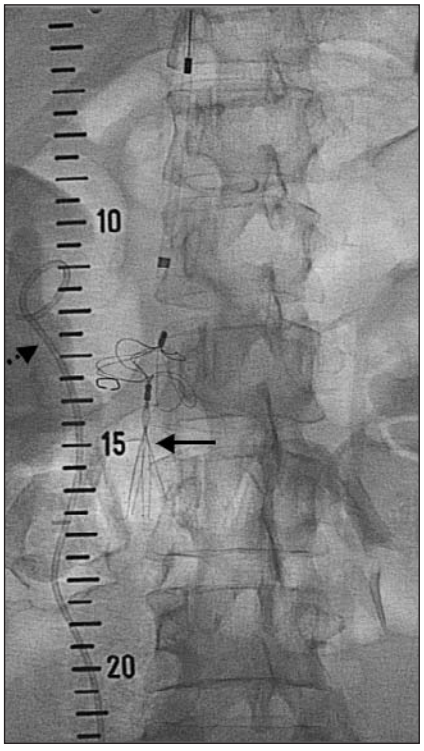

Fig. 3: Fluoroscopic image obtained at the time of insertion of the permanent inferior venous caval filter (arrow). The indwelling right ureteric stent can be seen (dotted arrow).

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interventional radiologist using fluoroscopic guidance. Subsequently, a right ureteric double J stent was placed to relieve flank pain caused by pressure from hydronephrosis. The patient's symptoms of bowel obstruction resolved almost immediately following insertion of the colonic stent. However, 1 month later, she experienced another bowel obstruction. A repeat spiral CT scan showed that the colonic stent was in the appropriate position. This time, we felt that the small-bowel obstruction was secondary to the adhesions, and surgical resection with an enteroenteral small-bowel anastomosis was performed.

Nine days after the operation, the patient had increasing pain in the lower right quadrant, fever and leukocytosis. A CT scan revealed a pelvic abscess and an unsuspected right iliac venous thrombosis. A central catheter was inserted peripherally to provide antibiotic therapy, and the abscess was drained percutaneously. Given the relative risk of anticoagulant therapy to a patient undergoing various procedures, we elected to insert an inferior venous caval filter to protect her from a pulmonary embolism. The patient was discharged home (having normal bowel movements) 2 weeks after the last interventional radiology procedure (Fig. 1, Fig. 2, Fig. 3) was performed. She died of the adenocarcinoma 3 weeks after being discharged.

Six minimally invasive interventions were performed to provide palliative care to our patient. These types of interventions reflect a partial shift away from open surgical techniques (e.g., abscess drainage, colostomy) to those performed by interventional radiologists. There is increasing evidence that these procedures are safe, effective and result in cost savings compared with open surgical techniques.[1] For example, colonic stents have been advocated as a bridge to surgery[2] and, more importantly, for the treatment of malignant obstructions in patients receiving palliative care. In the latter case, stenting prevents the need for a colostomy and allows the patient to eat normally (compared to enteral feedings or total parenteral nutrition) and to leave the hospital earlier.[3] The success and complication rates of colonic stent placement are within an acceptable range. A systematic pooled analysis that included 54 published reports with a total of 1198 patients found a technical success rate of 94% and a median clinical success rate (relief of obstruction) of 91%.[3] Major complications included stent migration (11.8%), recurrent obstruction (7.3%), perforation (3.8%) and death (0.58%).[3]

In the case we have described, the peripherally inserted central catheter and subcutaneous ports allowed the patient to return home and continue the antibiotic therapy and to receive chemotherapy as an outpatient. The inferior venous caval filter has been established in the prevention of pulmonary emboli in patients who cannot receive standard anticoagulation therapy,[4] including patients receiving palliative care and who have a limited life expectancy.[5] Urinary tract obstructions can be relieved by renal decompression through percutaneous nephrostomy or ureteric stent insertion, which preserves renal function, reduces pain and prevents a potential source of sepsis.

There are many minimally invasive procedures available to patients who require palliative care (Box 1). The goal of palliative care is primarily to improve the quality of the patient's remaining life and secondarily to prolong their life; thus, physicians should consider a referral for interventional radiology procedures at any point if they believe that it may help with either of these goals. Patients with an expected survival of less than several days would generally not be candidates, although this depends on the complexity of the procedure being considered.

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Box 1: Interventional radiology procedures for palliative care

Diagnostic

- Biopsy
- Fluid drainage
- Angiography
- Fistulography

Therapeutic

- Fluid drainage
  - Paracentesis
  - Thoracentesis
- Placement of venous access device
  - Peripherally inserted central catheter
  - Tunneled catheter
  - Port (e.g., for chemotherapy)
- Nephrostomy
- Biliary drainage
- Placement of inferior venous caval filter
- Stent placement
  - Ureteric stent
  - Vascular (e.g., for superior vena cava syndrome)
  - Enteric (e.g., for obstruction, fistula)
- Tumour embolization
- Radiofrequency ablation
- Pain control (e.g., celiac plexus ablation, transcatheter embolization, vertebroplasty)

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