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What family physicians should know about interventional radiology?

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Abstract:

Interventional radiology (IR) is a rapidly evolving specialty. The minimally invasive nature of the procedures has led to a paradigm shift in treating many disease processes from conventional surgery to interventional techniques that have become the first choice and the preferred method for the treatment of peripheral vascular disease, many aortic pathologies, and venous diseases. Interventional oncology procedures have become widely available for the treatment of solid hepatic and renal tumors. This includes palliative techniques for many advanced malignancies, and fluid drainage that is exclusively performed by interventional radiologists in many hospitals all around the world. Women's health-related procedures such as uterine fibroid embolization, fallopian tube recanalization, and embolization for pelvic congestion syndrome have become attractive choices for many patients. Family physicians (FPs) are the main source of patient referral to hospitals. However, there is a notable knowledge deficiency of IR among FPs in Saudi Arabia. This may be due to poor communication between FP and IR or the lack of FP's awareness of IR procedures. This is a nonsystematic review to introduce some IR procedures to FPs pertinent to their practice to optimize patient referral and management with the use of IR services. We focused on the most commonly performed IR procedures paying special attention to their clinical indications, benefits, and alternatives.

Keywords:

Family physicians, interventional radiology, minimally invasive procedures

Introduction

Interventional radiology (IR) is a rapidly evolving specialty that has revolutionized the face of medicine around the world in the last three decades.^[1] Many diseases which used to be treated with traditional surgery can now be managed with these minimally invasive techniques of IR.^[2] Interventional radiologists, in general, feel that family physicians (FPs) have little or no direct communication with them either for logistic reasons such as working in different places or the lack of awareness of how IR can help their patients. This is at least true for Saudi Arabia. A study from Saudi Arabia showed that almost half of the surveyed final-year medical students and interns, the

supposed future physicians (52%), felt that their knowledge of IR was poor.^[3] A study from India by Agrawal *et al.* showed that 60% of medical students who responded to their survey on IR awareness revealed poor or very poor knowledge.^[4] In many countries, FPs are the primary caregivers and advisors to patients. They also play an important role in the referral of patients for further investigations and treatment, which might include referral to an interventional radiologist for a minimally invasive procedure. Therefore, it is important for FPs to have the knowledge of IR and the spectrum of different procedures possible for different disease processes to optimize patient care.^[5] In view of the recent budget constraints in Saudi Arabia, requests for minimally invasive techniques of IR that use local anesthesia with no patient admission into hospital in most cases are expected to increase. Therefore, the awareness of FPs

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about indications, advantages, and possible adverse events of these procedures will enhance communication between them and the interventional radiologist and patients. The purpose of this review was to apprise family practitioners of the scope, indications, and techniques of IR procedures pertinent to the practice of family and community medicine. A search of the literature was made on the relationship between the practice of family medicine and IR with special focus on common procedures that can be done on an outpatient or day case basis.

Image-Guided Biopsy

Biopsy is key to the diagnosis and management of many diseases, especially in oncology patients. Many hepatic and renal diseases require tissue diagnosis for optimal diagnosis and management. Obtaining tissue samples used to be by surgical exploration or excisional biopsy. However, the general trend now is the use of image guidance with ultrasonography (US) or computed tomography (CT) and minimally invasive techniques to obtain tissues from almost all organs and tumors. Image-guided percutaneous biopsy, now the preferred method of obtaining tissue samples, is safe and effective, can be done as an outpatient or day procedure for adults under local anesthesia only, and has low complication rates and costs less than surgical techniques. With these techniques, even small lesions in difficult locations such as adrenal lesions, small liver and lung lesions, and small cortical bony tumors [Figure 1] can be sampled with high accuracy.

Biopsies can be done with small needles (20–25G) as in aspiration cytology of thyroid gland or with large-bore needles (14–18G) to obtain larger samples for histopathological and electron microscopic analysis. In general, percutaneous biopsy results with a sensitivity of 94% and a specificity of 99%.^[6]

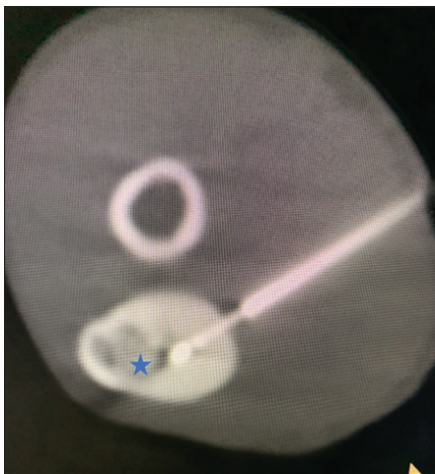


Figure 1: Percutaneous biopsy of small osteoid osteoma (star) of the proximal ulna using computed tomography guidance

Aspiration and Drainage of Fluids

Minimally invasive techniques of IR are perfectly employed to aspirate fluid accumulation in the body for analysis and diagnosis or to relieve distressing symptoms. It is also for oncology patients on palliative therapy who are often in need of frequent aspiration to improve their quality of life, avoid prolonged hospitalization, and minimize complications.

Thoracentesis and paracentesis are some of the most common procedures performed in the IR suite on a daily basis for diagnostic or therapeutic reasons to relieve shortness of breath or abdominal distension. When done under image guidance, the risk of complications is less and the accuracy in localization is greater than that of procedures which are performed blindly.^[6] Abscess collection that can result in life-threatening sepsis and high mortality is among the ten leading causes of death in the United States.^[7] With their knowledge of anatomy and imaging techniques, interventional radiologists are perfectly suited to performing percutaneous drainage using minimally invasive techniques.^[8] Currently, the treatment of choice for intra-abdominal abscess is with image-guided percutaneous techniques, which are minimally invasive and safe and can be done as an outpatient procedure in some cases, at a lower cost than surgery. CT-guided drainage leads to definite treatment of 70%–90% of abdominal abscess collections [Figure 2].^[9]

Peripheral Vascular Intervention

Peripheral vascular disease (PVD) is a common health problem, especially in diabetic patients, and the leading cause of amputation worldwide. The World Health Organization has reported that Saudi Arabia is the second highest for the incidence of diabetes in the Middle East and seventh in the world. Many diabetic patients are followed in primary health-care clinics, and it is, therefore, important for FPs to be aware of endovascular management of PVD, which has become the mainstay for treatment of diabetic vasculopathy. Proper communication and timely referral could prevent many major amputations.

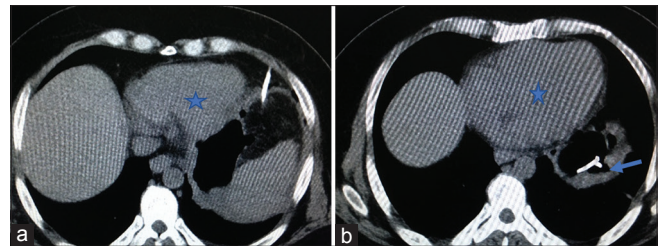


Figure 2: (a) Left subphrenic abscess collection following sleeve gastrectomy for morbid obesity very close to the heart (star). (b) Treated with computed tomography-guided percutaneous drainage insertion (arrow)

Manifestations of PVD vary from intermittent claudication to critical limb ischemia (rest pain, gangrene, or ulceration). The standard treatment for symptomatic PVD is the modification of vascular risk factors such as the cessation of smoking and exercise as well as best medical treatment with statins and antiplatelet agents, the treatment of diabetes, and blood pressure control.^[10] Patients with critical limb ischemia or who fail to respond to the best medical treatment have to be evaluated by a vascular or endovascular specialist for proper management.

Endovascular techniques have largely replaced traditional open surgical techniques and have become the first-line therapy for PVD [Figure 3]. Wolf *et al.*, in their multicentric, prospective, randomized trial that compared the outcomes of endovascular techniques with open surgical techniques in patients with iliac, femoral, or popliteal artery occlusions in 263 men, found no significant difference over a 4-year follow-up period.^[11] Another randomized trial of 452 patients with PVD randomized to either surgery or endovascular techniques (BASIL trial) showed an equivalent 2-year results.^[12] Endovascular techniques for revascularization of PVD that are being increasingly used all over the world, are associated with fewer morbidities than open surgery, and can be done in patients with comorbidities, usually under local anesthesia and in many cases as day procedures.

Dialysis Access Intervention

Patients with end-stage renal disease on chronic hemodialysis through native arteriovenous fistula or synthetic graft often need frequent procedures to maintain their access to continue hemodialysis, which is the gold standard replacement therapy. Currently, most of these patients are referred to IR for evaluation



Figure 3: Patient with severe intermittent claudication who failed best medical therapy. (a) Angiography shows stenosis of the right common iliac artery and total occlusion of the left side. (b) Treated with endovascular angioplasty and stenting percutaneously

and management of access problems. According to studies, <50% of hemodialysis access remain patent for more than 3 years.^[13] The most frequent complications of dialysis access are catheter blockage by fibrin sheath, catheter infection, access poor flow, and access thrombosis. All these complications can be handled and managed by minimally invasive techniques of intervention without the need for hospitalization or interruption of dialysis. Blockage of the catheter can be treated with the disruption of fibrin sheath with a snare or balloon; catheter infection is usually managed by catheter removal and antibiotics till blood culture is negative and then a re-insertion of a new catheter. Poor access flow, commonly due to venous stenosis, can be managed by balloon angioplasty and/or stent insertion in resistant or recoiling lesions [Figure 4]. Thrombosed access is commonly managed by thrombolysis, percutaneous thrombectomy, and balloon angioplasty of the underlying lesions. Bittl *et al.* reported that catheter-based interventions result in successful hemodialysis for at least 30 days without the need to repeat endovascular or open vascular interventions in 92% of patients.^[14]

Interventional Oncology

An increase in the number of aged populations has led to the increase in the burden of chronic diseases, especially cancer. Interventional oncology is a minimally invasive procedure performed by interventional radiologists for the treatment or palliation of cancer.^[15] A multiple techniques for minimally invasive treatment of cancer include thermal/cryo ablation of focal tumors of the liver, kidney, bone, and lung; chemo/radioembolization of liver primaries or metastasis; and bland embolization for vascular tumors and implant of ports for chemotherapy.

The most frequent application of interventional oncology is locoregional treatment of hepatic malignancy whether it is primary hepatocellular carcinoma (HCC) or liver

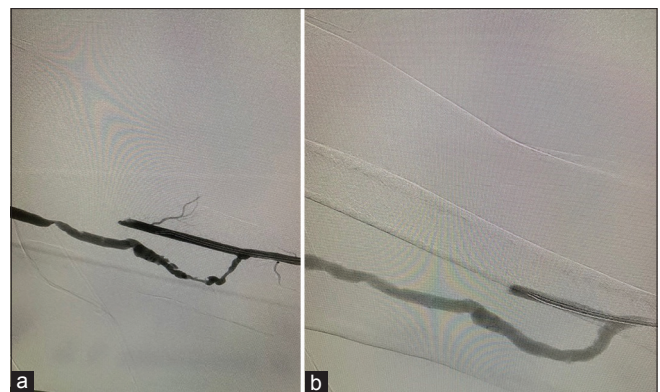


Figure 4: (a) Multiple stenoses at dialysis access arteriovenous fistula. (b) Treated with percutaneous balloon angioplasty

metastasis, which is the second most common cause of cancer-related death in men and sixth in women.^[16] Tumor ablation can be done by two basic mechanisms: thermal ablation using radiofrequency, microwave, or laser energy or hypothermic techniques using cryoablation devices. For small HCC of <3 cm, the 2-year survival is comparable between surgery and ablation, but the recurrence rate is less with surgery.^[17]

Advance hepatic malignancies which are not candidates for surgery or thermal ablation can be palliated with chemoembolization or radioembolization to improve and prolong survival. They include catheterization of feeding arteries and the infusion of chemotherapy or radioactive substances directly into the tumor cells to increase the concentration of the drug within the tumor tissues and minimize systemic side effects. A meta-analysis by Llovet and Bruix showed that chemoembolization improves the survival of patients with unresectable HCC more than the best medical care and tamoxifen.^[18] Bearing in mind the generally poor survival rates of hepatic malignancies and the limited surgical and medical options, locoregional treatment of liver malignancy plays an important role in prolonging survival, controlling the disease, and improving the quality of life of patients.^[19]

Interventions for Woman Health

Uterine fibroids, the most common benign tumor of the female genital tract, used to be treated with open surgical techniques such as myomectomy or hysterectomy. However, in the last two decades, uterine artery embolization (UAE) has emerged as an alternative to surgery. It involves catheterization and subsequent blocking of both uterine arteries with small particles made up of polyvinyl alcohol particles to induce ischemia of the fibroids and shrinkage in size to improve the symptoms, particularly menorrhagia, the most common indication for intervention. The outcomes after UAE include 50%–60% reduction in the size of the fibroid [Figure 5], 88%–92% improvement in bulk-related symptoms, more than 90% elimination of menorrhagia, and 80%–90% of patient satisfaction.^[20] Today, UAE is recognized as a safe and effective alternative to surgery by many organizing bodies all around the world.

Fallopian tube blockage is a well-known cause of infertility in women, and is usually caused by pelvic inflammatory disease. Infertile women who wish to conceive cannot have infertility treatment with blocked tubes. Therefore, the first step in treatment is the recanalization of Fallopian tubes, which can be done with minimally invasive techniques of IR. The procedures usually involve cannulation of the cervix with a speculum and an introduction of a small catheter under image guidance into the Fallopian tubes to clear

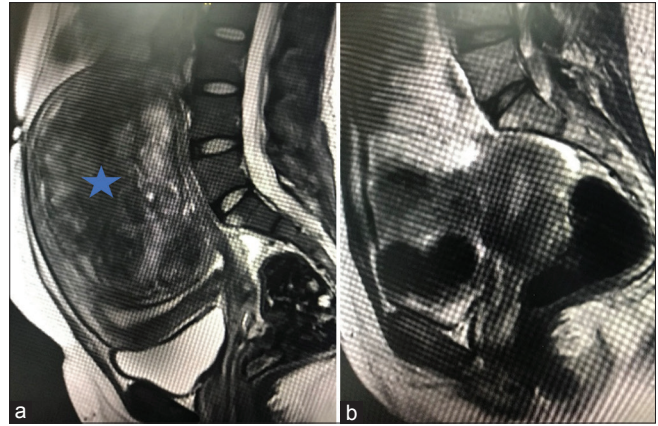


Figure 5: (a) T2-weighted images of the patient with a large uterine fibroid (star) reaching the umbilicus, causing menorrhagia and pressure symptoms. (b) Two-year postuterine artery embolization with significant reduction in the size of the fibroid

the blockage with guidewires and contrast injection. This can be done as part of hysterosalpingography as an outpatient procedure. The pregnancy rate after Fallopian tube recanalization ranges between 30% and 47% within a year.^[21]

Pelvic congestion syndrome (PCS), also known as ovarian varicosities, is a common problem in multiparous women, and is often underdiagnosed in many patients. The main presenting symptom is chronic pelvic pain. In the United States, the incidence of chronic pelvic pain in women aged 18–50 years is 15%.^[22] Soysal *et al.* reported a 31% incidence of PCS in symptomatic patients with chronic pelvic pain.^[23] Medical and open surgical therapy have a limited role in the treatment of PCS. Interventional techniques, which are considered the first-line therapy in modern practice, involve embolization of ovarian veins with metallic coils and sclerosant agents to obliterate the vein and stop the reflux, and thus improve the symptoms. Laborda *et al.* reported the largest series of patients with PCS treated with endovascular techniques (202 patients) and found clinical improvement in 94% of the patients using a visual analog scale pain questionnaire.^[24] This procedure can be done as day procedure under local anesthesia with minimal complications.

Venous Intervention

Currently, there is a strong trend toward the treatment of different venous diseases with minimally invasive techniques and ward phlebology whose advent in medical literature has increased in the last three decades mainly as a result of advances in technology and minimally invasive techniques. Chronic venous insufficiency, commonly known as varicose veins, is one of the most common problems worldwide. In the United States, it is estimated that half of the adult population has some form of venous disease and 25% of the general population clinically has varicose veins.^[25]

The classic symptoms of lower extremities varicose veins are heaviness, aching pain, muscle spasm, and leg swelling. In the advance stage of the disease, however, patients may get stasis venous ulcer, which occurs in 1%–2% of patients older than 65 years.^[26] Until recently, surgery with stripping and high ligation was the standard of care for symptomatic varicose veins. However, the high recurrence rate ranges from 26% to 62% in a period of 3–11 years.^[27,28] The use of general or epidural anesthesia and the presence of scars after surgery have made this option less favorable to patients and physicians. In addition, the rate of complications is quite high.^[29] For the treatment of varicose veins, several minimally invasive techniques such as endovenous thermal ablation with LASER or radiofrequency energy, US-guided foam sclerotherapy, and glue are available. These techniques are usually performed as office-based surgery in an outpatient setting under local anesthesia, which allow the patient to go home a few hours after the procedure. Carradice *et al.* randomized 280 patients either for surgery or for endovenous LASER ablation and concluded that patients who had LASER ablation had fewer postoperative complications and an early return to normal activity than patients who had stripping and high ligation.^[30]

Testicular varicocele is caused by dilation of veins of pampiniform plexus within the scrotum as a result of reflux within gonadal veins [Figure 6]. Its incidence in the general population ranges between 10% and 15%. In infertile men, however, the range reaches more than 40% in most series.^[31] The condition is traditionally treated by surgery, but an attractive alternative to surgery is by a minimally invasive radiological approach through the embolization of gonadal veins. This technique which is performed under local anesthesia through small needle puncture of arm, neck, or groin veins provides an equivalent efficacy to surgery with fewer complications and faster recovery.^[32] A recent study by Bou Nasr *et al.* compared the outcomes of surgery with embolization in 76 infertile men and found it as effective as surgery in improving fertility with better postoperative course and better patient satisfaction.^[33]

Conclusions

IR, an expanding field of minimally invasive techniques for the treatment of many conditions that used to be managed by traditional surgery, presents faster recovery and less morbidity. Many patients referred to the hospitals from family and community clinics end up in IR for procedures or consultation indirectly through other specialties. Awareness and knowledge of FPs of IR procedures would help them to advise their patients on the best treatment options and possibly speed up the



Figure 6: (a) Venography for a young patient with testicular varicocele due to reflux within the left gonadal vein (arrow). (b) Postembolization venography showed total stoppage of the reflux

referral process by direct communication and interaction with the IR service. Many IR procedures are perfectly suited to family medicine practice because time would be saved and cost could be reduced when performed as outpatient procedures under local anesthesia. Regular scientific meetings between FPs and IR professionals would create an easy referral pathway, bridging the gap between the two specialties to provide the best patient care. The main limitation of this review is the dearth of available research on the awareness of FP of IR and the absence of a good partnership between the two specialties.

Recommendations

We believe that the most effective way to enhance communication between FP and IR is through continuous educational meetings and seminars. In addition, FPs should have an easy direct access to IR service to which they can refer their patients through outpatient clinics or emergency room. Early exposure of students in medical school would give recognition to IR and its proper utilization for better patient care.

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Conflicts of interest

There are no conflicts of interest.

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