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Interventional Radiology



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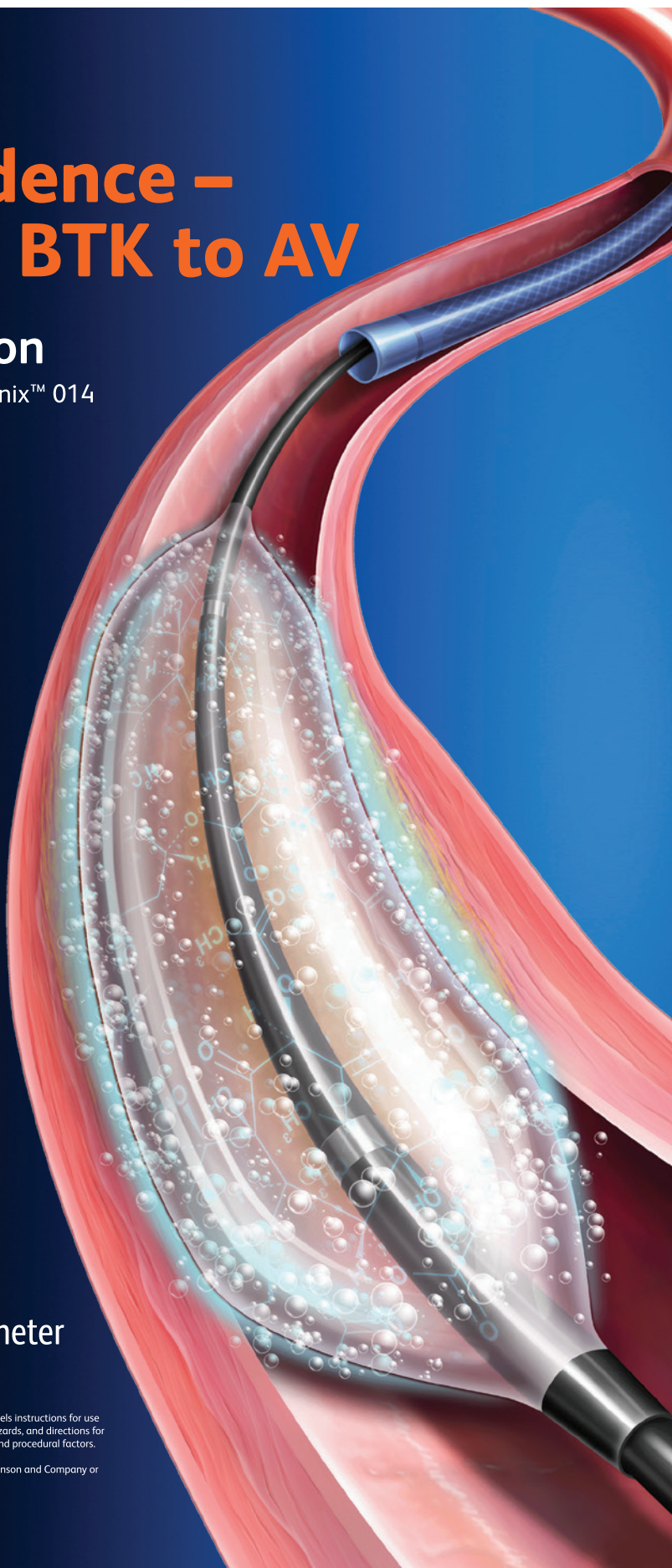
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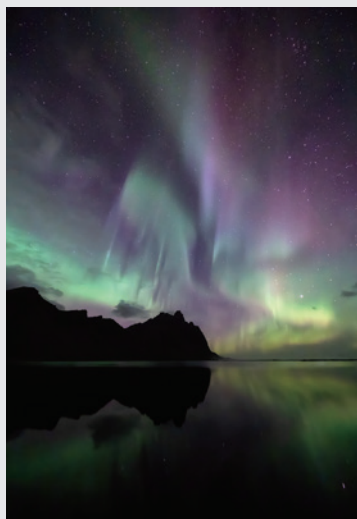
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The Cover Shot



Guiding Lights

This photo was taken in Iceland, showcasing the vibrant Northern Lights dancing above the majestic peaks of Vestrahorn. The unique geography of the area, featuring calm tidal pools on a black-sand beach, creates a flawless natural mirror that perfectly reflects the ethereal spectacle in the night sky.

It is a powerful visual metaphor for the field of interventional radiology. Much like how the aurora guides the eye in the night sky, interventional radiologists rely on the "flickering lights" of real-time imaging on a dark monitor background. These images are their guiding light, essential for navigating complex internal anatomy and performing minimally invasive procedures with precision.



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Issue Editors

Interventional Radiology (IR) has long been defined by a deceptively simple premise: that the least traumatic route to diagnosis and therapy is often the most effective. What began as a set of ingenious catheter and needle techniques has matured into a discipline that now sits at the centre of all specialties. The articles in this issue of the *Hong Kong Medical Diary* illustrate that maturation with unusual clarity. Together they show how image-guided, minimally invasive interventions are no longer adjunctive options but essential components of contemporary practice.

In February 2024, IR was formally established as a subspecialty under the Hong Kong College of Radiologists, following endorsement by the Hong Kong Academy of Medicine and acceptance by the Medical Council of Hong Kong as a recognised specialty. The structured subspecialty training programme commenced in October 2024. This milestone acknowledges a reality that has evolved over decades: contemporary interventional radiologists contribute far more to patient care than the performance of procedures alone.

The paediatric contribution is particularly instructive. Children are not merely scaled-down adults; their physiology, radiosensitivity, circulating blood volume and capacity to cooperate impose constraints that demand dedicated expertise. Procedures once adapted from adult practice - biopsy of solid tumours requiring extensive molecular profiling, embolisation of high-flow vascular malformations, sclerotherapy of lymphatic lesions, and endovascular management of renovascular hypertension - are now performed with paediatric-specific protocols for anaesthesia, temperature control, radiation protection and haemostasis. The result is not simply smaller wounds but measurably less physiological disruption at a stage of life when reserve is limited and long-term consequences matter most.

In the acute setting the same principle applies with greater urgency. Massive haemoptysis, superior vena cava obstruction, intermediate- and high-risk pulmonary embolism, uncontrolled variceal bleeding and pelvic arterial haemorrhage are conditions in which minutes and millimetres determine survival. Endovascular techniques - bronchial artery embolisation, mechanical thrombectomy, covered stenting, TIPS and selective pelvic embolisation - offer rapid haemostasis or restoration of flow while avoiding the morbidity of open surgery in critically ill patients. The key prerequisite is organisational: early imaging, anaesthetic readiness and a team that can move from diagnosis to therapy without delay. Where these elements are present, interventional radiology becomes an integral part of the emergency response rather than a late referral.

Nowhere is the expansion of the field more evident than in interventional oncology. Ablative technologies - thermal, cryogenic, irreversible electroporation and the emerging non-thermal modality of histotripsy - now sit alongside transarterial chemoembolisation, radioembolisation and palliative interventions such as cryoneurolysis and cementoplasty. The therapeutic spectrum ranges from curative intent in early



hepatocellular carcinoma and selected renal masses to bridging strategies before transplantation or resection and to durable symptom control in advanced disease. Equally important is the growing evidence that locoregional therapy can alter the tumour microenvironment in ways that potentiate immunotherapy. The combination of precise local destruction and systemic immune activation is reshaping treatment algorithms and placing the interventional oncologist firmly within the multidisciplinary tumour board.

Neurointervention occupies a distinctive niche. Mechanical thrombectomy for large-vessel occlusion stroke, endovascular coiling and flow diversion for aneurysms, parent-vessel reconstruction or sacrifice for dissecting lesions, embolisation of arteriovenous malformations and dural fistulae, middle meningeal artery embolisation for recurrent chronic subdural haematoma, and venous sinus stenting for idiopathic intracranial hypertension have transformed outcomes that were once regarded as the exclusive domain of open neurosurgery. The unifying theme is the ability to treat the intracranial circulation from within, preserving brain tissue while avoiding craniotomy. Success, however, depends on systems of care - rapid imaging, AI-assisted triage, seamless communication between emergency physicians, stroke neurologists and interventional teams - as much as on device technology.

Finally, the management of haemodialysis access illustrates the longitudinal, often unglamorous but indispensable role of interventional radiology in chronic disease. From image-guided placement and

salvage of tunnelled catheters to angioplasty (including drug-coated balloons), stent-graft placement and thrombectomy of failing fistulae and grafts, the specialty has become central to maintaining the vascular circuit on which life depends. Emerging techniques such as endovascular arteriovenous fistula creation and bioengineered grafts point toward a future in which access is created and preserved with still less tissue trauma.

Challenges remain. Workforce development must keep pace with expanding demand. Radiation protection, especially in children and young adults, requires perpetual vigilance. Evidence generation for newer devices and combination therapies must be rigorous. And the value of interventional radiology will continue to be measured not by the sophistication of its tools but by the tangible reduction in patient morbidity and the extension of meaningful survival.

The articles collected here do more than catalogue current practice. They document a specialty that has moved from the periphery to the centre of modern medicine, delivering therapy through the smallest of wounds while addressing some of the largest clinical problems. For the medical community of Hong Kong and beyond, the message is clear: interventional radiology is no longer a technical service to be called upon when other options fail. It is a recognised specialty and a core clinical discipline whose continued development will shape the care of patients across the lifespan.

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Interventional Neuroradiology - Ischaemic, Haemorrhagic and Beyond

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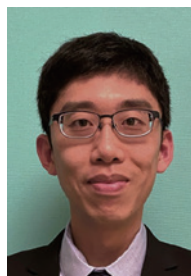
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INTRODUCTION

Interventional Neuroradiology, or for short, Neurointervention, is the use of image-guided minimally invasive endovascular techniques to diagnose and treat vascular diseases of the central nervous system. Most colleagues have heard of Neurointervention before, but what we do as Interventional Neuroradiologists may seem mysterious to them. It is true that we sometimes seem to speak a different medical dialect altogether, comprising obscure catheters, coils, stents and other instruments that may sound puzzling to outsiders.

However, Neurointervention is not a niche hidden behind the door of the radiology department: neurosurgical team may call us for a patient with ruptured arteriovenous malformation (AVM); Accident & Emergency (A&E) colleagues may call us for a patient presenting with acute stroke; ENT surgeons may ring us for a patient with carotid blowout.

Neurointerventionists, therefore, interact with many fields of medicine and treat patients with a wide range of diseases we see day to day in clinical practice. The purpose of this article is not only to describe what neurointerventionists can do, but also to answer a practical question for doctors outside our field: "When should you think of us?"

THE BASICS: TREATING THE BRAIN WITHOUT OPENING THE SKULL

Neurointerventionists operate from inside blood vessels. After gaining a small calibre vascular access, often via the common femoral artery or radial artery, we navigate catheters and wires into the vessels of the brain, neck and spine. We deliver coils, stents, embolic agents, balloons, or clot retrieval devices via catheters to treat a variety of neurovascular diseases under real-time image guidance. Thanks to its minimally invasive nature, patient recovery time is generally much shorter than open surgery.

Although Neurointervention is minimally invasive, it is a delicate art and certainly never risk-free. The vessels

supplying the brain and spinal cord are unforgiving and the margin of error is small. A millimetre matters. A minute matters. The patency of a tiny intracranial vessel can make the difference between a patient walking away with completely normal function and major disability or even death.

What do Neurointerventionists do? When Shall I Refer?

Scenario 1: Acute Stroke - Time is Brain!

Q: You are an orthopaedic medical officer on call. At midnight, you receive a call from a ward nurse. A 70-year-old lady, who just had hip replacement surgery today, suddenly develops slurring of speech and gaze deviation. On examination, you find that she has dense left hemiplegia. What would you do?

In acute stroke, time is brain. In 2015, five landmark trials established mechanical thrombectomy as superior to intravenous thrombolysis alone in patient with large vessel occlusions (intracranial internal carotid artery and M1 segment of the middle cerebral artery)¹⁻⁵. The HERMES meta-analysis showed that endovascular thrombectomy significantly reduced disability at 90 days, with a number needed to treat as low as 2.6 to reduce disability by at least one modified Rankin Scale level when compared to medical treatment alone⁶.

Since then, further research has expanded the group of patients who may benefit from mechanical thrombectomy. Today, selected patients with basilar artery occlusion (VERITAS meta-analysis)⁷, M2 occlusion (HERMES M2 meta-analysis)⁸, large infarct core (ATLAS meta-analysis)⁹ and those presenting in an extended time window beyond six hours (AURORA meta-analysis)¹⁰ may be candidates for this treatment.

Two main thrombectomy approaches are commonly adopted. Aspiration thrombectomy uses a large-bore reperfusion catheter to remove the clot by suction, while stent-retriever thrombectomy deploys a temporary retrievable stent across the clot, allowing it to integrate with the thrombus before pulling it out. The two techniques are often combined to achieve even higher recanalisation rates (Fig. 1).



Fig. 1: (View captions and photos in normal size, please scan the QR code)

Rapid and safe mechanical thrombectomy for large-vessel occlusion requires seamless multidisciplinary coordination across emergency care, neurology, interventional neuroradiology, neurosurgery, radiology, and nursing. To streamline this workflow, several HA hospitals adopted a "smart stroke" mobile platform. By providing real-time updates and shared communication across the entire care team, this system optimises transport logistics and minimises treatment delays.

A: The key message is simple: recognise the symptoms and signs of acute stroke early and refer promptly to the stroke team. Sudden onset of unilateral weakness, aphasia, neglect, gaze deviation, severe brainstem symptoms should raise suspicion of large vessel occlusion stroke. Activate the local stroke pathway early, obtain urgent vascular imaging, whereby the patient will be directed to the Neurointervention team for urgent thrombectomy once large vessel occlusion is confirmed. Your role is very important!

Scenario 2: Intracranial Aneurysms - Ticking Time Bomb in the Brain

Q: You are a physician conducting a morning round in a hospital. You stop by the bed of a 62-year-old man who suddenly complains of a severe headache, describing it as "the worst headache of my life". On examination, Glasgow Coma Scale (GCS) is E4V5M6. However, you notice his left eye is deviated outward and downward, accompanied by pupil dilatation and neck stiffness. What is your next move?

Unruptured intracranial aneurysms are found in about 3 % of the general adult population¹¹. While many remain clinically occult, aneurysm rupture carries 35 % - 44 % 30-day mortality rate, and re-rupture carries mortality up to 80 %^{12,13}.

The landmark International Subarachnoid Aneurysm Trial (ISAT) established endovascular therapy over open clipping as the preferred approach due to superior 1-year functional survival¹⁴. Today, endovascular treatment has become the first-line approach for both ruptured and unruptured aneurysms in many modern neurovascular centres because of its minimal invasiveness and high efficacy. Choosing the correct endovascular strategy is like tailoring a bespoke suit. It depends on the aneurysm location, size, morphology and the vascular anatomy of individual patients.

For a narrow-neck aneurysm, we can simply navigate a microcatheter into the aneurysmal sac and pack it with platinum coils (Fig. 2). This will induce thrombosis and resolution of the aneurysm.

For aneurysms with wide necks or more complex geometries, we may need to use balloons or stents to prevent coil protrusion into the parent artery for achieving adequate embolisation while avoiding complications.



Fig. 2: (View captions and photos in normal size, please scan the QR code)

In the recent decade, one of the most effective endovascular therapies for intracranial aneurysm has been flow diversion. This is achieved by placing a device called "flow diverter", a stent with densely braided wire mesh, across the aneurysm neck. This device works by diverting blood flow away, leading to aneurysm thrombosis and healing over time while keeping the parent vessel and side branches open (Fig. 3). Flow diverter embolisation is ideal for the treatment of previously difficult entities such as giant aneurysms, blister aneurysms or bifurcation aneurysms.

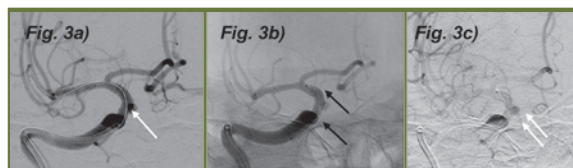


Fig. 3: (View captions and photos in normal size, please scan the QR code)

The latest addition to our toolkit for treating aneurysms is intrasaccular devices (Fig. 4 and 5). These are densely braided mesh baskets that can be placed entirely within the aneurysmal sac, serving to disrupt blood flow within the aneurysm without the need of stent placement in the parent arteries, significantly reducing the procedure time while maintaining a favourable safety profile.

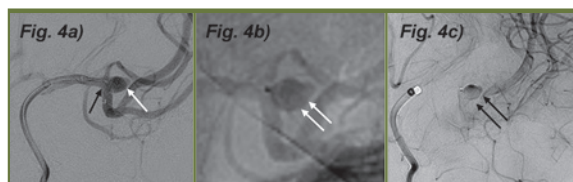


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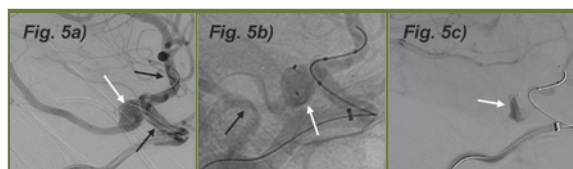


Fig. 5: (View captions and photos in normal size, please scan the QR code)

Unruptured aneurysms are a different kind of challenge. Treatment decisions must weigh rupture risk against procedural risk. Using validated risk models (e.g. PHASES score)¹⁵, we evaluate factors such as size, location, morphology, interval growth, age, smoking, and hypertension to determine whether early intervention or surveillance is indicated. A

tiny stable cavernous carotid aneurysm in an elderly patient is a very different problem from an enlarging lobulated anterior communicating artery aneurysm in a young smoker.

A: Think of subarachnoid haemorrhage and request urgent CT brain immediately when there is high clinical suspicion. Initiate an urgent neurosurgical consult, and a neurointerventional referral should follow. When you find an intracranial aneurysm, whether on an emergency CT for a thunderclap headache or as an incidental note on an outpatient MRI, get us involved early. We are here to help defuse the bomb. Intracranial aneurysm should never be left alone with the radiology report.

Scenario 3: Intracranial Dissections and Dissecting Aneurysms: When the Artery Wall Misbehaves

Q: You are an emergency physician on a busy Saturday night. A 54-year-old woman is brought to A&E by ambulance for collapse. Her husband reports that the patient has been experiencing neck pain and dizziness in the last two weeks after an intense yoga lesson. Patient thinks it might be due to a pulled muscle from a headstand. On examination, her GCS is E1V1M1. Urgent CT brain shows posterior fossa SAH.

This is a case of ruptured vertebral artery dissecting aneurysm. Arterial dissection occurs when a tear develops in the intima of the vessel wall, where high-pressure arterial blood enters and dissects its way into the media, splitting the vessel wall layers apart. This creates a "false lumen" and can result in parent vessel narrowing, occlusion or rupture, depending on the exact configuration of dissection.

Arterial dissection is an important cause of stroke, especially in young and middle-aged patients. History can be subtle and may involve seemingly unrelated triggers often ignored by the patient, such as massage, heavy lifting, yoga, or chiropractor manipulation. Neurological symptoms range from dizziness or headache to Horner syndrome or full-blown stroke-like symptoms.

For most uncomplicated head and neck artery dissections, the first-line management is medical treatment. Most dissections heal on their own over 3 - 6 months with anti-platelet therapy. However, neurointerventional treatment is indicated in the following scenarios¹⁶:

1. Thromboembolism causing recurrent transient ischaemic attacks;
2. Flow-limiting stenosis or near-occlusion;
3. Dissecting aneurysm - ruptured dissection with the formation of a fragile pseudoaneurysm. Urgent intervention is indicated especially for posterior fossa dissecting aneurysms, as intracranial pressure build-up in the posterior cranial fossa can rapidly lead to brainstem compression and death.

Endovascular therapy in arterial dissection can be divided into two main types:

1. Vessel reconstruction: in ruptured cases, the damaged artery is reconstructed with flow diverter stenting, preserving the normal flow in the parent vessel while

sealing off the intimal tear and excluding the associated pseudoaneurysm. In non-ruptured cases, stenting and in selected cases, gentle angioplasty may be employed to restore parent artery flow.

2. Vessel sacrifice (Fig. 6): In ruptured cases where the artery is too damaged to be salvaged or if the vascular anatomy renders stent placement very risky, parent artery sacrifice by coil trapping or even judicious injection of liquid embolic agent may be employed to secure haemostasis.

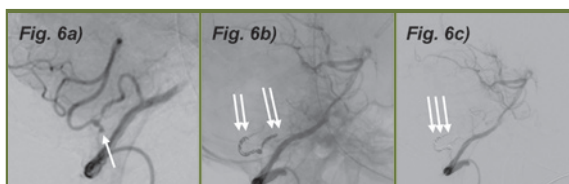


Fig. 6: (View captions and photos in normal size, please scan the QR code)

A: Urgent CT/MR angiogram and Neurointervention team referral is warranted. High index of suspicion is needed for young patients presenting with acute, atypical neck pain or headache, especially following minor trauma or physical exertion. While medical treatment is usually adequate for most cases of dissection, do remember the above discussed high-risk scenarios and know who to find when the suspicion is high.

Scenario 4: Carotid Blowout - a Doctor's Nightmare

Q: You are a surgical house officer in a day surgical ward. You are called to assess a 65-year-old man complaining of heavy epistaxis after colonoscopy. He has a history of nasopharyngeal cancer (NPC) and had radiotherapy completed in 2010. On assessment, BP 98/62 mmHg, pulse 102 / min, SpO2 91 % on room air. What should you do?

Carotid blowout syndrome is one of the most frightening clinical conditions. It refers to rupture or impending rupture of the internal carotid artery (ICA). The presentation may be dramatic, with massive haemorrhage from the mouth, nose, or tracheostomy site. It is almost exclusively seen in patients treated for head and neck malignancies, especially NPC in our locality¹⁷. This acute, torrential haemorrhage is the result of arterial wall weakening and rupture, usually after radiotherapy, infection, tumour recurrence or tissue necrosis.

Endovascular treatment has become the standard of care because open surgery with vessel ligation is often extremely difficult in a heavily irradiated, scarred and fibrotic neck.

Emergency management of carotid blowout syndrome relies on rapid collateral evaluation to select between reconstructive and deconstructive endovascular strategies:

1. **Reconstructive treatment** (Fig. 7): Placing a covered stent across the arterial defect allows preserving internal carotid artery (ICA) patency and lowers the risk of ischaemic stroke when compared to vessel trapping. However, placement of a covered stent requires an aggressive anti-platelet regimen to prevent in-stent thrombosis, with associated risk of bleeding. Covered stent placement also carries risks of infection and rebleeding.



2. Deconstructive treatment (Fig. 8): Parent vessel sacrifice via coil trapping provides rapid, durable haemostasis with very low rebleed rates. It is indicated for massive exsanguination, severely disrupted vessels unsuitable for stenting, or when adequate collateral circulation is demonstrated (via balloon occlusion test). Ischaemic stroke remains the primary risk.

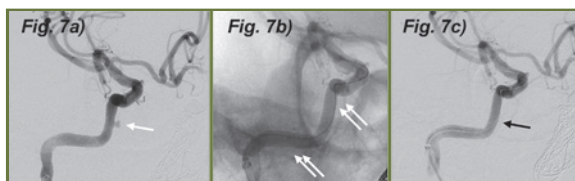


Fig. 7: (View captions and photos in normal size, please scan the QR code)

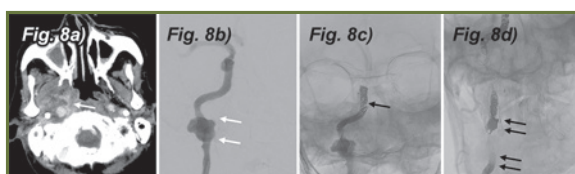


Fig. 8: (View captions and photos in normal size, please scan the QR code)

A: Urgent ENT consult for posterior nasal packing and arrange urgent CT head and neck angiogram. Get the Neurointervention team involved early for life-saving treatment if carotid blowout is confirmed. Meanwhile, do not forget to stabilise the patient. It is essential to ensure the airway is patent. Secure large-bore IV access and crossmatch immediately.

Scenario 5: Arteriovenous Malformation - A Bomb with a Thousand Wires!

Q: You are a neurologist in an outpatient clinic. A 28-year-old woman is brought in by her husband. She had a first-time seizure this morning while eating breakfast. She mentions she has had a vague, throbbing headache on the left side of her head for the past few months, which she dismissed as "migraines". On examination, there is no neurological deficit. MRI shows an abnormal tangle of blood vessels at left temporal region.

Cerebral arteriovenous malformation (AVM) manifests as an abnormal tangle of vessels (nidus) where arteries connect directly to veins without the normal intervening capillary network. Whilst some AVMs remain asymptomatic, the annual risk of haemorrhage from AVM is reported at 2.3 %, with an even higher annual risk of re-rupture reaching 4.8 %¹⁸. AVM can cause vascular steal, focal ischaemia, and intracranial venous hypertension, clinically manifesting as seizures and other neurological deficits¹⁹.

AVM management is complex and involves multidisciplinary care with a combination of modalities including open surgery, stereotactic radiosurgery (Gamma Knife), and endovascular embolisation – which is often the mainstay of AVM treatment nowadays²⁰.

Neurointerventionists utilise microcatheters to inject cohesive

liquid embolic agents such as ethyl vinyl alcohol copolymers (Onyx) or precipitable hydrophobic injectable liquid (PHIL) into the feeding arteries of the nidus. These liquid embolic agents can infiltrate deep into the micro-fistulae which constitute the AVM. Multiple feeders are often tackled in the same procedure. This permanently occludes the shunts and leads to devascularisation of the AVM (Fig. 9).

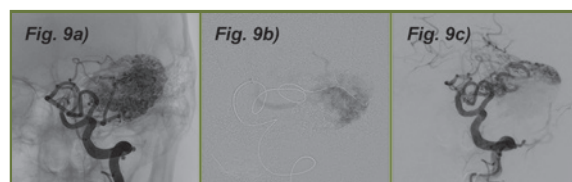


Fig. 9: (View captions and photos in normal size, please scan the QR code)

A: Brain AVMs are complex vascular lesions that require highly specialised evaluation. Early specialist referral is key for timely assessment and treatment. Neurointerventionists are here to help the patient decide when to treat these lesions with which modality, and when observation is better than bearing the risk of upfront treatment.

Scenario 6: Dural Arteriovenous Fistula - the Most Obscure Vascular Disease of the Brain

Q: You are a general practitioner in an outpatient clinic. A 54-year-old woman comes in for persistent tinnitus over two months. On further questioning, the tinnitus is pulsatile in nature. She is unresponsive to conservative treatment (ear drops and caffeine reduction). MRI/MRA brain revealed a dilated and tortuous blood vessel at the right temporal region, suspicious of dural arteriovenous fistula.

Unlike brain AVMs, dural arteriovenous fistula (dAVF) are acquired vascular lesions pertaining to the dura mater, where abnormal connections have formed between arteries supplying the meninges into dural venous sinuses or cortical veins²¹. dAVF accounts for up to 10 - 15 % of intracranial vascular malformations²². These arteriovenous fistulae are believed to result from chronic venous sinus stenosis related to previous trauma, operation, or infection²³⁻²⁴.

Dural AVF may be clinically occult for months or years before they are diagnosed. Patients can become symptomatic with debilitating neurological deficits due to haemorrhage or venous hypertension. Symptomatology depends largely on the anatomical location and angioarchitecture of the dAVF. Pulsatile tinnitus is typical for transverse-sigmoid dAVF; while chemosis and proptosis are classical for indirect carotid cavernous fistula (CCF). Patients with venous outflow stenosis, venous hypertension or cortical venous reflux are at higher risk of deterioration and bleeding²⁵.

Endovascular embolisation is the mainstay of treatment, and can be curative in many of the cases. Depending on the anatomy, we can approach the fistula from two directions.

1. Transarterial Embolisation: injection of liquid embolic agents (Onyx/PHIL) via feeding arteries close to the fistula to occlude the shunt.

2. Transvenous Embolisation (Fig. 10): retrograde cannulation and embolisation of the draining venous sinus or cortical vein with a combination of coil trapping and injection of liquid embolic agents.
3. Venous angioplasty or stenting: in selected cases, where embolisation is not feasible, careful re-opening of occluded dural venous sinuses has shown promise in reducing the venous hypertension and associated neurological deficits caused by dAVF.



Fig. 10: (View captions and photos in normal size, please scan the QR code)

Successful occlusion of the dAVF often abolishes turbulent flow, providing immediate symptom relief. Stopping the "whooshing" sound that had plagued the patient for months is profoundly life-changing.

A: If you have a patient with pulsatile tinnitus, progressive red eye with proptosis, or atypical venous congestion on brain imaging, think of dAVF. Write us a referral and get us involved: we can really help these patients a lot by restoring their quality of life.

Scenario 7: Spinal Vascular Malformations - Rare, Insidious and Potentially Devastating

Q: You are an internal physician evaluating a 58-year-old man. He complains of progressive lower limb weakness over the past two months. He was previously diagnosed with "severe lumbar stenosis" elsewhere and underwent lumbar laminectomy at an outside hospital four months ago, but his symptoms have only gotten worse.

Spinal vascular malformations comprise 5 - 9% of vascular lesions of the central nervous system²⁶. They are uncommon but critical to recognise, including spinal dural arteriovenous fistulas, perimedullary AVFs, and intramedullary spinal cord AVMs. Among these, spinal dAVFs are by far the most common and typically affect middle-aged or elderly men, often in the thoracolumbar spine²⁷.

The classic presentation is progressive myelopathy. Patients develop lower limb weakness, numbness, gait disturbance, sphincter or sexual dysfunction. Symptoms may fluctuate or worsen gradually over months. This presentation is easily mistaken for degenerative spine disease, peripheral neuropathy or inflammatory myelitis. Classic MRI triad includes long-segment cord T2 hyperintensity, cord swelling and dilated perimedullary vessels. It is easy to miss when you have not encountered this before.

Spinal angiography is the gold standard for diagnosis and treatment planning. Left untreated, chronic venous congestion of the spinal cord will lead to irreversible paraplegia. Endovascular embolisation is effective when the arterial anatomy is favourable and the fistulous point can be safely reached (Fig. 11). Embolisation however carries a dreaded risk: if the arterial feeder is connected to

the anterior spinal artery, posterior spinal artery or artery of Adamkiewicz, embolisation may lead to spinal cord infarction²⁸. If the risk is already apparent on the diagnostic spinal angiogram, a more prudent treatment option may be microsurgical disconnection.



Fig. 11: (View captions and photos in normal size, please scan the QR code)

A: If you have a patient with unexplained insidious, progressive lower limb weakness, arrange spinal MRI to look for signs of spinal vascular malformation. Avoid the temptation to attribute it to "wear-and-tear" spinal stenosis. Refer them to us immediately for a diagnostic workup. Let's catch it and fix it before the damage becomes permanent.

Scenario 8: Carotid Artery Stenosis - I just had a Stroke, what shall I Do?

Q: You are a physician in an outpatient clinic. A 69-year-old man with a history of hypertension, hyperlipidaemia and diabetes presents with transient loss of vision in his right eye and left arm weakness while watching a Premier League football match. The episode lasted for about five minutes before his vision and power completely returned to normal. Carotid USG and doppler study revealed focal severe (> 70 %) stenosis at the proximal right cervical internal carotid artery. What is the next step of management?

This is a classical presentation of amaurosis fugax accompanied by a contralateral motor transient ischaemic attack (TIA). One of the most common underlying causes is underlying carotid artery stenosis. Carotid artery stenosis remains an important and preventable cause of stroke. The management options include best medical therapy, carotid endarterectomy and carotid artery stenting. The best choice depends on symptoms, degree of stenosis, age, anatomy, co-morbidities, surgical risk, plaque morphology and local expertise.

Carotid artery stenting is a well-established and non-inferior alternative to carotid endarterectomy in managing this disease entity. It may be particularly useful in patients with high surgical/general anaesthesia risk, prior neck irradiation, high cervical stenosis, and significant cardiopulmonary co-morbidities.

During carotid stenting, an umbrella-shaped instrument called an embolic protection device is usually first placed distal to the site of stenosis to capture debris released during angioplasty and stent deployment. A self-expanding stent is then deployed to cover and open up the stenosis (Fig. 12), often followed by balloon angioplasty for better stent-vessel apposition²⁹.

The major risk of carotid stenting is periprocedural embolic stroke, especially in elderly patients and those with challenging aortic arch anatomy. Referral is most common for patients with symptomatic moderate-to-severe carotid stenosis³⁰, despite best medical therapy. Other scenarios



for carotid stenting include radiation-induced multifocal stenosis, or asymptomatic stenosis in a patient with contralateral ICA occlusion.

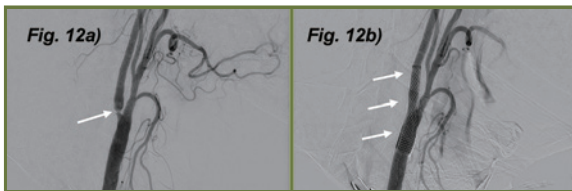


Fig. 12: (View captions and photos in normal size, please scan the QR code)

A: Carotid artery stenosis is a major, preventable cause of ischaemic stroke, responsible for up to 15 % of all strokes. An early referral to Neurointervention team for assessment of carotid artery stenting is warranted.

Scenario 9: Middle Meningeal Artery Embolisation - a New Trick to Tackle Recurrent Chronic Subdural Haematomas

Q: An 82-year-old man on apixaban for atrial fibrillation was brought to your geriatrician clinic by his relative because of progressive gait instability and confusion. Four weeks ago, he underwent right burr hole drainage for a symptomatic chronic subdural haematoma (cSDH). A repeat CT brain reveals recurrence of right cSDH. The patient's family is terrified of him undergoing another open brain surgery, and you are highly reluctant to stop his anticoagulation again for fear of stroke. What is your next move?

cSDH commonly occurs in elderly patients who are on anti-coagulation or anti-platelet medication after minor trauma. Conventional treatment has long been surgical drainage. However, recurrence is common. Recurrence is driven by an inflammatory membrane with leaky capillaries supplied by the middle meningeal artery (MMA), causing continuous micro-bleeding and haematoma expansion³¹.

MMA embolisation breaks this cycle by injecting particles or liquid embolic agents to starve the membrane of its arterial supply (Fig. 13), allowing the haematoma to gradually reabsorb. Supported by recent randomised trials (EMBOLISE, MAGIC-MT, STEM)³²⁻³⁴, MMA embolisation serves as a standalone treatment for high-risk surgical candidates or as an adjunct to surgery to prevent recurrence. It redefines how we think about and manage a common disease. Instead of draining the leak, we are treating the underlying cause.

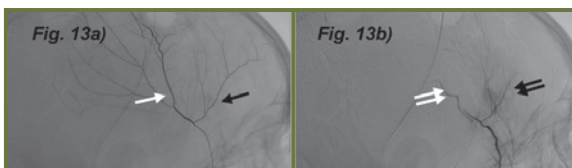


Fig. 13: (View captions and photos in normal size, please scan the QR code)

A: When you are managing elderly patients with cSDH - especially those who are frail, on anticoagulants, or experiencing recurrence, remember that the answer may not be another burr hole. Give us a call, and let's discuss how we can kill the haematoma from inside out.

Scenario 10: Venous Stenting for Idiopathic Intracranial Hypertension - Stopping A Chronic Headache

Q: You are a family physician seeing a 29-year-old obese lady in your clinic with chronic headache for six months. She describes it as a constant throbbing, worse in the mornings and when she bends over. On fundoscopy, you notice bilateral papilloedema. CT brain shows partial empty sella. What would you do next?

Idiopathic intracranial hypertension (IIH) is a debilitating condition characterised by increased intracranial pressure (ICP) without an obvious underlying cause. While the exact aetiology is unknown, IIH is often associated with transverse sinus stenosis, which creates a physical bottleneck that impairs venous drainage and cerebrospinal fluid absorption³⁵.

When medical therapy fails, venous sinus stenting offers a minimally invasive alternative to a traditional ventriculoperitoneal (VP) shunt, which carries risks of shunt clogging, breakage or over-drainage.

Before performing the stenting, we must first measure the pressure gradient across the stenosis. If a significant transverse-sigmoid sinus pressure gradient (typically 8 mmHg or more) is detected, the patient's raised ICP is likely due to venous sinus stenosis³⁶. Using the same venous access, we can deploy a flexible, self-expanding venous stent across the stenotic segment, gently opening up the stenotic venous sinus and instantly improving the pressure gradient and CSF drainage.

A: If you are treating a patient with chronic headache related to IIH and is medically refractory, do not wait for permanent loss of vision to set in. Order an early MR Venogram to look for venous sinus outflow obstruction. If you find one, remember to give us a call! We can help these patients with a relatively simple procedure.

Scenario 11: Head and Neck Tumour Embolisation - Stopping the Intra-operative Haemorrhage before it Starts

Q: You are a head and neck surgeon going to operate on your next patient, who is a 42-year-old woman with a large left jugular paraganglioma. You know from experience that dissecting this hypervascular tumour can lead to torrential bleeding. What is your next move to ensure a safe, successful surgery?

Hypervascular head and neck tumours such as paraganglioma, juvenile nasopharyngeal angiofibroma (JNA), sinonasal tumours and hypervascular metastases risk catastrophic intraoperative haemorrhage during resection. Attempting to resect these tumours without pre-operative embolisation is like trying to repair a high-pressure pipe while the water is still running.

Preoperative endovascular embolisation functions as a highly targeted internal tourniquet. We navigate microcatheters ultraselectively into the feeding branches of the tumour, bypassing those supplying the normal tissues of the head and neck. Particles and liquid embolic agents can be used (Fig. 14). This is usually done 24 to 48 hours before the planned resection³⁷. This timing is crucial, ensuring maximal necrosis and devascularisation of the tumour while minimising

inflammatory response and collateral vessel recruitment that can occur if the delay is too long.

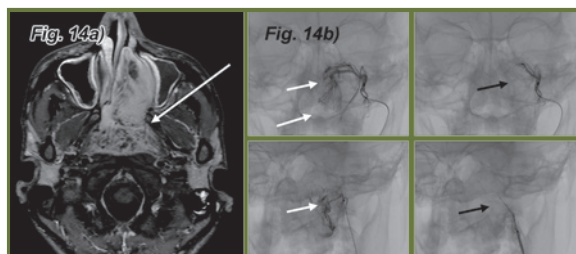


Fig. 14: (View captions and photos in normal size, please scan the QR code)

A: If you are planning a resection of a suspected paraganglioma, JNA, skull base meningioma, or any hypervascular head and neck mass, get us involved early in the planning stage. Pre-operative tumour embolisation can dramatically reduce intraoperative blood loss and provide a cleaner surgical field, promoting success of a more precise, safe and complete tumour resection.

Scenario 12: The Next Frontier: eShunt, Artificial Intelligence (AI), Robotic Neurointervention eShunt

A minimally invasive alternative to traditional open brain surgery (VP shunt) for normal pressure hydrocephalus. Using a transvenous endovascular route via the inferior petrosal sinus, a micro-engineered shunt creates a direct CSF-to-venous drainage pathway into the cerebellomedullary cistern under local anaesthesia³⁸.

Artificial Intelligence

1. **Acute Stroke Triage:** Platforms like RapidAI automatically analyse non-contrast CT brain, CT cerebral angiogram, and perfusion scans to detect LVO, quantify ischaemic core vs. penumbra, and immediately notify interventionists via encrypted apps, significantly reducing door-to-puncture times³⁹.
2. **Intraoperative Co-Pilot:** Systems like Neuro-Vascular Assist (iMed Technologies, Tokyo, Japan) analyse live angiographic images to track catheter/guidewire tips, coil markers, and liquid embolic agents. Real-time audio/visual alerts warn of coil protrusion or catheter displacement, reducing cognitive burden and enhancing safety⁴⁰⁻⁴². Future applications include real-time flow dynamic simulation in complex AVM and automated pathfinding.

Robotic Interventional Radiology: Precision at a Distance

Remote robotic platforms allow operators at a radiation-shielded console to control microcatheters, coils, and stents via precision joysticks⁴³⁻⁴⁴. This eliminates heavy lead wear, reduces occupational radiation exposure, and enhances procedural precision.

We are now transitioning from a manual specialty focused on managing diseases to a digital, automated, and micro-engineered science. As technologies like the eShunt, AI diagnostic platforms, and robotic endovascular systems continue to mature, they will make Neurointervention safer,

faster, more precise, and accessible to patients who previously had no options.

CONCLUSION: WHAT WE WISH EVERY DOCTOR REMEMBERED

Neurointervention is one of the most rapidly evolving frontiers in modern medicine. It sits at the intersection of anatomy, imaging, cutting-edge biomedical engineering, and high-stakes emergency care.

To our colleagues across all of medicine - whether you practice in a busy emergency department, a crowded family clinic, a rehabilitation ward, or a surgical theatre - our invitation is simple: think of us when patients exhibit classical presentations of neurovascular conditions. Sudden weakness or aphasia, thunderclap headache, a relentless pulsatile tinnitus, a progressive red eye with proptosis, a recurrent chronic subdural haematoma, a hypervascular head and neck tumour, or progressive, unexplained myelopathy, these are not just isolated clinical puzzles to be managed expectantly. They are opportunities for a minimally-invasive endovascular condition for the patient's problems. Next time when you encounter a puzzling neurovascular condition, do not hesitate to drop us a consult and let's help the patient together.



Please scan this QR code to view the full-size figures.

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Radiology Quiz



Radiology Quiz

Dr Stanley HAU

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Dr Stanley HAU



Question

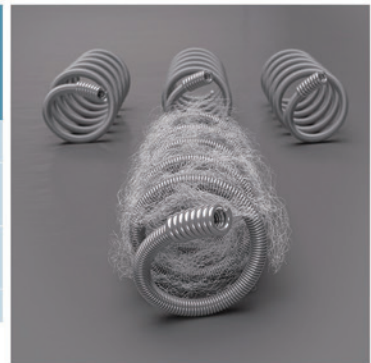
What are the abnormalities on this radiograph?

(See P. 30 for answers)

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Small Wounds for Small Patients: the Expanding Role of Paediatric Interventional Radiology

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This article has been selected by the Editorial Board of the Hong Kong Medical Diary for participants in the CME programme of the Medical Council of Hong Kong (MCHK) to complete the following self-assessment questions in order to be awarded 1 CME credit under the programme upon returning the completed answer sheet to the Federation Secretariat on or before 31 October 2026.

INTRODUCTION

Paediatric interventional radiology (IR) encompasses a broad range of image-guided, minimally invasive procedures performed for diagnostic and therapeutic purposes in children. These procedures are guided by imaging modalities such as ultrasound, fluoroscopy, computed tomography (CT) and magnetic resonance imaging (MRI). Compared with conventional open surgery, image-guided interventions are typically performed through percutaneous needle access or small skin incisions, thereby reducing procedural trauma, post-operative pain, blood loss and recovery time¹.

At the Hong Kong Children's Hospital, as in many centres worldwide, paediatric IR has undergone steady growth in both case volume and procedural complexity. This development reflects the efforts of a dedicated paediatric IR team, increasing multidisciplinary recognition of the role of minimally invasive therapy, and clear patient benefit. Similar trends have been observed internationally. In the United States, a workforce survey reported that the proportion of practices with a dedicated paediatric IR clinic increased from 34 % in 2005 to 73 % in 2015². In mainland China, many specialised children's hospitals have dedicated paediatric interventional radiology departments.

Although many techniques commonly performed in adults can be adapted to paediatric practice, the old adage that "children are not small adults" remains highly relevant. Paediatric patients differ substantially from adults in anatomy, physiology, disease spectrum, ability to cooperate and tolerance of procedural stress¹. The growth of paediatric IR therefore depends not only on technical expertise, but also on dedicated physicians, radiographers, nurses and anaesthesia support staff who understand the unique needs of children and work closely in a multidisciplinary setting.

PERIPROCEDURAL OPTIMISATION

Anaesthesia and Sedation

Image-guided interventions are among the most common indications for paediatric anaesthesia outside the operating theatre, and the IR suite is a remote procedural environment where both procedural and anaesthetic risks must be anticipated¹. Importantly, anaesthetic risk may not correlate with technical complexity. For example, in a young child with an anterior mediastinal mass requiring biopsy, induction of general anaesthesia may precipitate airway obstruction or cardiovascular compromise due to compression of the airway, heart or great vessels³. Close collaboration between the anaesthesia and paediatric IR teams is therefore essential.

A pre-procedural team huddle with radiographers, nurses and anaesthesia team is recommended, particularly for complex or high-risk cases. This should include the indication, patient positioning, airway and vascular access considerations, anticipated duration, imaging requirements, blood product availability, contingency plans and post-procedural care such as admission to paediatric intensive care unit (PICU) (Fig. 1). Such multidisciplinary planning improves situational awareness and helps the team prepare for unexpected deterioration.

Temperature Control

Children, particularly neonates and preterm infants, are vulnerable to peri-procedural hypothermia because of their high surface area-to-body mass ratio, immature thermoregulation and limited physiological reserve⁴. The IR environment may further increase this risk, as procedures are often performed in cool rooms with parts of the body exposed for sterile preparation and image guidance.

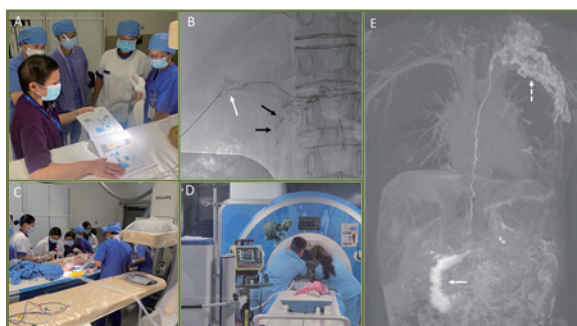


Fig. 1: (View captions and photos in normal size, please scan the QR code)

Mitigative measures include increasing the ambient room temperature, minimising unnecessary exposure, using forced-air warming devices, warming mattresses or overhead warmers, and administering warmed saline, irrigation fluid or blood products where appropriate. Temperature monitoring should be considered for infants, prolonged procedures and patients with limited physiological reserve^{1,4}.

Blood Volume and Medication Dosing

The small circulating blood volume of infants and young children means that even modest absolute blood loss may be clinically significant. Before procedures with a risk of haemorrhage, such as solid organ biopsy or angiography, the estimated blood volume and maximum allowable blood loss should be considered¹.

Iatrogenic blood loss during catheter-based procedures should also be minimised. Repeated aspiration and flushing, although routine in adults, may become clinically relevant in small children. Smaller syringes, low-volume flushes and attention to catheter dead-space volume can help reduce unnecessary blood loss and fluid administration⁴.

Medication dosing must be calculated according to body weight. This applies to sedative and analgesic agents, local anaesthetics, heparin, contrast medium, antibiotics and other drugs commonly used during IR procedures. Preparing and labelling only the required doses may reduce the risk of inadvertent overdose¹.

Radiation Exposure

Radiation protection is central to paediatric IR. Children are more radiosensitive than adults and have a longer remaining lifespan during which radiation-related stochastic effects may manifest. Whenever clinically appropriate, ultrasound or MRI guidance should be considered in preference to CT or fluoroscopy⁵.

When fluoroscopy or CT guidance is required, paediatric-specific protocols should be used and the ALARA principle applied. Practical measures include careful pre-procedural planning, using pulsed low-dose fluoroscopy, tight collimation, last-image hold, appropriate frame-rate selection and removal of the anti-scatter grid when suitable. For CT-guided procedures, the scan range should be limited to the region of interest

and dose parameters should be adjusted according to patient size and clinical indication. Radiation dose should be monitored and documented where appropriate⁶.

How Can Paediatric IR Help?

Oncology

Along the journey of a child with cancer, from diagnosis to treatment and palliation, IR plays an integral role in multidisciplinary care. This includes image-guided biopsy for tissue diagnosis, placement of long-term tunnelled central venous catheters for chemotherapy and frequent blood sampling, and increasingly, endovascular and ablative therapies for tumour-directed treatment.

Compared with adults, paediatric tumour biopsy often requires a larger amount of tissue to support molecular profiling, risk stratification and treatment planning. Examples include MYCN status in neuroblastoma and CTNNB1 mutation status in hepatoblastoma. For this reason, suspected paediatric tumours are commonly biopsied using a coaxial technique, in which an introducer needle is positioned at the lesion edge, allowing multiple core samples to be obtained through a single access route. For hepatoblastoma, the biopsy guidelines of the Paediatric Hepatic International Tumour Trial recommend obtaining a minimum of 10 core-needle specimens using a 16G core biopsy needle, with samples taken from different regions of the lesion⁷. At the end of the biopsy, haemostatic materials such as Gelfoam slurry, or heat- or electric-based tract cautery devices, may be deployed through the coaxial cannula to reduce post-biopsy haemorrhage⁸.

Endovascular interventions have improved outcomes in selected paediatric tumours. Intra-arterial chemotherapy has improved globe salvage rates in advanced retinoblastoma to approximately 70 - 80 %, while reducing systemic adverse effects compared with intravenous chemotherapy⁹. Transarterial radioembolisation may downstage hepatoblastoma and serve as a bridge to surgical resection or liver transplantation¹⁰. Bland embolisation can also be life-saving in tumour rupture or haemorrhage¹¹.

Percutaneous thermal and non-thermal ablation techniques are increasingly used in benign and malignant paediatric tumours, including desmoid fibromatosis, primary liver tumours and metastatic lesions involving the lungs, liver, soft tissues and bones. Because children often have less subcutaneous and perivisceral fat than adults, thermo-protective measures are required during thermal ablation. These may include hydrodissection, pneumodissection, and neurophysiological monitoring¹².

Beyond tumour control, image-guided interventions can improve quality of life through symptomatic palliation. Indwelling tunnelled catheters can relieve dyspnoea and discomfort caused by malignant pleural effusions or ascites while enabling home-based care. Cryoablation and chemical neurolysis may provide opioid-sparing options for durable pain control, particularly in children with painful bone metastases¹³.



Nephrology

IR plays an important role in the diagnosis and management of paediatric patients with acute and chronic kidney disease, including image-guided kidney biopsy, vascular access planning for haemodialysis and endovascular treatment of renovascular hypertension.

There is an increasing incidence of paediatric end-stage kidney disease in Hong Kong, with a reported median time to transplantation of 3.7 years. Haemodialysis accounts for approximately 20 % of renal replacement therapy¹⁴. In the study by Ma et al., dialysis catheter placement in infants was associated with symptomatic thrombosis in 34 % of cases involving internal jugular and femoral venous access¹⁵. Therefore, preservation of venous capital is critical in children who may require long-term renal replacement therapy. Access planning should aim to place the smallest catheter that can meet dialysis requirements in the largest suitable vein. The right internal jugular vein is usually preferred because it provides a relatively straight route to the superior vena cava and right atrium. Catheter selection and tip positioning can be challenging in infants, especially when the length of a staggered-tip catheter approximates the length of the superior vena cava. Newer symmetrical-tip catheter designs may help mitigate these issues¹⁶.

Renovascular hypertension is uncommon in children but may be difficult to control with medical therapy alone. Persistent uncontrolled hypertension may lead to end-organ injury, including chronic kidney disease, stroke and left ventricular hypertrophy. Fibromuscular dysplasia is the most common cause in the paediatric age group, with other associations including neurofibromatosis type 1, Williams syndrome, polyarteritis nodosa and Alagille syndrome¹⁷.

When Doppler ultrasound, CT angiography or MR angiography suggests features of renal artery stenosis, digital subtraction angiography is the reference standard for anatomical assessment and allows treatment in the same setting. Balloon angioplasty has been reported to be clinically effective in 48.5 - 100 % of patients. Favourable outcomes are associated with short-segment stenoses of less than 1 cm and residual stenosis of less than 10 - 20 % after intervention. Low-profile adult coronary balloons may be useful in young children because their small diameters and flexible delivery systems are well suited to paediatric vessels. Throughout the procedure, attention should be paid to preventing arterial spasm, thrombosis and vascular injury¹⁸.

Vascular Anomalies

Vascular anomalies, including vascular tumours and vascular malformations, are frequently encountered in children. They may affect the skin, soft tissues, visceral organs, bones or multiple anatomical regions. Some are apparent at birth, while others become more prominent as the child grows.

Historically, terminology surrounding vascular anomalies has been inconsistent. Lesions may be incorrectly labelled as "haemangiomas" despite having very different biological behaviour and treatment requirements. Such discrepancies can cause

confusion among clinicians and families, potentially leading to delayed diagnosis, inappropriate treatment or unnecessary surgery. A detailed discussion of nomenclature is beyond the scope of this article, and readers are referred to the updated 2025 International Society for the Study of Vascular Anomalies classification¹⁹.

Many vascular anomalies are associated with genetic alterations affecting angiogenesis, lymphangiogenesis and vascular remodelling. Improved understanding of their pathogenesis has reinforced the importance of multidisciplinary care, as a single treatment modality is often insufficient. Such dedicated vascular anomalies multidisciplinary team may include haematologists/oncologists, interventional radiologists, otolaryngologists, paediatric surgeons, plastic surgeons, dermatologists, geneticists, pathologists, diagnostic radiologists, ophthalmologists and allied health professionals²⁰.

Accurate diagnosis requires integration of clinical history, physical examination and imaging. Ultrasound is often first-line, while MRI defines lesion extent and relationships with adjacent structures. Skin biopsy or image-guided core biopsy may be required to clarify lesion type and obtain tissue for somatic mutation analysis. Many vascular anomalies harbour mutations affecting receptor tyrosine kinase signalling and the RAS or PIK3CA pathways, for which targeted therapies are increasingly available²¹.

For slow-flow venous and lymphatic malformations, percutaneous sclerotherapy is a commonly used minimally invasive treatment. Under ultrasound or fluoroscopic guidance, the malformation is directly punctured and a sclerosant is injected to promote endothelial inflammation, thrombosis, and to induce lesion shrinkage through fibrosis. Common sclerosants include absolute alcohol, sodium tetradecyl sulphate and bleomycin. Alcohol and sodium tetradecyl sulphate may cause skin necrosis and nerve injury, and high-dose alcohol may be associated with pulmonary hypertension and systemic hypotension. Bleomycin may cause flagellate dermatitis and has a rare association with acute interstitial pneumonitis²⁰.

Interventional management of high-flow arteriovenous malformations is more complex and requires detailed assessment of angioarchitecture. The aim is nidus obliteration. Common embolic agents include ethylene-vinyl alcohol copolymer and N-butyl cyanoacrylate, while sclerosants such as absolute alcohol and bleomycin may also be used in selected cases. Proximal arterial embolisation alone should be avoided, as it may promote collateral recruitment without definitive nidus occlusion. Interstitial bleomycin injection, transvenous retrograde embolisation or direct percutaneous puncture with sclerosant injection may be considered in selected arteriovenous malformations with complex angioarchitecture²².

Lymphatic imaging has expanded the diagnostic and therapeutic role of paediatric IR in children with complex lymphatic disorders. Dynamic contrast-enhanced MR lymphangiography provides a radiation free modality for evaluation of detailed anatomical and flow information of the lymphatic system, helping

identify abnormal lymphatic reflux, central lymphatic flow pattern and chylous leak²³. These imaging techniques can guide targeted intervention. In selected children with chylothorax secondary to post-operative trauma, intranodal lymphangiography followed by embolisation of the thoracic duct using coil and liquid embolics may help alleviate chylothorax. Selective embolisation of abnormal lymphatic channel using liquid embolic has shown to be useful in post-Fontan patients with plastic bronchitis²⁴. However, thoracic duct embolisation should be avoided in patients with central lymphatic flow abnormalities or chylous ascites, as further obstruction of lymphatic outflow may worsen the underlying condition²³.

CONCLUSION

Delivering safe and effective paediatric IR requires more than adapting adult techniques to smaller patients. It depends on a dedicated multidisciplinary team with paediatric-specific expertise, an understanding of the needs of both the child and family, and close multidisciplinary collaboration across paediatric specialties. As technology advances and clinical models of care mature, paediatric IR will continue to expand its role in delivering precise, minimally invasive care through the smallest of wounds.



Please scan this QR code to view the full-size figures.



Fig. 2: (View captions and photos in normal size, please scan the QR code)

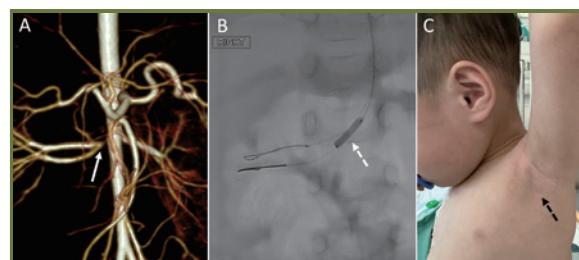


Fig. 3: (View captions and photos in normal size, please scan the QR code)

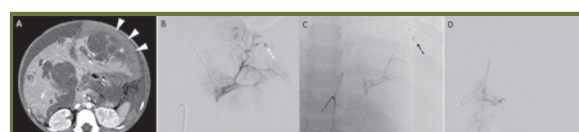


Fig. 4: (View captions and photos in normal size, please scan the QR code)

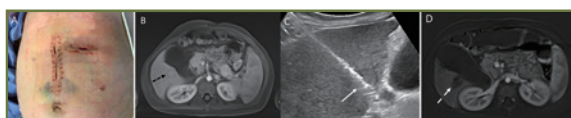


Fig. 5: (View captions and photos in normal size, please scan the QR code)

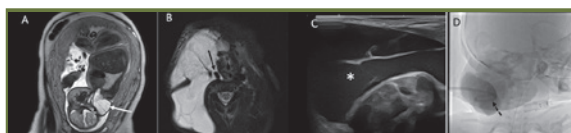


Fig. 6: (View captions and photos in normal size, please scan the QR code)

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MCHK CME Programme Self-assessment Questions

Please read the article entitled "Small Wounds for Small Patients: the Expanding Role of Paediatric Interventional Radiology" by Dr Kevin KF FUNG, Dr Joyce PK CHAN, Dr Claudia CHEUNG and Dr Elaine YL KAN and complete the following self-assessment questions. Participants in the MCHK CME Programme will be awarded CME credit under the Programme for returning completed answer sheets via fax (2865 0345) or answer link: <https://forms.gle/yJjeGKrYP97Q8Rna9> or by mail to the Federation Secretariat on or before 31 October 2026. Answers to questions will be provided in the next issue of The Hong Kong Medical Diary. (Address: Duke of Windsor Social Service Bldg., 4/F., 15 Hennessy Rd., Wan Chai. Enquiry: 2527 8898)

Questions 1 - 10: Please answer T (true) or F (false)

1. A technically straightforward paediatric IR procedure may still carry substantial anaesthetic risk, particularly when the underlying pathology compromises the airway or cardiovascular structures.
2. In infants undergoing interventional radiology procedures, thermal protection is not necessary for straightforward procedures.
3. The anti-scatter grid should always be retained during paediatric fluoroscopy because it improves image quality.
4. The coaxial biopsy technique allows multiple core specimens to be obtained through a single access route and may also facilitate tract haemostasis after sampling.
5. Intra-arterial chemotherapy is a globe-salvage strategy for advanced retinoblastoma and is able to reduce systemic adverse effects compared with intravenous chemotherapy.
6. For paediatric haemodialysis access, the right internal jugular vein is generally preferred because it provides a relatively straight course to the superior vena cava and right atrium.
7. In children undergoing renal artery angioplasty, stenoses longer than 1 cm and residual stenosis exceeding 20 % are associated with more favourable clinical outcomes.
8. In high-flow arteriovenous malformations, occlusion of the proximal feeding artery is usually an adequate treatment endpoint even if the nidus remains patent.
9. Dynamic contrast-enhanced MR lymphangiography can provide anatomical and lymphatic flow information without exposing the child to ionising radiation.
10. Thoracic duct embolisation remains suitable for patients with central lymphatic flow abnormalities or chylous ascites because further obstruction of lymphatic outflow is unlikely to worsen these conditions.

ANSWER SHEET FOR OCTOBER 2026

Please return the completed answer sheet to the Federation Secretariat on or before 31 October 2026 for documentation. 1 CME point will be awarded for answering the MCHK CME programme (for non-specialists) self-assessment questions.

Small Wounds for Small Patients: the Expanding Role of Paediatric Interventional Radiology

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Answer Link

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Answers to September 2026 Issue

Orthodontics for Children - Achieving Dento-facial Aesthetics, Skeletal Harmony and Psychosocial Well-being

1. T 2. F 3. T 4. F 5. T 6. T 7. T 8. F 9. T 10. T

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Interventional Oncology - from Tumour Ablation to Palliation

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INTRODUCTION

Interventional oncology (IO) is now firmly established as the fourth pillar of cancer care, standing alongside medical, surgical, and radiation oncology. The field's scope spans the entire continuum of cancer treatment, from curative ablative procedures and locoregional transcatheter therapies to bridging interventions and palliative care. Furthermore, emerging research into combination regimens and immunotherapies continues to expand IO's therapeutic horizons. This review discusses the evolving spectrum of interventional oncology and highlights recent advances in the field.

ABLATIVE PROCEDURES

Ablation is an established technique for cancer management. Tumour ablation can be classified into thermal and non-thermal modalities. Thermal ablation includes radiofrequency ablation, microwave ablation, cryoablation and high-intensity focused ultrasound (HIFU). Non-thermal ablation includes irreversible electroporation, histotripsy, and chemical ablation such as alcohol¹.

A 2021 regional review highlighted radiofrequency ablation (RFA) as the most commonly utilised technique, followed by microwave ablation (MWA). The liver and lungs represent the most frequently targeted organs for tumour ablation in Asia². The choice of ablation modality depends on the location and size of the lesion.

The mode of imaging guidance depends on the ablation technique and lesion characteristics. The use of hybrid imaging techniques such as ultrasound fusion imaging improves targeting of lesions which are not conspicuous on conventional USG while enabling real-time needle guidance³.

Thermal Ablation

Heat-based Techniques

Heat-based ablation techniques include radiofrequency ablation (RFA) and microwave ablation (MWA). MWA offers a larger ablation zone and a shorter procedural time, but with a higher procedural cost⁴. In the liver, ablation is considered as the first-line treatment option for very early stage hepatocellular carcinoma (HCC) smaller than 2 cm⁴. RFA and MWA represent the most commonly used techniques, depending on lesion size and location. (Fig. 1)



Fig. 1: (View captions and photos in normal size, please scan the QR code)

During thermal ablation, the precise spatial distribution of heat is critical to predicting treatment outcomes. To improve real-time monitoring of the ablation zone, advanced techniques like magnetic resonance (MR) thermometry are being studied. A recent retrospective study demonstrated a strong correlation between the volume of thermal dose-predicted lesions on proton-resonance-frequency (PRF)-based MR thermometry and the actual ablation zone volumes visualised on postprocedural day-one MRI⁵.

Cold-based Technique

Cryoablation is a cold-based ablation technique. It offers less procedural pain compared with heat-based modalities. In the kidney, it is considered as an alternative to surgery in the treatment of small renal masses smaller than 4 cm⁶. (Fig. 2) In the liver, cryoablation is historically associated with the feared complication of cryoshock, which is potentially fatal. A recent meta-analysis showed that the incidence of cryoshock was less than 0.3 % in all cryoablation procedures and it was not reported for treating liver lesions smaller than 3 cm⁷.

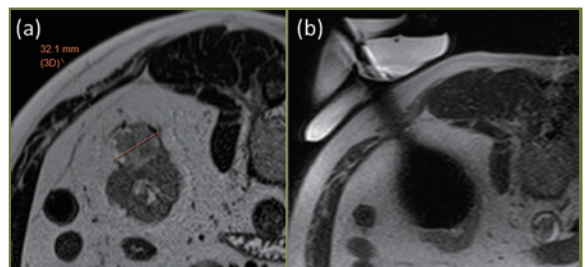


Fig. 2: (View captions and photos in normal size, please scan the QR code)

Cryoablation is a widely studied modality for the treatment of soft tissue tumours, including soft tissue sarcoma and aggressive fibromatosis. The utilisation



of multiple, synergistically placed cryoprobes allows for the precise sculpting of iceballs of various sizes and geometries, which enables tailored coverage of irregular tumour margin⁸. Studies have shown that cryoablation has high local tumour control rates of 77.8 % to 100 % for malignant soft tissue and bone tumours, and 72 % to 96.7 % for bone metastases⁹.

Non-thermal Ablation

Irreversible Electroporation

Irreversible electroporation (IRE) is a non-thermal ablation technique that utilises high-voltage electrical pulses to create pores in the tumour cells membranes, leading to mechanical cell death via apoptosis. Since this technique does not generate heat, it is advantageous for treating tumours near critical structures. However, due to the high voltages applied, this procedure requires general anaesthesia with complete neuromuscular blockade, and cardiac synchronisation to prevent cardiac arrhythmias¹.

IRE has been most extensively studied for treatment of pancreatic cancer, where proximity to major splanchnic vessels often precludes the use of thermal ablative modalities. The efficacy of percutaneous pancreatic IRE was evaluated in the PANFIRE-II trial, which demonstrated a prolonged median overall survival of 17 months in patients with locally advanced pancreatic cancer, despite a notable 58 % overall complication rate¹⁰. Furthermore, preliminary results from a prospective multicentre registry confirm the role of IRE as a consolidative treatment for stage III pancreatic ductal adenocarcinoma following induction chemotherapy, demonstrating improved overall survival when compared to standard of care alone¹¹.

Histotripsy

Histotripsy is a novel, non-thermal and non-invasive ablation technique that utilises high-amplitude, low-duty-cycle ultrasound pulses to mechanically disintegrate tissue via cavitation. This technique does not create any thermal energy, which enables precise lesion targeting adjacent to critical structures. This mechanism of cellular destruction also preserves collagenous structures such as blood vessels and bile ducts^{1,12}.

Histotripsy was approved by the FDA in 2023 for primary and secondary liver tumours. A recent meta-analysis confirmed its efficacy and safety. The study reported a high pooled technical success rate of 94.1 % and good local control, with an 89.3 % pooled event rate for the absence of nodular enhancement, and a pooled major complication rate of 7.0 %¹².

TRANSARTERIAL THERAPY

Transarterial Chemoembolisation (TACE)

Transarterial chemoembolisation (TACE) is the first-line treatment for intermediate stage HCC⁴. (Fig. 3) Cisplatin is often the chemotherapeutic agent used in this procedure. The preparation of the chemoembolic

suspension can affect the treatment outcome. A prospective, multicentre, randomised controlled trial in Hong Kong showed better treatment outcome, in terms of complete tumour response (90 % vs 47 %; $p < 0.001$), progression-free survival (21.1 months vs 10.4 months; $p < 0.001$) and overall survival (53.3 months vs 36 months; $p = 0.004$), for TACE using ethiodised oil-based anhydrous cisplatin suspension compared with conventional aqueous cisplatin emulsion¹³.

The role of TACE in treating tumours in other body systems is also being investigated. A retrospective study on bronchial artery chemoembolisation (BACE) for unresectable non-small cell lung cancer (NSCLC) using paclitaxel with cisplatin or carboplatin showed better objective response rate (46.43 % vs 28.33 %; $p = 0.007$), progression-free survival (17 months vs 11 months; $p = 0.035$) and overall survival (19.5 months vs 13 months; $p = 0.044$), compared with systemic chemotherapy¹⁴. A phase II trial on BACE using Tislelizumab for Stage IIIA-IIIC NSCLC demonstrated an objective response rate of 60 % and no grade 3 or above treatment-related adverse event¹⁵.

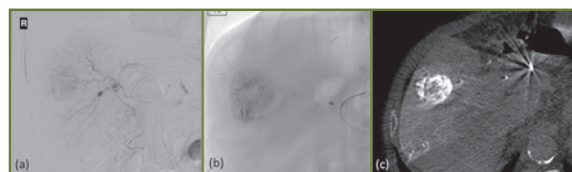


Fig. 3: (View captions and photos in normal size, please scan the QR code)

Transarterial Embolisation (TAE)

Transarterial embolisation (TAE) is often used to treat bleeding complications, particularly in cases of hypervascular tumour rupture, such as ruptured HCC. In Asia, ruptured HCC accounts for approximately 10 % of deaths among patients diagnosed with HCC¹⁶. TAE is highly effective in achieving hemostasis in this setting, with a success rate of 53 - 100 %¹⁶. Apart from acute bleeding control, TAE also contributes to local tumour control. A meta-analysis demonstrated that TAE is as effective as TACE for the treatment of unresectable HCC¹⁷.

TAE also plays a role in preoperative management of hypervascular tumours. A meta-analysis evaluating renal artery embolisation prior to partial nephrectomy in patients with renal cell carcinoma (RCC) demonstrated a significant reduction in estimated blood loss compared with patients without preoperative embolisation¹⁸. (Fig. 4) RAE was also found to be safe and effective when combined with cryoablation for treating tumours greater than 3 cm^{19,20}.

Transarterial Radioembolisation (TARE)

Transarterial radioembolisation (TARE) with Yttrium-90 (Y90) is a locoregional therapy, also known as selective internal radiation therapy (SIRT), that involves the delivery of radioactive microspheres into the hepatic artery for treatment of liver tumour. (Fig. 5) The role of TARE has been described across various stages of HCC²¹.

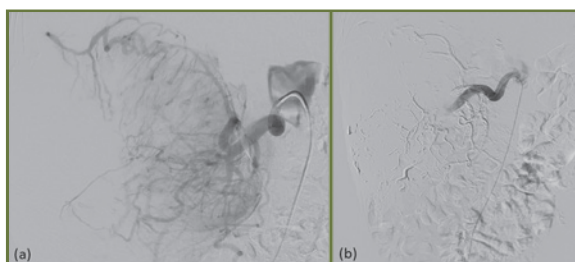


Fig. 4: (View captions and photos in normal size, please scan the QR code)

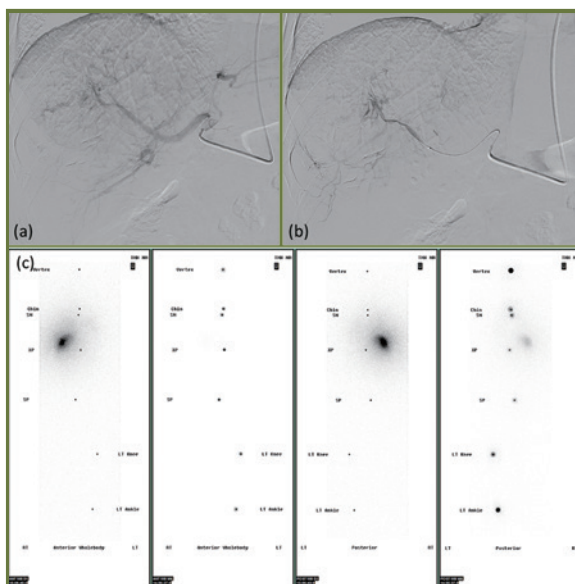


Fig. 5: (View captions and photos in normal size, please scan the QR code)

The LEGACY trial established the role of radiation segmentectomy in the treatment of solitary HCC up to 8 cm in size. The delivery of a high ablative radiation dose to the tumour yielded an objective response rate of 88.3 %²².

For patients with unilobar disease, radiation lobectomy is a commonly adopted technique to deliver radiation to a single lobe, achieving local tumour control while inducing hypertrophy of the contralateral lobe, potentially serving as a bridge to resection in patients with an insufficient future liver remnant (FLR). When evaluating the capacity to induce FLR hypertrophy, a recent systematic review concluded that portal vein embolisation (PVE) elicits a higher volume of hypertrophy than Y-90 radiation lobectomy²³. Another study demonstrated that Y-90 results in a higher rate of tumour necrosis compared with PVE²⁴.

PALLIATIVE CARE

Pain Management

Cryoneurolysis

Cryoneurolysis is an emerging technique for cancer pain management. It works by using freezing temperature to

achieve a Sunderland II injury of the nerve, allowing for subsequent axonal regeneration. Theoretical advantages compared with other techniques like nerve blocks and RFA include real-time monitoring of the iceball zone for a more controlled treatment area, and less peri-procedure pain²⁵.

A recent expert consensus suggests considering cryoneurolysis for patients with localised chronic pain refractory to conservative therapies²⁶. A retrospective study evaluating percutaneous splanchnic nerve cryoneurolysis for pancreatic cancer-related pain demonstrated a 100 % technical success rate, with 76 % of patients experiencing pain relief alongside a reduction in opioid usage²⁷.

Interventional Bone Therapies

Bone is the third most common site for metastases and at least 50 % of patients experience skeletal-related events (SRE), such as pain or pathological fractures. The 2025 National Comprehensive Cancer Network (NCCN) guidelines suggest that ablation techniques may be considered for pain management when pharmacologic therapy fails, in the absence of an oncologic emergency²⁸.

Cementoplasty is effective for painful lytic lesions, particularly in the spine. Injection of polymethylmethacrylate (PMMA) causes thermal neurolysis of intraosseous pain receptors through the exothermic polymerisation reaction while restoring mechanical stability. (Fig. 6) Its application has also expanded to the pelvic ring and sacrum to support weight-bearing. While cement is effective in resisting compressive forces, the addition of screws (osteosynthesis) helps to resist other mechanical stresses, particularly shear and torsional forces. Combined cementoplasty and osteosynthesis is often performed for fractures of the pelvis and appendicular skeleton^{29,30}.



Fig. 6: (View captions and photos in normal size, please scan the QR code)

RECENT ADVANCES

Electrochemotherapy

Electrochemotherapy (ECT) utilises reversible electroporation (EP) to enhance the targeted delivery of chemotherapeutic agents into tumour cells. EP refers to the use of high-voltage electrical pulses to transiently increase cell membrane permeability, boosting the cytotoxicity of drugs. Bleomycin and cisplatin are the currently established agents for this treatment. In practice, the chemotherapeutic agent is administered



either intratumourally or intravenously. The treatment area is then uniformly covered by an adequate electric field³¹. ECT is a non-thermal technique that does not damage surrounding organs or vessels. However, ECT procedures can be of longer duration and usually require general anaesthesia³².

ECT is indicated for the palliative management of cutaneous tumours and cutaneous metastasis, demonstrating a consistent objective response rate of approximately 80 % across all cutaneous malignancies, regardless of tumour histology³³.

With the development of new electrodes, the application of ECT to deep locations has been studied. A recent systematic review looking at ECT on primary and secondary liver tumours showed safety and efficacy in the treatment of liver metastases, and concluded that ECT performed better than other thermal ablation techniques in lesions larger than 6 cm in size and in locations adjacent to vital structures such as bile duct or blood vessel³⁴.

Image-guided Brachytherapy

Image-guided brachytherapy has emerged as a novel treatment modality for unresectable hepatocellular carcinoma (HCC). This procedure involves placement of a brachytherapy catheter into the target lesion under image guidance, after which the patient is transferred to the radiotherapy unit for treatment delivery via an afterloading system. Compared to thermal ablation techniques, key advantages include its versatility in treating tumours of various sizes and the absence of heat-sink effect near vasculature. It is also less affected by respiratory movement when compared with external stereotactic body radiotherapy³⁵.

CT and MRI guidance for this technique has been described^{36,37}. A recent study comparing CT-guided high-dose-rate (HDR) brachytherapy with TACE for treatment of unresectable HCC showed a lower hazard of death and disease progression in HDR brachytherapy group compared with TACE group³⁸.

Interventional Oncology and Immunotherapy

The effect of combining immunotherapy with locoregional therapy is being extensively investigated for the management of hepatocellular carcinoma (HCC). It is hypothesised that locoregional therapies cause local tumour destruction and enhance the exposure of tumour antigens to antigen-presenting cells, which convert an immunosuppressive tumour microenvironment toward a more potent T-cell response³⁹. Results from LEAP-012, EMERALD-1 and EMERALD-3 trials have consistently demonstrated prolonged progression-free survival when combining TACE with immunotherapy when compared with TACE alone^{40,41,42}. However, the optimal sequencing of locoregional therapy and immunotherapy remains under active investigation to determine whether these combined modalities yield a merely additive effect or a truly synergistic response.

CONCLUSION

Interventional oncology is a rapidly evolving field, continuously driven by novel techniques and expanding clinical evidence. Beyond standalone procedures, the emerging role of combined therapies, particularly when integrated with immunotherapy, offers promising new strategies for advanced cancer management. Ultimately, a robust multidisciplinary approach remains essential to navigate these innovations and deliver truly individualised, precision medicine for oncology patients.



Please scan this QR code to view the full-size figures.

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24 Nov 2026	Assertive and Respectful Communication	Dr. LAW Chi Lim, Robert Specialist in Obstetrics & Gynaecology
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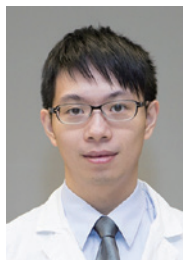
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INTRODUCTION

Interventional radiology (IR) has become an essential component in the care of patients with life threatening conditions, offering minimally invasive, image guided therapeutic options. This article reviews key emergency IR interventions with emphasis on endovascular interventions, including pulmonary embolism thrombectomy, management of superior vena cava obstruction (SVCO), bronchial artery embolisation (BAE), transjugular intrahepatic portosystemic shunt (TIPS) and embolisation techniques for gastrointestinal and trauma related haemorrhage.

Patients considered for emergency IR require prompt stabilisation in accordance with local protocols, with early involvement of anaesthetic support when clinically indicated. Comprehensive pre procedural imaging is essential: contrast enhanced computed tomography is the workhorse for emergent IR which confirms the diagnosis and allows procedural planning for swift and effective intervention.

Haemorrhage control is the goal in the majority of emergency endovascular procedure which involves use of embolic materials. An overview of the major embolic materials is discussed in the following table (Table 1).

Major indications, contraindications of the selected emergency procedures are tabulated as follows (Table 2):

PART 1: THORACIC EMERGENCIES

A. Bronchial Artery Embolisation:

The Clinical Challenge:

Massive haemoptysis is a medical emergency that can cause asphyxiation, with mortality rates of 50 - 100 % if untreated. Bronchoscopy is often the preferred initial procedure in unstable patients for lateralisation and airway protection, as well as clot extraction, tamponade and ablation of culprit vessels. However, visualisation is often limited during active bleeding, and it may control haemorrhage without identifying the exact vascular

Table 1: Classifications of common embolic agents used in emergency IR (Developed by the authors, with references listed in the reference page).

Please scan the QR code to view the full table.

Table 2: Indications and contraindications of selected emergency interventional radiology procedures (Developed by the authors, with references listed in the reference page)

Please scan the QR code to view the full table.



source. As approximately 90 % of cases arise from the bronchial circulation, bronchial artery embolisation (BAE) has become a standard interventional treatment¹.

Patient Preparation:

Bronchoscopy should be considered in life-threatening cases for airway maintenance and localisation if CT is inconclusive.

Procedural Considerations:

Pre-procedural imaging plays a key role in planning. Contrast extravasation is rarely seen on CT, even in severe haemoptysis. Common findings include ground-glass opacities and hypertrophied bronchial arteries (> 3 mm). CT also provides a roadmap, with bronchial arteries typically arising from the aorta between T3 - T8. There are usually two left and one right bronchial artery, the latter often originating from the intercostobronchial trunk². Non-bronchial systemic collaterals and anatomical variants should also be scrutinised.

The procedure is typically performed under local anaesthesia if the patient is stable. Transfemoral access is preferred, although approaches via upper limb may facilitate catheterisation of aberrant vessels.

Reverse-curve catheters enable stable ostial positioning, followed by selective microcatheter cannulation of the culprit vessel. Meticulous exclusion of branches supplying critical structures is essential prior to embolisation. The artery of Adamkiewicz, recognisable by its characteristic hairpin configuration supplying the anterior spinal cord, must be avoided as inadvertent embolisation may result in spinal cord infarction.



Bronchopulmonary shunting increases the risk of non-target embolisation via the pulmonary circulation. Embolisation should therefore be as selective as possible; larger particles or occlusive devices are preferred when significant shunting is present.

Calibrated and non-calibrated particles are commonly used embolic materials in BAE. Particles < 300 μm are generally avoided due to the risk of bronchi or pulmonary vasculature ischaemia¹. Larger particles (700 - 900 μm) may reduce complications in the presence of shunts. Microcoils are also used in cases with shunts, although it has been reported with a higher recurrence rate, this has not been observed in our experience. Liquid embolic agents are increasingly utilised and may provide improved haemoptysis control compared with polyvinyl alcohol (PVA) particles when used by experienced operators¹. However, inappropriate NBCA-lipiodol ratios may result in premature polymerisation or non-target embolisation (Fig. 1).

Complications¹:

BAE is generally safe, with most complications being self-limiting, including transient chest pain, dysphagia and post-embolisation syndrome. Serious complications include spinal cord, bronchial or myocardial infarction, oesophagobronchial fistula and stroke.

Special considerations:

Rasmussen aneurysm is a pulmonary arterial pseudoaneurysm, typically secondary to tuberculosis and can lead to massive haemoptysis if ruptured. Recognition on CT is essential, as management requires pulmonary artery embolisation instead (Fig. 2a-c). Whilst technically similar to BAE, caution is required when crossing the right ventricular outflow tract due to risks of arrhythmia and right ventricle perforation.

B. SVC Obstruction

Clinical Challenge:

Superior vena cava obstruction (SVCO) is considered a medical emergency when venous hypertension leads to neurological deterioration or respiratory compromise. Malignancy, particularly lung cancer and lymphoma, accounts for most cases, while benign causes such as catheter-related thrombosis are increasingly recognised. Although chemotherapy and radiotherapy have been the mainstay treatments for malignant SVCO, symptom relief is often delayed compared with SVC stenting.

Specific Patient Preparation:

Covered stents and large balloons should be available in case of venous rupture.

Technical Considerations:

Dedicated uncovered venous stents are typically deployed via the femoral vein. Brachial or internal jugular access may be required in challenging cases to facilitate a through-and-through wire technique.

Following lesion crossing, a diagnostic venogram should be performed cranial to the obstruction to assess extent and guide stent sizing. Stenting should extend across normal-to-normal segments to optimise outcomes. In occlusive disease, the distal extent may

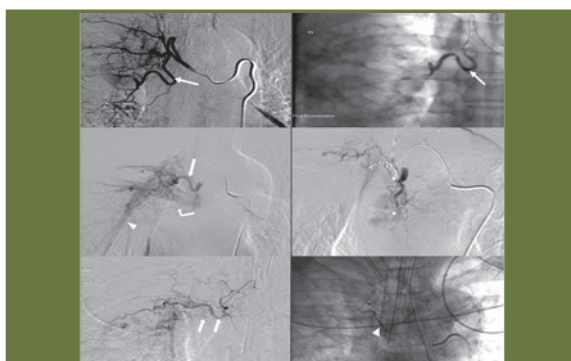


Fig. 1: (View captions and photos in normal size, please scan the QR code)

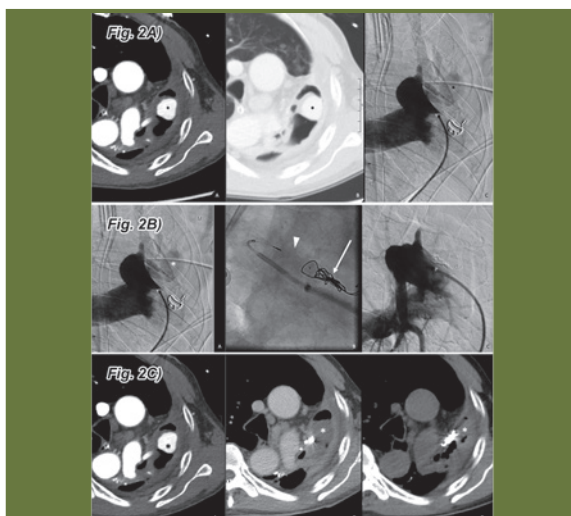


Fig. 2: (View captions and photos in normal size, please scan the QR code)

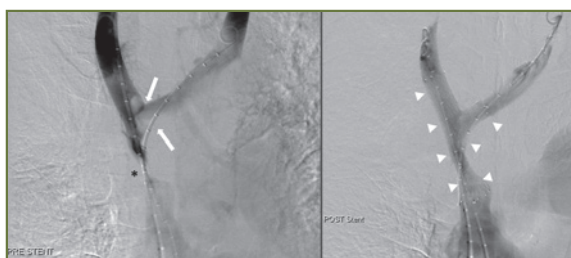


Fig. 3: (View captions and photos in normal size, please scan the QR code)

not opacify; in such cases, an additional catheter should be used to delineate the landing zone and identify the SVC-right atrial junction.

Parallel stenting may be required when the SVC diameter exceeds that achievable with a single stent or when disease involves the brachiocephalic confluence (Fig. 3). Although unilateral stenting may be effective, reconstruction of physiological venous anatomy should be pursued where feasible. With improving survival in both benign and malignant conditions, preservation of venous anatomy and venous access options are increasingly important.

To minimise stent migration, 20 - 30 % oversizing relative to the unaffected SVC is recommended. Measurements should incorporate CT, venography and prior imaging, as current studies may underestimate true vessel diameter due to disease involvement.

Post-deployment balloon dilatation (2 - 3 mm smaller than the stent diameter) is performed if significant residual stenosis persists, followed by completion venography. Simultaneous venoplasty is performed when parallel stents are deployed.

Complications³:

Major complications (approximately 4 %) include stent migration, thrombosis, SVC rupture, pericardial tamponade, cardiac arrhythmias or failure. Minor complications (approximately 3.2 %) include self-limiting chest pain, access-site haematoma, stent restenosis or occlusion.

Special Consideration:

There is no consensus regarding anticoagulation following SVC stenting. In our institution, it is routinely prescribed unless contraindicated, when the risk of bleeding is considered to outweigh the risk of stent occlusion. The latter can often be managed with recanalisation if required.

C. Mechanical Thrombectomy for Acute Pulmonary Embolism

Effective management of acute pulmonary embolism begins with risk stratification. We stratify patients based on the 2019 European Society of Cardiology (ESC) Guidelines⁴ and review candidacy of the patient for mechanical thrombectomy following CIRSE standard of practice⁵.

Specific Patient Preparation:

CT pulmonary angiogram is performed to ascertain the thrombus load and distribution as well as evidence of right heart strain prior to the procedure.

Extracorporeal Membrane Oxygenation (ECMO) is considered in case-by-case scenario.

Procedural Considerations and Technique:

Common femoral venous access is preferred. A pigtail catheter is brought to the pulmonary trunk and bilateral main pulmonary arteries, followed by digital subtraction angiography and measurement of baseline pulmonary artery pressure⁵.

The venous sheath is upsized appropriately based on the size of aspiration device. Before exchange to aspiration catheter, a 4F inflated balloon will be passed along the wire to ensure that subsequent introduction of large-bore sheath will not cause injury of chordae tendineae or papillary muscles. Next, the aspiration catheter will be introduced over wire to bilateral pulmonary arteries for mechanical thrombectomy. Both large-bore and small-bore aspiration catheters are available in our institute and will be considered in case-by-case scenario. Measurement of pulmonary artery pressure is also performed before and after mechanical thrombectomy⁵.

The endpoint of the mechanical thrombectomy is not based on complete angiographic success but on improvement in haemodynamic status and right ventricular dysfunction(Fig. 4).

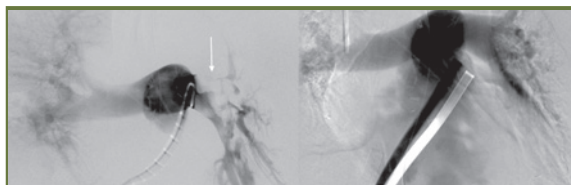


Fig. 4: (View captions and photos in normal size, please scan the QR code)

Complications:

Major complications include arrhythmia, cardiac or vascular injury resulting in haemopericardium or major haemorrhage.

Follow-up and Further Management:

Appropriate anticoagulation is still needed after mechanical thrombectomy. For patients contraindicated for anticoagulation, IVC filter insertion should be considered.

PART 2: ABDOMINAL AND PELVIC EMERGENCIES

A. Embolisation of Active Bleeding in Upper Abdomen

Procedural Considerations and Technique:

Embolisation procedure begins with artery access, followed by cannulating appropriate target arteries (e.g. hepatic artery, GDA) using catheters/microcatheters. Various embolic agents are available and are used in different conditions (Table 1).

For ruptured HCC, temporary embolic agents, e.g. Gelfoam are used, which stop bleeding while reducing the risk of ischaemia/infarction of liver⁶.

For management of pseudoaneurysm in upper gastrointestinal bleeding, e.g. from GDA, it is necessary to block the artery distal and proximal to the pseudoaneurysm (front-door and back-door technique)⁷. Agents commonly used in our institute include coils and glue (Fig. 5).

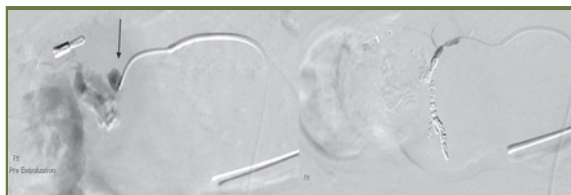


Fig. 5: (View captions and photos in normal size, please scan the QR code)

For prophylactic embolisation of upper gastrointestinal bleeding e.g. GDA, coils are commonly used in our institute.



Complications:

Embolisation for ruptured hepatocellular carcinoma (HCC) may be complicated by hepatic failure, liver abscess, bile-duct injury, and non-target embolisation involving the bowel, gallbladder, pancreas, stomach, or spleen.

Embolisation for upper gastrointestinal bleeding may result in bowel ischaemia or infarction, as well as non-target embolisation involving the pancreas or liver.

Follow-up and Further Management:

These patients have to be under close clinical monitoring for any signs/symptoms of rebleeding and end-organ ischaemia.

B. Transjugular Intrahepatic Portosystemic Shunt (TIPS) for Variceal Bleeding

Specific Patient Preparation:

Existing ascites should be drained completely if double-wire technique for TIPS is contemplated, which is practised in our institute. Preoperative imaging including contrast CT or Doppler ultrasound is needed to define vascular anatomy.

Procedural Considerations and Technique:

TIPS is performed under general anaesthesia in our institute. Traditional TIPS is done via transjugular route with a guiding sheath positioned in the hepatic vein, followed by advancement of TIPS needle from a hepatic venous branch into a portal venous branch. It is rather unpredictable and can be aided by intravascular ultrasound or wedged portography in challenging anatomy.

In our institute, we adopt the double wire technique described by Professor Yu⁹(Fig. 6). Under ultrasound guidance, a percutaneous transhepatic puncture is made into a portal venous branch, followed by puncture of hepatic venous branch. A guidewire is advanced from the portal system into the hepatic vein/IVC and up to the right internal jugular sheath.

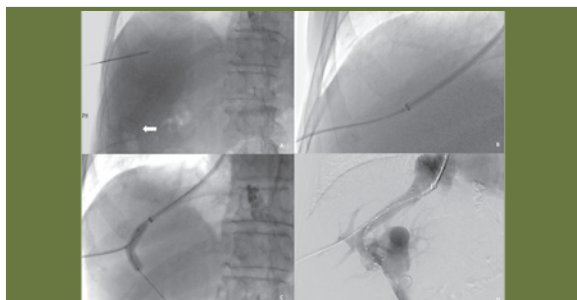


Fig. 6: (View captions and photos in normal size, please scan the QR code)

This establishes a continuous percutaneous portal-hepatic venous-jugular pathway with the first wire acting as a safety wire. A second (working) wire can be introduced from right internal jugular access, through the hepatic vein back to the portal venous system.

Balloon dilatation is performed over the working wire, followed by stent-graft deployment.

IVC and portal vein pressures are measured before and after stent deployment, with a target reduction of the portosystemic pressure gradient to < 12 mmHg or by at least 20 % from baseline to effectively prevent rebleeding. Adjunctive embolisation of varices or collateral veins with coils or plugs may be performed to further reduce rebleeding risk in selected patients.

Complications

These include stent occlusion, migration or TIPS dysfunction, worsening or new hepatic encephalopathy and cardiac overload leading to pulmonary hypertension or congestive heart failure. Endovascular intervention can be performed to treat corresponding complications.

Follow-up and Further Management

After TIPS, patients require close monitoring for clinical response. Doppler ultrasound can be performed to assess shunt patency and flow direction. Antiplatelet/ anticoagulation is essential for stent patency and should be prescribed unless contraindicated.

C. Pelvic Arterial Embolisation for Trauma and Obstetric/Gynaecological Haemorrhage.

Specific Patient Preparation:

Pre-procedural imaging such as CT angiography is highly preferred though not mandatory, especially in critically unwell patients when emergent haemostasis is anticipated.

Procedural Considerations and Technique:

Pelvic angiograms, either flush aortogram at distal aorta or above iliac bifurcations are obtained to identify any vascular injury¹³.

Superselection of bleeding branches of internal iliac arteries can be performed with microcatheter-microguidewire systems if focal bleeding is identified. Alternatively, in patients with multiple bleeders, non-selective embolisation at IIA can be performed^{11,13}.

For uterine artery embolisation, the bilateral uterine arteries should be cannulated prior to embolisation (Fig. 7). Non-selective embolisation should be avoided. The uterine angiogram should be carefully scrutinised to evaluate for any ovarian, cervical, vaginal or vesical supply¹².

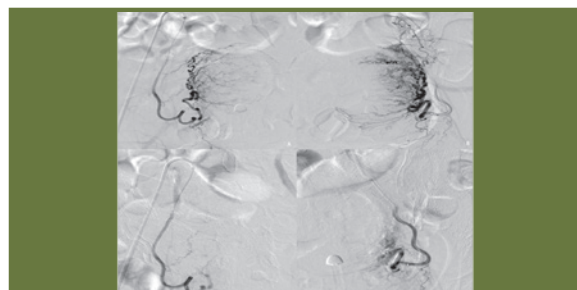


Fig. 7: (View captions and photos in normal size, please scan the QR code)

Angiographic endpoints are cessation of contrast extravasation, exclusion of pseudoaneurysms and restoration of stable haemodynamics. In diffuse damage-control embolisation, the endpoint is adequate pruning of arterial inflow to permit clot stabilisation.

Complications:

For pelvic trauma embolisation, specific complications include gluteal muscle or bladder necrosis, sciatic nerve palsy and erectile dysfunction¹¹.

For UAE, specific complications include transient or permanent amenorrhoea, endometritis, uterine necrosis or rupture. Premature ovarian failure may develop if ovarian arteries are embolised¹².

Follow-up and Further Management:

Early post-procedure monitoring focuses on recurrent bleeding, limb and pelvic organ perfusion (buttocks, perineum, lower limbs), and renal function. Repeat angiography may be needed for secondary haemorrhage.

For UAE, patients generally resume normal menses with most studies reporting preserved fertility and successful subsequent pregnancies but with a slightly increased risk of placental abnormalities in future gestations.

CONCLUSION

Endovascular intervention offers management of various medical emergency conditions with minimally invasive options, but they are not without risk. Adequate pre-procedural investigation, choice of approaches and preparedness for managing complications allow safe and efficient management of these medical emergencies.



Please scan this QR code to view the full-size figures.

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Answers to Radiology Quiz

Answers:

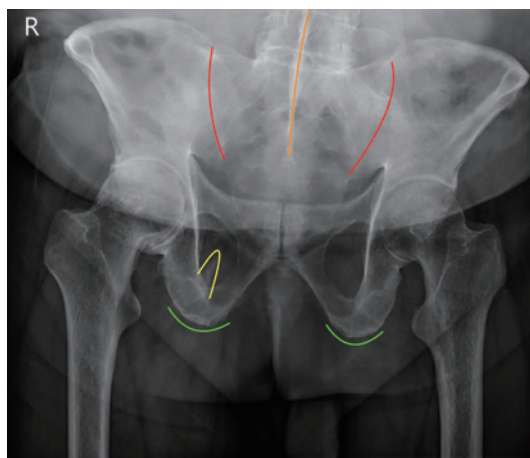
Fused bilateral sacroiliac joints (Red).

Ossification of supraspinous and interspinous ligaments - "dagger spine" appearance (Orange).

Right sacrotuberous ligament calcification (Yellow).

Whiskering of the ischial tuberosities (Green).

Overall features suggestive of ankylosing spondylitis.



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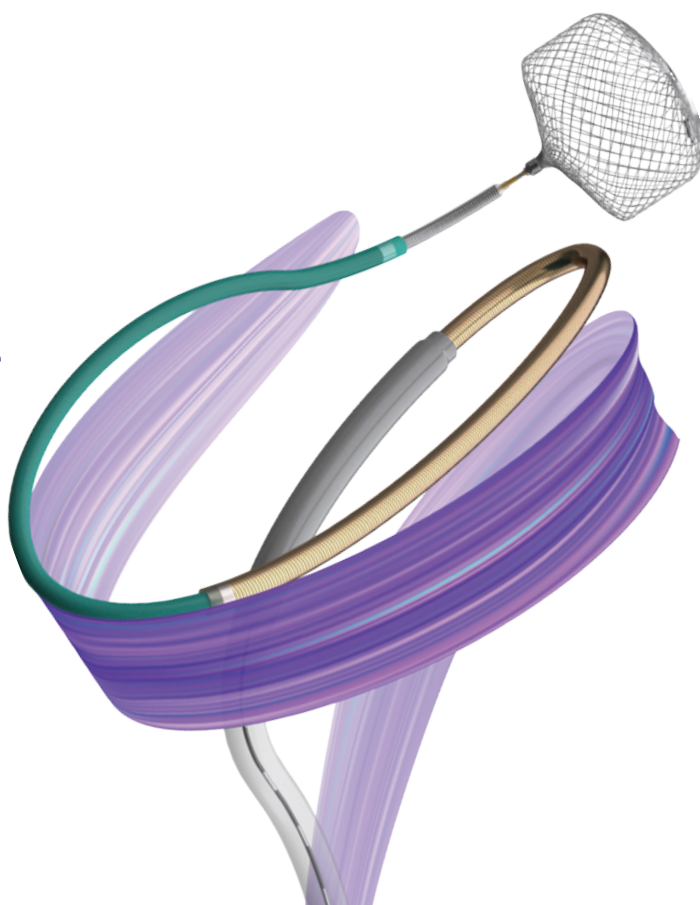
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From Catheter to Circuit - The Evolving Role of Interventional Radiology in Haemodialysis Care

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INTRODUCTION

The global prevalence of end-stage renal disease continues to rise, with haemodialysis remaining the primary modality of renal replacement therapy. Optimal management of this population increasingly depends on multidisciplinary collaboration among interventional radiologists, nephrologists, urologists, and vascular surgeons. This article aims to illuminate how interventional radiology contributes to the care of haemodialysis-dependent patients.

OVERVIEW OF INTERVENTIONAL RADIOLOGY

Interventional radiology (IR) is a radiology subspecialty that uses minimally invasive, image-guided techniques to diagnose and treat a broad range of medical conditions. In haemodialysis care, IR plays a key role in dialysis catheter placement and the management of vascular access dysfunction, with endovascular arteriovenous fistula creation representing a promising future direction.

1. Creating Access : The IR Approach

A tunnelled haemodialysis catheter provides central venous access for patients with end-stage renal disease who require urgent dialysis when a functional arteriovenous fistula or graft is not available. It may also be appropriate in selected patients with limited life expectancy, prohibitive vascular access anatomy, or exhaustion of other long-term access options. However, tunnelled catheters are associated with important mechanical and infectious complications and therefore require careful planning, insertion, and maintenance. Here we focus on the technical considerations of tunnelled catheter placement and the interventional radiologic management of challenging catheter-related complications.

Planning of Venotomy and Exit Site

The right internal jugular vein is the preferred venotomy site for tunnelled haemodialysis catheter insertion because it provides the shortest and most direct course to the right atrium, optimising dialysis flow and

minimising resistance. The left internal jugular vein is less favourable owing to its longer, more tortuous course, which may reduce flow rates and increase technical difficulty and the risk of venous injury during insertion. Femoral access is generally unsuitable for long-term use because of its higher risk of catheter-related infection.

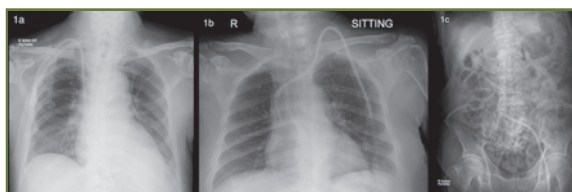


Fig. 1: (View captions and photos in normal size, please scan the QR code)

The catheter exit site should be positioned in a clean, stable area that minimises mechanical irritation during daily activity. For jugular catheters, the exit site should be placed away from the axilla to reduce discomfort, infection risk, and accidental dislodgement. A caudal or lateral orientation is generally preferred to minimise stress and kinking within the subcutaneous tunnel.

Tunnelled haemodialysis catheter insertion should be performed by trained operators using image guidance. Ultrasound-guided venous puncture reduces haematoma and inadvertent arterial cannulation, while fluoroscopy, when feasible, helps ensure optimal catheter tip position and may reduce early dysfunction, central venous stenosis, and thrombosis.

IR Management of Tunneled Catheter Related Morbidities

Tunnelled dialysis catheters are associated with both infectious and noninfectious complications. While migration or structural failure is typically managed by catheter exchange, dysfunction due to thrombosis, fibrin sheath formation, or central venous stenosis may require interventional treatment after bedside measures fail. Diagnostic venography is essential to define the level and cause of dysfunction before intervention.

i) Intraluminal or Catheter-tip Thrombosis

On venography, thrombus appears as a persistent filling



defect within the catheter lumen or at the catheter tip. Complete occlusion is suggested by high resistance during contrast injection. Restoration of patency is typically achieved with intraluminal thrombolytic therapy, commonly using alteplase or urokinase with 4 % citrate. Catheter exchange may be considered if thrombolytic fails.



Fig. 2: (View captions and photos in normal size, please scan the QR code)

ii) Fibrin Sheath Formation

Fibrin sheath formation is a common response to prolonged catheter placement. The term is a misnomer, as the sheath composition contains variable degrees of thrombus and cellular-collagen tissue, depending on implantation duration. Encasement of catheter ports impairs the flow rates required for effective haemodialysis and appears on venography as retrograde contrast tracking along the catheter surface.

Treatment is either pharmacological (thrombolytics, discussed above) or mechanical. Fibrin sheath disruption involves catheter exchange or manipulation over a guidewire to fragment the obstructing sheath, often supplemented by balloon angioplasty along the catheter tract. When disruption fails, fibrin sheath stripping using a gooseneck snare offers a catheter-salvage option, where immediate function is reliably restored, though durability is limited by frequent sheath recurrence¹.

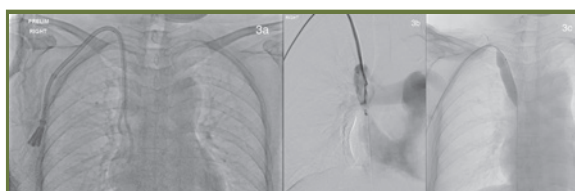


Fig. 3: (View captions and photos in normal size, please scan the QR code)

iii) Central Venous Stenosis

Chronic endothelial irritation from long-term catheter placement induces intimal injury, inflammation, smooth muscle proliferation, and fibrosis, leading to progressive luminal narrowing. Suboptimal catheter position and resultant turbulent flow may accelerate this process. Significant stenosis or occlusion is managed with venous angioplasty, with or without stent placement, to restore central venous outflow to the right atrium.

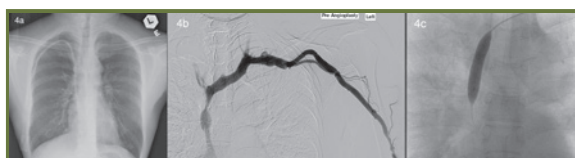


Fig. 4: (View captions and photos in normal size, please scan the QR code)

2. Dialysis Access Dysfunction

Despite advances in modern medicine, dialysis access remains vulnerable to stenosis, thrombosis, and infection. Stenosis, driven primarily by neointimal hyperplasia, is the leading cause of access failure. In arteriovenous access, abnormal flow and shear stress promote venous outflow injury, progressive luminal narrowing, and subsequent thrombosis. It has been reported that up to half of accesses may develop significant stenosis during their lifetime, making reintervention common rather than exceptional. Thrombosis is typically secondary to underlying stenotic disease.

Changing Treatment Paradigm

To standardise the evaluation of failing dialysis access circuits, current practice relies heavily on the Kidney Disease Outcomes Quality Initiative (KDOQI) 2019 Clinical Practice Guidelines. Whereas intervention was previously often based on angiographic findings alone, the current guidelines emphasise a clinical indicator-driven approach, recommending intervention only when physiologic or clinical evidence of access dysfunction is present².

Balloon Angioplasty

Percutaneous transluminal angioplasty (PTA) remains the first-line treatment for dialysis access stenosis, but management is increasingly shifting toward lesion-specific endovascular strategies. Although PTA restores luminal patency and flow, its durability is limited by restenosis. Drug-coated balloons (DCBs), most commonly paclitaxel-coated, improve patency and reduce reintervention, particularly in recurrent stenosis. The landmark IN.PACT AV Access Randomised Trial demonstrated superior target lesion primary patency and reduced need for reintervention compared with conventional PTA, without increased mortality at three years³. Subsequent analysis also demonstrated reduced intervention rates per access-year and lower thrombosis rates⁴. DCBs appear particularly useful for recurrent stenotic lesions, especially in arteriovenous fistulas, although outcomes depend on meticulous technique, including adequate predilation and sufficient balloon inflation time⁵.

Stent Scaffolding

When angioplasty, including drug-coated balloon angioplasty, fails to maintain luminal patency due to severe mechanical remodelling, stent scaffolds provide structural support to maintain vessel patency and are especially useful in lesions with elastic recoil or restenosis. Multiple large-scale randomised trials demonstrate that, in selected clinical settings, stent grafts outperform standard PTA by improving patency, prolonging access circuit salvage, and reducing reintervention. According to current consensus, the best indications for stent grafts include venous anastomotic stenosis in synthetic AV grafts, severe elastic recoil stenosis that instantly narrows immediately after balloon deflation, and recurrent, aggressive lesions that return rapidly despite multiple optimised PTA or DCB

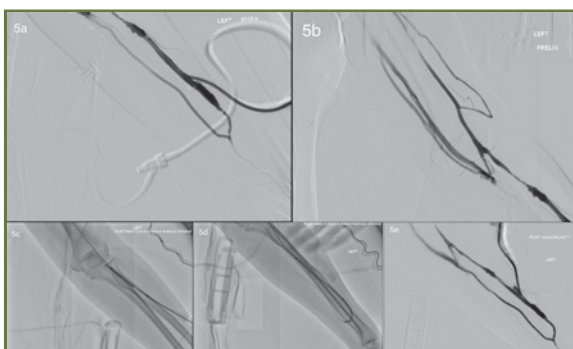


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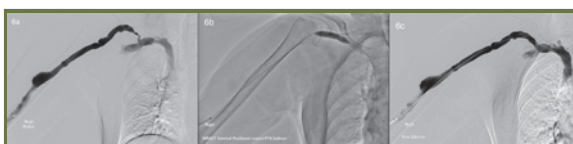


Fig. 6: (View captions and photos in normal size, please scan the QR code)

attempts. Careful patient selection remains essential to preserve future access options.

Drug-eluting stents (DES) are an emerging option for complex lesions, combining mechanical scaffolding with local anti-proliferative drug delivery. A recent comprehensive meta-analysis highlighted highly encouraging results, reporting promising patency outcomes and low restenosis rates, although their role in dialysis access management continues to evolve⁶.

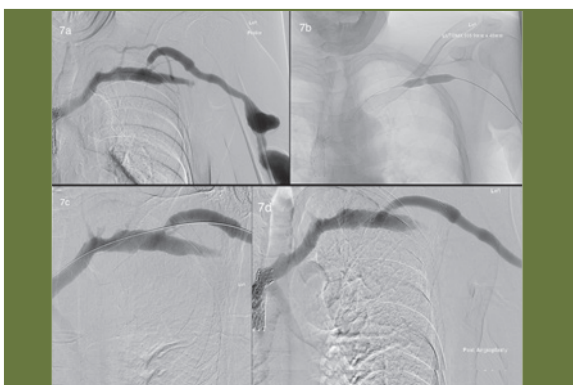


Fig. 7: (View captions and photos in normal size, please scan the QR code)

Thrombosis: A Clinical Emergency

Access thrombosis is a common and urgent complication requiring prompt management. Urgent endovascular declotting should ideally be initiated within 48 hours of the thrombotic event to maximise circuit salvage and protect the underlying access. Endovascular thrombectomy has become increasingly favoured due to its minimally invasive nature and high technical success rates. Crucially, clinicians must remember that thrombosis is usually secondary to an underlying stenotic lesion, which must be identified and treated with angioplasty or stent placement at the same sitting to prevent early rethrombosis.

Several endovascular thrombectomy techniques are available for dialysis access salvage. Rheolytic systems are effective for large, fresh thrombi but may cause hemolysis and transient bradycardia. Rotational devices are useful for organised or adherent clot, although distal embolisation remains a risk. Aspiration systems are generally simpler and safer, but their long-term patency may be less favourable⁷.

Newer aspiration and clot-capture devices may overcome limitations of conventional thrombectomy by improving treatment of acute-on-chronic thrombus, reducing blood loss, and enhancing navigation in tortuous or fragile vessels. Computer-assisted aspiration systems use algorithm-guided audiovisual feedback to distinguish thrombus from flowing blood, thereby limiting blood loss and potentially reducing procedure time. Combined mechanical extraction-aspiration systems offer a lytic-free approach with high technical success, low blood loss, and encouraging access-specific outcomes, particularly in graft thrombosis and organised clot retrieval.

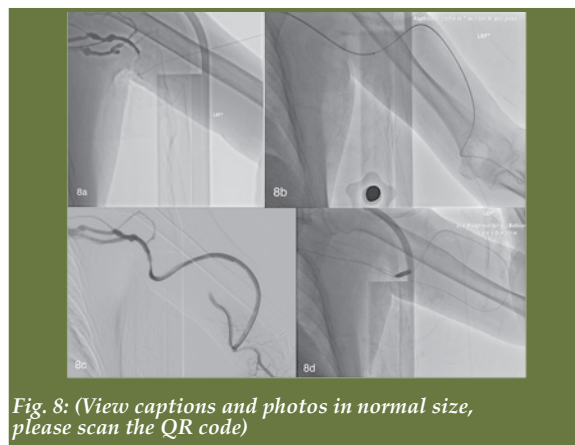


Fig. 8: (View captions and photos in normal size, please scan the QR code)

FUTURE DIRECTIONS

Endovascular arteriovenous fistula (EndoAVF) creation has emerged as a compelling minimally invasive alternative to surgical fistula creation and may represent an important future direction in haemodialysis access. EndoAVF has the potential to reduce procedural trauma, improve patient recovery, and expand access options in selected patients. Early and mid-term studies of currently available platforms have demonstrated high technical success, acceptable maturation, and encouraging patency in a substantial proportion of cases⁸. Although definitive randomised comparisons with surgically created AVFs are still limited, growing prospective and comparative data are helping to clarify which patients benefit most, how maturation can be optimised, and how reintervention burden compares with conventional surgery. As device technology, patient selection, and operator experience continue to improve, endoAVF is poised to assume an expanding role in the future vascular access armamentarium.

Bioengineered vascular grafts represent a promising advance in dialysis access, particularly through the development of acellular human tissue-engineered



vessels designed to integrate with host tissue over time. Early clinical studies suggest potential advantages over conventional synthetic grafts, including acceptable patency, successful repeated cannulation, low immunogenicity, and a lower susceptibility to infection.

Sirolimus-coated balloons have emerged as a potential alternative to paclitaxel-coated devices for the treatment of dialysis access stenosis. Early prospective data suggest that sirolimus-coated balloon angioplasty is feasible and safe, with encouraging short-term patency outcomes. The clinical value has yet to be confirmed in adequately powered randomised trials with longer follow-up.

Artificial intelligence is an emerging area in vascular access care, with machine learning models being explored for the prediction of fistula maturation and access dysfunction using clinical, haemodynamic, and dialysis surveillance data. These approaches may eventually enable earlier identification of failing access circuits and support pre-emptive intervention before thrombosis occurs.

CONCLUSION

IR represents a cornerstone of contemporary haemodialysis access management, offering minimally invasive, image-guided strategies that are crucial for catheter optimisation, vascular access salvage, and complication mitigation. As guideline-based, patient-centred practice continues to evolve, the field is moving toward safer procedures, improved access durability, and more individualised care for patients with end-stage renal disease.



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7:00 PM	Certificate Course on Respiratory Medicine 2026 – Update on Knowledge for Expert Respiratory Care (Video Lectures) Organisers: The Federation of Medical Societies of Hong Kong, Hong Kong Thoracic Society Limited & CHEST Delegation Hong Kong & Macau Limited Speakers: Dr Pui-hing CHIU & Mr Mun-chun CHOW	Tel: 2821 3512
7 WED 7:00 PM	Certificate Course on Rehabilitation 2026 - Bridging Technology, Specialty Care and Practice (Video Lectures) Organisers: The Federation of Medical Societies of Hong Kong, & Hong Kong Association of Rehabilitation Medicine Speakers: Dr Charles LEUNG & Dr Jocelyn CHAN	Tel: 2821 3512
8 THU 2:00 PM	In-person / HKMA CME Portal (Online) The HKMA CME Hybrid Lecture Topic: Potency Meets Protection: Advancing Hypertensive Care Organiser: The Hong Kong Medical Association Speaker: Dr Adrian Yan-yue CHEONG Venue: HKMA Central Clubhouse, 2/F, Chinese Club Building, 21-22 Connaught Road Central, Central	HKMA CME Dept. Tel : 2527 8452 1 CME Point
13 TUE 7:00 PM	Certificate Course on Respiratory Medicine 2026 – Update on Knowledge for Expert Respiratory Care (Video Lectures) Organisers: The Federation of Medical Societies of Hong Kong, Hong Kong Thoracic Society Limited & CHEST Delegation Hong Kong & Macau Limited Speakers: Dr Chun-yu CHEUNG & Mr Shu-wah NG	Tel: 2821 3512
14 WED 7:30 AM	The Hong Kong Neurosurgical Society Monthly Academic Meeting – To be confirmed Organiser: Hong Kong Neurosurgical Society Speaker(s): Dr Him-pui LAW Chairman: Dr Tony Kam-tong CHAN Venue: Seminar Room, G/F, Block A, Queen Elizabeth Hospital; or via Zoom meeting	CME Accreditation College: 1.5 points College of Surgeons of Hong Kong Dr Jason Chow Tel: 2595 6456 Fax. No.: 2965 4061
7:00 PM	Certificate Course on Rehabilitation 2026 - Bridging Technology, Specialty Care and Practice (Video Lectures) Organisers: The Federation of Medical Societies of Hong Kong, & Hong Kong Association of Rehabilitation Medicine Speakers: Dr Yukie TSE, Dr Rana TAM & Ms Shirley XIAO	Tel: 2821 3512
16 FRI 2:00 PM	HKMA CME Portal (Online) The HKMA CME Online Lecture Topic: Beyond Corticosteroids: Integrating Non-Steroidal Topicals to Circumvent Corticophobia and Optimise Adherence in Infant Atopic Dermatitis Organiser: The Hong Kong Medical Association Speaker: Dr Sarah Tsz-kwan TSUI	HKMA CME Dept. Tel : 2527 8452 1 CME Point
20 TUE 2:00 PM	In-person / HKMA CME Portal (Online) HKMA- HKIC(W) CME Hybrid Lecture Topic: The Long Road After Radioactive Iodine Treatment - A Practical Guide for Primary Care Organisers: The Hong Kong Medical Association and Hong Kong West Cluster Speaker: Dr AJoyce Lok-sze AU Venue: Southern DHC – Core Centre, 22/F, Vertical SQ, 28 Heung Yip Road, Wong Chuk Hang, Hong Kong	HKMA CME Dept. Tel:2527 8452 1 CME Point
7:00 PM	Certificate Course on Respiratory Medicine 2026 – Update on Knowledge for Expert Respiratory Care (Video Lectures) Organisers: The Federation of Medical Societies of Hong Kong, Hong Kong Thoracic Society Limited & CHEST Delegation Hong Kong & Macau Limited Speakers: Dr Hoi-yee KWAN & Prof David YU	Tel: 2821 3512
21 WED 2:00 PM	HKMA CME Portal (Online) The HKMA CME Online Lecture Topic: Ultrasound-Guided Interventions for Common Musculoskeletal Disorders Organiser: The Hong Kong Medical Association Speaker: Dr Peter Kam-to SIU	HKMA CME Dept. Tel : 2527 8452 1 CME Point
7:00 PM	Certificate Course on Rehabilitation 2026 - Bridging Technology, Specialty Care and Practice (Video Lectures) Organisers: The Federation of Medical Societies of Hong Kong, & Hong Kong Association of Rehabilitation Medicine Speakers: Dr Sophia TENG & Mr Brian LO	Tel: 2821 3512
22 THU 7:00 PM	FMSHK Foundation Meeting Organiser: The Federation of Medical Societies of Hong Kong Venue: Council Chamber, 4/F, Duke of Windsor Social Service Building, 15 Hennessy Road, Wanchai, Hong Kong	Ms Mabel TSANG Tel: 2527 8898
8:00 PM	FMSHK Executive Committee Meeting Organiser: The Federation of Medical Societies of Hong Kong Venue: Council Chamber, 4/F, Duke of Windsor Social Service Building, 15 Hennessy Road, Wanchai, Hong Kong	Ms Mabel TSANG Tel: 2527 8898
24 SAT 2:00 PM	In-person / HKMA CME Portal (Online) HKMA Mental Health CME Symposium on "New Perspectives in Mental Health Through Gut Science" Topics 1. Rethinking Mental Health in Everyday Practice 2. The Gut-Brain Axis in Mental Health and Emerging Research and Clinical Evidence Organiser: The Hong Kong Medical Association Speakers: Dr Eugene Yu-hang YEUNG and Dr King-yee CHONG Venue: Michelle Room, 2/F, Eaton HK Hotel, 380 Nathan Road, Kowloon	HKMA CME Dept. Tel : 2527 8452 2 CME Points
26 MON 2:00 PM	HKMA CME Portal (Online) HKMA-HKCOG CME Online Lecture Series on "Treatment of Common Conditions in Pregnancy for GPs" Topic: Management of Headaches and Back/Pelvic Pain During Pregnancy Organisers: The Hong Kong Medical Association and the Hong Kong College of Obstetricians & Gynaecologists Speaker: Dr Teresa Man-kee MA	HKMA CME Dept. Tel : 2527 8452 1 CME Point
28 WED 7:00 PM	Certificate Course on Rehabilitation 2026 - Bridging Technology, Specialty Care and Practice (Video Lectures) Organisers: The Federation of Medical Societies of Hong Kong, & Hong Kong Association of Rehabilitation Medicine Speakers: Dr Angus CHU & Dr Annie MEW	Tel: 2821 3512
29 THU 2:00 PM	In-person The HKMA CME Lecture in Physical Attendance Mode Topic: Update of Early Diabetes Care Management in Primary Care Setting Organiser: The Hong Kong Medical Association Speaker: Dr Peter Chun-yip TONG Venue: Crystal Ballroom A&B, 2/F, The Cityview, 23 Waterloo Road, Kowloon	HKMA CME Dept. Tel : 2527 8452 1 CME Point

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WHO standardized range	22 - 27%	5 - 7%	2.8 - 3.4%	2.6 - 3.2%	<5 mg/kg

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2027



1 JANUARY

Sa	2	廿五	1	元旦	9	初二	16	廿三	30	廿六
Fri	1	廿四	8	十一	15	初二	22	廿九	31	廿七
Thu	7	十三	14	初五	17	初六	24	三十		
Wed	6	廿九	13	初四	20	初五	27	三十		
Tue	5	廿八	12	初三	19	初四	26	三十		
Mon	4	廿七	11	初二	18	初三	25	廿九		
Sun	3	廿六	10	初一	17	初二	24	廿八	廿四	

2 FEBRUARY

Sa	6	廿一	1	初二	8	初九	15	廿二	28	廿九
Fri	5	廿九	4	初八	7	初九	14	廿一	27	廿八
Thu	4	廿八	3	初七	6	初八	13	廿	26	廿七
Wed	3	廿七	2	初六	5	初七	12	廿九	25	廿六
Tue	2	廿六	1	初五	4	初六	11	廿八	24	廿五
Mon	1	廿五	31	初四	3	初五	10	廿七	23	廿四
Sun	7	廿四	14	初三	21	初二	28	廿五		

3 MARCH

Sa	6	廿一	1	初二	8	初九	15	廿二	28	廿九
Fri	5	廿九	4	初八	7	初九	14	廿一	27	廿八
Thu	4	廿八	3	初七	6	初八	13	廿	26	廿七
Wed	3	廿七	2	初六	5	初七	12	廿九	25	廿六
Tue	2	廿六	1	初五	4	初六	11	廿八	24	廿五
Mon	1	廿五	31	初四	3	初五	10	廿七	23	廿四
Sun	7	廿四	14	初三	21	初二	28	廿五		

4 APRIL

Sa	3	廿七	1	初二	8	初九	15	廿二	28	廿九
Fri	2	廿六	31	初八	7	初九	14	廿一	27	廿八
Thu	1	廿五	30	初七	6	初八	13	廿	26	廿七
Wed	7	廿四	24	初六	5	初七	12	廿九	25	廿六
Tue	6	廿三	23	初五	4	初六	11	廿八	24	廿五
Mon	5	廿二	22	初四	3	初五	10	廿七	23	廿四
Sun	4	廿一	21	初三	2	初二	9	廿	22	廿三

5 MAY

Sa	1	廿六	3	初二	10	初九	17	廿四	31	廿七
Fri	31	廿五	2	初八	9	初九	16	廿三	30	廿六
Thu	30	廿四	1	初七	8	初八	15	廿二	29	廿五
Wed	29	廿三	31	初六	7	初七	14	廿一	28	廿四
Tue	28	廿二	30	初五	6	初六	13	廿	27	廿三
Mon	27	廿一	29	初四	5	初五	12	廿九	26	廿二
Sun	26	廿	28	初三	4	初二	11	廿八	25	廿一

6 JUNE

Sa	5	廿	1	初二	8	初九	15	廿二	28	廿九
Fri	4	廿九	31	初八	7	初九	14	廿一	27	廿八
Thu	3	廿八	30	初七	6	初八	13	廿	26	廿七
Wed	2	廿七	29	初六	5	初七	12	廿九	25	廿六
Tue	1	廿六	28	初五	4	初六	11	廿八	24	廿五
Mon	31	廿五	27	初四	3	初五	10	廿七	23	廿四
Sun	30	廿四	26	初三	2	初二	9	廿	22	廿三

7 JULY

Sa	3	廿九	1	初二	8	初九	15	廿二	28	廿九
Fri	2	廿八	31	初八	7	初九	14	廿一	27	廿八
Thu	1	廿七	30	初七	6	初八	13	廿	26	廿七
Wed	7	廿六	24	初六	5	初七	12	廿九	25	廿六
Tue	6	廿五	23	初五	4	初六	11	廿八	24	廿五
Mon	5	廿四	22	初四	3	初五	10	廿七	23	廿四
Sun	4	廿三	21	初三	2	初二	9	廿	22	廿三

8 AUGUST

Sa	7	廿一	1	初二	8	初九	15	廿二	28	廿九
Fri	6	廿	31	初八	7	初九	14	廿一	27	廿八
Thu	5	廿九	30	初七	6	初八	13	廿	26	廿七
Wed										

■ 2027年澳門公眾假期

■ 2027年中國公眾假期（節假日安排只供參考）

References: 1. Tanakan product insert. 2. World Health Organization. WHO Monographs on Selected Medicinal Plants – Volume 1. 1999. 3. Egb 761® data on file for Healthcare Professionals' reference and sole use only.

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