Interventional oncology (IO) has evolved into its own subspecialty in IR and the fourth pillar in cancer care. Locoregional treatments in oncology have grown from a last resort treatment option to becoming the standard of care for some cancers. This growth has its own set of challenges and successes.

**Standardization**

IO has seen major advances in two main forms of locoregional treatments: ablation and embolisation. Alcohol ablation led the way to RFA, microwave, cryoablation and irreversible electroporation. Transarterial chemoembolisation was followed by drug-eluting embolics and selective internal radiation therapy. Combination treatments using some of the ablation and arterial treatments are also used. However, the variations in regional practices make it challenging to combine our experiences and come up with large data pools that could help us draw meaningful conclusions in a timely fashion. A Whipple procedure is done the same way in any part of the world; contrast that with a TACE procedure where you can have variations even within the same institution.

**Data acquisition**

Many IO technologies receive regulatory approvals without a specific indication, and consequently are used in an off-label fashion. As clinical adoption and data evolve, some of them have received specific indications; however, this process can take years. Insurance reimbursement for IO procedures usually requires an indication for a particular type of cancer with reimbursement codes, which in turn requires data from trials. Lack of data has insurance providers dismissing promising technologies as experimental, leading to scant usage or even an early demise of some of them.

In the past, adoption of new IO technology was based mostly on anecdotal evidence, case series or retrospective studies. A few randomised controlled trials (RCT) were completed, but none in the scope or size of medical oncology trials. Today, getting an IO trial off the ground requires a tremendous effort and investment, and once a trial is up and running, it tends to have some unique challenges. While a medical oncology trial will not have trouble recruiting patients, since they are primarily managed by them, the interventional oncologist has to rely on the primary oncology specialists for referrals, which can slow the accruals in the study. Outcomes in device trials have a significant component of operator experience, which is not the case in medical oncology trials, where usually one drug is being tested against the drug that is the current standard of care.

**Pathways & Challenges in IO**

Govindarajan Narayanan

The introduction of new and improved versions of existing technologies at breakneck speed takes away our ability to study them in a meaningful fashion and produce robust data. Finally, the treatment costs have also been a stumbling block to global adoption. Other specialties that deal with the oncology patient have also had significant improvements. Robotic surgery, combination chemotherapy and checkpoint inhibitors in medical oncology, advances in immuno-oncology, MR Linac and proton beam therapy in radiation oncology all have the potential to revolutionise the way cancer is managed.

**Finding time for clinical work**

While the clinical model has been widely accepted, explaining the value proposition and setting up one can be a daunting task. The time spent in tumour boards has no reimbursement and the time spent in the clinic tends to have low to poor reimbursement compared to time spent in the lab. With the added pressure to read diagnostic imaging studies in between procedures, the desire of an IR to participate in several tumour boards can be impacted negatively.

**Possible solutions**

So how does IO compete with these challenges, stay relevant and make progress? Embracing the clinical model and being a part of multidisciplinary tumour boards is a start. Collaborations with other specialists to find treatment synergies and improve outcomes will help broaden the spectrum of treatment...
options. Exciting new signals from bench studies regarding abscopal effects and immune modulation following ablations open new avenues for research and clinical applications. Virtual reality and artificial intelligence are adding new dimensions to our field.

Standardising protocols and recording outcome measures for the care we deliver will be key in not only demonstrating our ability to all the health care players, but also in having the data to back up the claims. Well-planned registries right from when a technology is introduced will allow us to collect more data points to understand capabilities, pitfalls and outcomes. Positive RCTs will pave the way for approvals for specific indications and move IO treatments into national treatment guidelines.

We still remain a relatively undiscovered jewel to many of our potential patients and reaching out through all available channels to propagate the information about IO is critical. Our societies have helped create mentorship programmes for medical students, and being an IR/IO mentor is necessary for the continued success of these programmes.

More procedures are being shifted to the outpatient centres, and several of our treatments can be performed safely in an outpatient setting, which helps reduce costs while improving patient comfort and convenience. Medicine is moving towards precise, cutting-edge, minimally invasive treatment solutions with good outcomes, less morbidity and shorter hospital stays. Interventional oncology delivers just that. The future of IO is truly bright.
Modern radiological imaging plays a central role in the diagnostic work-up of the various possible causes of haematuria, while the great majority of affected patients will afterwards not be treated by interventional radiologists. But nevertheless, there are certain indications for embolotherapy, ranging from palliative to acute life-saving, which are important to know.

The invisible microscopic haematuria is distinguished from the more concerning macroscopic haematuria with visible discoloration of the urine, ranging from as little as 1 ml blood in 1,000 ml urine up to a massive and possibly life-threatening haemorrhage with urinary tract tamponade. The usually asymptomatic microscopic haematuria has a worldwide prevalence ranging from 2-31%, in Europe usually around 5%. However, a high sensitivity of urine dipstick tests not distinguishing between pathologic haematuria and transient physiological erythrocyturia, mild myoglobinuria after physical exercise and bacterial contamination cause a high number of false positives.

Thus, up to two thirds of cases of initially diagnosed microscopic haematuria remain unresolved. The remaining cases can usually be assigned to a urinary tract infection (4-22%), a bleed from the prostate in the setting of benign prostatic hyperplasia (10-13%), a urinary tract stone (5%), bladder cancer (3%), renal cystic disease (2-3%) or a glomerular nephropathy (2%, e.g. IgA-nephropathy, thin basement membrane nephropathy, Alport-syndrome, post-infectious glomerulonephritis, mesangiproliferative glomerulonephritis). With a prevalence of less than 1%, renal cell cancer and prostate cancer each play a minor role as a differential diagnosis in microscopic haematuria. With ultrasound, computed and magnetic resonance tomography as well as modern fusion imaging techniques, diagnostic radiology provides a variety of imaging methods for the elective diagnostic clarification and targeted biopsy. With the exception of prostatic artery embolisation in the treatment of symptomatic benign prostatic hyperplasia as a possible cause for microscopic as well as macroscopic haematuria, interventional radiological therapies play a minor role in causal treatment of microscopic haematuria.

At first sight, the differential diagnoses in patients presenting with macroscopic haematuria don’t differ too much from those in microscopic haematuria; however, the higher likelihood of malignancy and the possible life-threatening course increase the importance in clinical practice. In up to 50% of cases of macroscopic haematuria, diagnosis remains unclear. However, as in patients with microscopic haematuria, malignancies of the kidney, the urothelium or the prostate are much more likely and, according to the literature, are found in up to 19-30% of cases and demand thorough clarification. Further causes of macroscopic haematuria are diverse and include benign tumours, such as angiomylipomas and oncocytomas, urinary tract stones and strictures, infections, renal infarction, renal vein thrombosis, trauma, glomerular nephropathies and iatrogenic

Fig. 1: Male patient with intermittent severe macroscopic haematuria following partial tumour nephrectomy on the right side. Axial CT (a) showing the haemorrhage, defect in the upper third of the right kidney. Invasive angiography (b) revealing a massive Weer from a large side-branch of the renal artery, which was successfully occluded using six microcoils (c) with no further bleeding in the completion angiography (d) and during follow-up.

Fig. 2: Female patient with cervical carcinoma after pelvic surgery and radiation therapy in combination with long-time bilateral ureteral stenting presenting with repeated episodes of gross haematuria with consequent urinary tract tamponade. Pelvic angiography (b) revealing bilateral large pseudoaneurysms of the iliac arteries at the crossing points of the uterine close to the iliac bifurcations. Occlusion of the right hypogastric artery using an Amplatz vascular plug (b) and the left hypogastric arteries using pushable macrocoils (0.035 inch coils), (c) to prevent retrograde perfusion of the affected vessel segments. Liberal lining of the iliac arteries using long Gore Viabahn Endoprostheses (d) with angiographically (e) and clinically successful cessation of bleeding.
causes, e.g. following biopsies, renal-preserving surgery, catheterisation, radiation therapy or extracorporeal shockwave lithotripsy.

Patients under oral anticoagulation within therapeutic range face no higher risk for haematuria than other patients and therefore require the same diagnostic work-up. This starts after positive urine dipstick with urine microscopy and culture to rule out possible infectious causes of haematuria, which should be treated empirically. Additional urine cytology may show malignant cells with the highest sensitivity for lower urinary tract tumours. However, a normal cytology does not exclude a malignancy, which is why it is usually used as an adjunct to routinely performed cystoscopy only. Computed tomography, including low-dose non-enhanced acquisitions as well as multi-phase protocols including a late-phase urography, is given a key role in the process of diagnostic clarification.

Regarding the topic of this focus session, the following three groups of indications for embolisation therapy can be highlighted as the most important ones to be kept in mind.

Each group thereby reflects a different endovascular treatment strategy.

I) Haematuria following trauma, partial nephrectomy and biopsy

Renal trauma is usually blunt trauma following motor vehicle accidents and falls. Gunshot and stab wounds causing penetrating trauma of the kidneys are less frequent. Both blunt and penetrating trauma are currently managed non-operatively when haemodynamically stable, with angiembolisation in case of active bleeding as an adjunct. Bleeding from the urethra or the prostate after pelvic trauma is rare but can also be addressed by super-selective angiembolisation in the acute trauma management. Partial nephrectomies, biopsies as well as penetrating trauma of the kidneys may lead to relevant injury of renal vessels with parenchymal pseudoaneurysm, vessel truncations or AV fistulas causing intermittent bleeding and thus haematuria. All these pathologies can be safely and effectively treated by super-selective angiembolisation, predominantly with the use of microcoils, but also particles or glue.

II) Massive haematuria as a late complication after pelvic surgery and pelvic radiation therapy (usually in combination with chronic ureteral stenting)

With about 100 cases described in the literature, it is not highly frequent; however, due to the potentially life-threatening magnitude of bleeding it has to be highlighted when talking about haematuria. Fistulas can occur uni- or bilaterally, usually along the course of the common iliac arteries close to the iliac bifurcation at the crossover of the ureter. Active bleeding from the arteries into the ureter can hardly ever be documented and also relevant alterations of the vessel walls, like the usual pseudoaneurysm, may be subtle on computed tomography angiography and invasive angiography. For a good technical and durable clinical result, it is of great importance to liberally cover the iliac arteries over a long distance with stent grafts, usually after prior embolisation of the internal iliac (aka hypogastric) artery using coils or vascular plugs to prevent retrograde filling of presumably excluded pseudoaneurysm.

III) Haematuria in connection with benign and malignant tumours

These include angiomylipomas and oncocytomas, but also renal cell carcinomas, which may be embolised with palliative intent or pre-operatively in large hypervascular tumour burden. A benign prostatic hyperplasia causing lower urinary tract symptoms and concomitant haematuria as well as an actively bleeding prostatic cancer previously treated with radiotherapy can effectively be addressed with prostatic artery embolisation. Tumour embolisation is mainly realised with the use of particles and, in certain situations, glue.

In conclusion, diagnostic radiology plays a key role in the diagnostic work-up of patients with haematuria, both microscopic and macroscopic. In addition, interventional radiology can effectively and safely treat various causes of debilitating and potentially life-threatening haematuria.

Further reading
- Zhao M, Grove JR, Doolin DR. Assessment of Asymptomatic Microscopic Haematuria in Adults. 2013;03(01):1 R
- I) Haematuria following trauma, partial nephrectomy and biopsy
- II) Massive haematuria as a late complication after pelvic surgery and pelvic radiation therapy (usually in combination with chronic ureteral stenting)
- III) Haematuria in connection with benign and malignant tumours

Find out more at www.cvirendovascular.org

Solve the Case and win a ticket to the CIRSE Farewell Party!

Send your answer to info@cvirendovascular.org by 17:00 today to be in with the chance of winning a ticket to the CIRSE Farewell Party.
Burning issues in radiation protection: critical dose levels and substantial radiation dose

Interventional radiologists are exposed to high levels of radiation in daily practice and therefore face particular health risks. Join us at the Radiation Protection Pavilion and learn how to reduce and protect against exposure as well as the health hazards linked to high levels of occupational exposure to radiation with our best-practice guides and information materials; or take a seat and listen to a brief talk hosted by our Subcommittee or industry partners.

Today’s RPP Radiation Safety Talks

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<tr>
<th>Time</th>
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<td>TUE SEPT 10</td>
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<tr>
<td>11:00 – 11:15</td>
<td>The value of Medical simulation in management of patient and staff exposure</td>
<td>G. Bartal (Kfar-Saba/IL)</td>
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<tr>
<td>11:15 – 11:30</td>
<td>Stereotactic navigation enables highly accurate, CT-guided ablation without radiation exposure for clinicians</td>
<td>M. Peterhans (Bern/CH)</td>
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<td>13:00 – 13:15</td>
<td>Radiation exposure using radial vs. femoral vs. brachial access</td>
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<tr>
<td>13:30 – 13:45</td>
<td>Online resources of ESR dealing with radiation protection (Eurosafe Imaging)</td>
<td>W. Jaschke (Innsbruck/AT)</td>
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Radiation Protection Quiz

Don’t forget to test your radiation protection skills with our electronic quiz, which you can fill out via the CIRSE app!
News on Stage

News on Stage will feature displays on the latest results from multi-centric trials, groundbreaking techniques and many more IR hot topics, shown in a dedicated open area. Large-screen presentations given by the authors during dedicated slots around lunch time will give delegates the opportunity to hear from the experts and engage with them and other key opinion leaders in active, lively discussions.

Tuesday, September 10, 13:15-14:15, News on Stage Area

News on Stage: From science to practice

Moderators: Y. Arai (Tokyo/JP), M.D. Darcy (St. Louis, MO/US)

2802.1 Perfusion imaging with 320-slice spiral computed tomography and color-coded digital subtraction angiography for assessing acute skeletal muscle ischemia-reperfusion injury in a rabbit model
C. Li; Guangzhou/CN

2802.2 Radiation exposure during transarterial chemoembolization: angio-CT versus cone-beam CT
L. Piron1, J. Le Roy1, C. Cassinotto1, J. Delacque1, A. Belgou1, C. Allimant1, J.-P. Beregi1, J. Greffier1, N. Molnari1, B. Guil1; ‘Montpellier/FR, ‘Nîmes/FR

2802.3 A randomized and controlled study comparing patient controlled and radiologist controlled intra-procedural conscious sedation, using midazolam and fentanyl, for patients undergoing insertion of a central venous line
W. Clements1, D. Sneddon1, J. Koukoouzas1, T. Joseph1, G.S. Goh1, J. Koukoouzas1, T.M. Snov1; ‘Melbourne, VIC/AU, ‘Brisbane, QLD/AU

2802.4 Left distal Percutaneous Radial Hemostasis using a Truncated Deflation Algorithm; ldPROTEA: safety and nursing impact assessment
D. Klass, L. Cardarelli-Leite, A. Hadjivassiliou, J. Chung, D.M. Liu, S. Ho; Vancouver, BC/CA

2802.5 Women in interventional radiology: Australia’s gender gap
M. Foo1, J. Maingard2, M. Wang1, K. Phan3, R. Lim4, H.K. Kok5, R. Chandra2, M.J. Lee6, H. Asadi2, M. Brooks1; 1Heidelberg, VIC/AU, 2Clayton, VIC/AU, 3Liverpool, NSW/AU, 4Frankston, VIC/AU, 5Melbourne, VIC/AU, 6Dublin/IE

2802.6 Platform for preclinical MRI-guided focused ultrasound hyperthermia
U. Roy1, M. Fournelle2, S. Greiser1, R.V. Gorkum3, D. Speicher2, T. Grunwald1, S. Kozerke3, S. Tretbar2, L. Landgraf1, A. Melzer1; 1Leipzig/DE, 2St. Ingbert/DE, ‘Zurich/CH

The News on Stage Area is located next to Auditorium 2, opposite the Members Lounge.
Since 2014, five major randomised controlled trials and associated meta-analysis have shown endovascular mechanical thrombectomy (EVT) as the standard of care for acute stroke associated with large vessel occlusion (1-5). More recent trials have extended therapy for acute large vessel occlusion up to 24 hours from onset of symptoms (6-7). Various societies have published standards for the delivery of this life-saving procedure. Neuro-interventional international societies have taken the lead, insisting on a one-year neuro-interventional fellowship, and bi-plane imaging to allow delivery of this time-critical procedure (8). Other recommendations have concentrated on delivery metrics and patient outcomes (9). Unfortunately, there is a lack of formal training objectives, and vague and inconsistent performance targets.

The delivery of EVT in Canada is geographically challenging. The geographic expense of Canada is twice the size of Europe (9,985 km vs 4,476 km). Canada’s population is much smaller, spreading a population comparable to California (37 million) into a vast territory. When compared to Europe, we are significantly less dense (29 Canadians/km² vs 144 Europeans/km²). In the few years after the large EVT trials, delivery of such care was limited to approximately a dozen academic centres across Canada. Neuro-interventional radiologists and endovascular-trained neurosurgeons exclusively provided this care. This left a large segment of the population without timely access to EVT. Geographic constraints prevented the timely transfer of patients to centres with neuro-interventional radiologists.

Although neuro-interventional radiologists manage the EVT approach and delivery, we saw an opportunity for vascular and interventional radiologists to contribute to this care. Queen’s University is one of the smaller medical academic centres in Canada, centred in a town of 125,000 people, but responsible for a population of 500,000 patients scattered over a driving distance of up to 2 hours. We embarked on a structured approach to delivering this procedure safely and rapidly, with a planning stage spread over nine months.

In the first phase, we evaluated our existing resources and abilities. An audit of all interventional radiology procedures between 2003 and 2016 identified over 450 carotid/aortic intracranial angiograms, with approximately 80 procedures (carotid stent, epistaxis embolisation, intracranial stroke ICA/SPA) spread among three fellowship-trained vascular and interventional radiologists. Two on-site stroke neurologists provided excellent acute stroke care, with door-to-needle IPA infusion times consistently near 30 minutes. Our institution performs all of its angiographic procedures on two biplane machines.

In the second phase, we mapped out all elements of care delivery, through monthly meetings involving all departments that may be participating, including paramedic services, emergency, internal medicine, intensive care and anaesthesia. A common care delivery pathway was then mapped out and agreed to by all services.

Training of the interventional radiologists, interventional radiology technologists and nurses became our third area of focus. We received mentoring and one-on-one teaching from an endovascular-trained neurologist who had vast experience in EVT delivery at another Ontario academic centre. The IR team practiced the procedure on phantoms. We performed practice runs, from the emergency door, through the IR suite, to the intensive care unit, to identify possible sites of delay and confusion. Quality measurement and continued improvement became the fourth area of focus. We instituted a novel preceptorship model. Given the low volume and unpredictable timing of acute stroke/EVT, keeping an on-site preceptor was not feasible. We utilised an existing tele-medicine network in the province of Ontario. The video feed of the angiographic suite, as well as an in-room camera, were connected to this network. This telecommunication arrangement allowed our training preceptor over 350 km away, to directly supervise and communicate with us from his institution, on a laptop, smartphone or tablet. The communication system was similar to Skype or Facetime. We laboured over the method of remote precepting—"tele-fluroscopy." We believe this tool could become a crucial component of future implementation of EVT or other new time-critical interventional procedures in a safe and supervised fashion.

All participants of the first fifteen cases debriefed within 48 hours. We itemised areas for improvement, decided on action plans and wrote reports, sharing them with all care providers involved in the case. We measured performance metrics such as door-to-puncture and door-to-reperfusion times, 90-day modified Rankin score (mRs), TICI scores and 90-day mortality. We compared our metrics to all other centres in the province of Ontario that are providing EVT. Two years into our programme, we perform favourably when compared to the other centres in our province, with the fastest door-to-reperfusion times and mortality outcomes slightly better than the average in our province. We achieved these results despite having single-plane equipment, no neuro-interventional fellowships and being a junior programme.

Most societies are concentrating on fellowship training, equipment standards and volume/outcome standards for the delivery of EVT. It is the belief at our centre that the processes utilised early in the implementation, the active participation of all and the careful measurements of outcomes, the debriefs and the continual improvement processes are far more critical. One standardised EVT programme approach would be to delineate the implementation and continued evaluation of a programme into four stages.

1. Prep to first delivery: In this stage, the centre identifies leaders from the appropriate services. Through planning meetings, practice sessions and discussions, a clinical itemised care pathway is identified. Crucially, a team from an experienced external centre, including stroke neurologists, interventional radiologists and lead tech/nurses can participate in this stage, bringing in suggestions and lessons learned.

2. Early delivery phase: A direct supervision model is utilised to allow for safe preceptor guidance. The same team that assisted in the first phase can directly supervise the first cases with tele-fluroscopy. Post-care debriefs can also be performed with the outside team to review possible mistakes and suggest alternative actions in future cases. A software programme can accomplish this phase without the inconvenience of travel and a care team away from their institution.

3. Delivery phase with indirect supervision: The external team can participate in post-case debriefs, and review the actions taken, the angiographic images and the early clinical outcomes, with performance improvement adjustments suggested.

4. Audited independent practice: An external centre team reviews metrics (door to injection, door to reperfusion, TICI score) and outcomes (modified Rankin score at 90 days, mortality rate), ensuring that there is an improvement plan towards the recommended society guideline metrics.

The expending techniques, improved equipment and continued research will likely result in expanded indications for EVT in acute stroke care. Given the volume of EVT procedures required, the time limitation in patient transfer and the limited number of neuro-interventional radiologists available, vascular and interventional radiologists are best suited to participate in this care.

We believe that a structured approach to programme implementation, with graduated levels of supervision and continued quality improvement is essential to achieve success.

Experience and lessons learned in a stroke endovascular thrombectomy programme

Alexandre Menard

University of Ottawa in 2015 before carrying out postgraduate studies and a clinical fellowship in diagnostic radiology at the University of Toronto. He is currently a radiologist specializing in diagnostic radiology at Kingston General Hospital, and is also the undergraduate director of the department of diagnostic radiology at the Queen’s University School of Medicine in Kingston, Ontario.

References:
Please note that September 11 is Catalonia’s national holiday. It may be more difficult than usual to get around the city, as public ceremonies will be going on throughout the day.

Traditional celebrations will take place throughout the morning in the area surrounding the Arc de Triomf.

Additionally, a mass demonstration will take place in the afternoon between approximately 15:30-19:00 in the Plaça d’Espanya area, including Paral·lel, Creu Coberta, Tarragona, Mª Cristina, Gran Via and Passeig de Gràcia. The flow of traffic and density of public transit in these areas and their surroundings will be significantly impacted.

The city police recommend using the ring route to more easily get around during this time. Delegates should allow ample transport time if they plan to connect to the airport on September 11.

Important Travel Notice: September 11

Join us for a meet & greet with CVIR Endovascular’s Editor-in-Chief

CIRSE’s journal publishing research in the field of endovascular therapy

Stop by the journal’s booth for a chat with Prof. Jim Reekers

Today, September 10 at 13:00-14:00

The CVIR Endovascular booth is located in the exhibition hall, outside Auditorium 2

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Prostatic artery embolisation (PAE) is emerging globally as a minimally invasive alternative to surgical therapy for the treatment of bladder outlet obstruction (BOO) caused by benign prostatic hyperplasia (BPH). As of today, the published data obtained from more than 2,000 PAE procedures has shown its efficacy in treating lower urinary symptoms (LUTS) secondary to BPH, with a favourable side effect profile, with short to very short recovery time (1,2). Recently, PAE was added to the NICE guidelines as an accepted technique for the treatment of BPH (3). Based on current evidence, these guidelines define PAE as an effective and safe technique. The procedure has certain advantages: it can be done on an outpatient basis, there is no need for urinary catheterisation, it is a painless procedure, and there are no surgical limitations (anticoagulant/anti-aggregant therapy, size of prostate, etc.). However, PAE has not yet been recognised by the European Association of Urology (EAU) in the American Urological Association (AUA) (4,5).

To date, only three randomised clinical trials have been published comparing the efficacy and safety of PAE versus TURP for BPH (5-7). Gao et al. (5) published the first clinical trial, and had a significantly higher percentage of complications in the PAE group in comparison to the TURP group. This clinical trial was criticised, however, for only reporting the complications in the TURP group and overlooking the clinical outcome with PAE. The other two clinical trials, Carnevale et al. (6) and Abt et al. (7), reported a higher number of complications in the TURP group than in the PAE group, being also more severe. Pisco et al. published a randomised clinical trial comparing PAE and open prostatectomy (OP) (8), with a complication rate of 31.2% in the OP group and 8.8% in the PAE group.

Complications should be graded with the modified Clavien-Dindo classification system (9), with grades I and II considered minor complications and grades III and IV considered major complications. PAE has a low complication rate, and most of these complications are not clinically significant. Major complications are rare, and only 7 major complications have been reported in 1,800 patients. Picco et al. (10) published long-term outcomes in 630 patients with a minor complication rate of less than 10% and a major complication rate of less than 1%.

Post-embolisation syndrome (PES) is one of the most common complications after PAE, presenting as pain, edema, temporary worsening of previous symptoms, fever, etc. It usually disappears within a week, and it should be managed with symptomatic treatment. In a recently published meta-analysis, Mallings et al. (11) reported a PES rate of 3.6%.

Acute urinary retention (AUR) is caused by urethral compression due to edema, and often disappears within the first 3 days (12). Picco et al. reported an AUR rate of 2.4%, whereas Gao et al. (5) reported an AUR rate of 25.9%.

Non-target embolisation (NTE) is the most serious complication interventional radiologists have to deal with, it is generally self-limiting and is resolved with conservative management. Two cases of bladder wall ischaemia requiring partial surgical resection have been published (13,14), and Moreno et al. (13) described in 2013 transient ischaemic rectitis, which was successfully treated with conservative management. Another important NTE is ischaemic balanitis (penile ischaemia), which usually occurs due to the presence of an accessory pudendal artery or penile anastomosis, presenting with local pain, erythema, ulcerations and sexual dysfunction. Carnevale et al. reported a case of penile ischaemia observed on MRI at 3-month follow-up, but bone or skin ischaemia is rare because of their rich vascular network. Zhang et al. (14) in 2018 reported seminal vesical ischaemias (ischaemia and haemorrhage) observed in MRI during follow-up in 6.9% of the patients. Clinically, patients with seminal vesical haemorrhage or ischaemia usually present with haematospermia.

Transient haematuria, haematospermia and rectal bleeding are minor adverse events which disappear within the first week and are reported in 76.8%, 8%, and 5.9% of cases, respectively (15).

Ejaculatory disorders are rare after PAE, but Abt et al. (7) encountered this complication in their series in a 56% of patients. Although this is less than with TURP, it was unexpected for them, and they cannot provide an explanation for it. The UK-ROPE study reported a 24.1% rate of retrograde ejaculation after PAE, and 48% of retrograde ejaculation after TURP. However, most patients in the PAE group reported that the problem had resolved from the medication and had existed prior to embolisation.

The radiation exposure of patients who underwent PAE is similar to that reported for other complex interventional procedures (15). Laborda et al. (16) published a case of radiodermatitis after PAE, necessitating 72 minutes of fluoroscopy with a dose-area product of 8,023.102 cGy-cm².

So far there has been no mortality or urinary incontinence reported after PAE.

There are some important points to consider when endeavouring to minimise post-PAE complications:

- Pre-procedural CT angiography (CCTA): CTA prior to PAE delineates the arterial anatomy and possible anastomosis, and facilitates procedural planning. This results in a reduction of procedural time and radiation, as well as NTE complications.

- Use of cone-beam CT: Modern angiographic equipment with cone-beam CT is vital for the visualisation of potential non-target vessels. May be used in case of doubt, as it may occasionally show small anastomoses to the rectum or penis, better than with DSA.

- Coil embolisation of anastomosis: We should coil-embolise the anastomosis from the prostate arteries to rectum, penis or bladder, to avoid NTE (Figs. 1 and 2).

- Radiation protection protocols: Using cone-beam CT demonstrates an anastomosis with penile artery or a rectal bleeding (Figs. 1 and 2). Cone-beam CT is useful to avoid NTE.

Case report

Dr. Inigo Insauti is a urologist at the University Clinic of Navarra (UCN Pamplona), Spain and primarily specialises in prostate embolisation, however he has various other specialisations. He is currently a vascular and interventional radiologist at the University Clinic of Navarra (UCN Pamplona). With more than 12 years of comprehensive experience, Dr. Insauti teaches courses on PAE to urology workshops as well as presenting at both national and international conferences. In addition to CIRSE, he is also a member of various societies including the Spanish Society of Medical Radiology (SERAM), the European Society of Radiology (ESR) and the Spanish Society of Vascular and Interventional Radiology (SEIREN).
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Our research is only made possible through the research grants provided by our trusted partners in the medical device industry.

Partners & Service Providers
CIRSE partners with prestigious academic institutions such as EORTC or FFCD and contracts high-quality suppliers to get the job done.

Visit us at our booth located in the entrance hall to find out about our projects and services in IR research.

Whether you have an idea for a project, are a current CIRSE study investigator (or would like to become one) or work in the medical industry, we’re interested to hear your unanswered questions and eager to help you find an answer.

Don’t miss
the Morbidity & Mortality Conference tomorrow at 11:30 in Room 112

The 2019 Morbidity & Mortality Conference will analyse vascular and non-vascular IR cases which have led to complications or deaths that could have been avoided. This provides a valuable learning experience for attendees, who can benefit from the experience and insights of their colleagues, allowing them to avoid the same pitfalls.

Once presented with a case, audience members will be asked to vote on their preferred course of action – allowing you to see how you might have fared when faced with that difficult decision.

Don’t miss this golden opportunity to learn from someone else’s mistakes!

MM 3401  11:30-12:30
Moderators: A. Hatzidakis (Iraklion/GR), A.G. Ryan (Waterford City/IE)
Treatments in metastatic thyroid cancer

Roberto L. Cazzato

Even though the lifetime risk of developing thyroid carcinoma (TC) is less than 1%, its incidence has almost tripled within the last few decades [1]; this is thought to be mostly due to the increased detection rate of TC offered by the large use of high-resolution ultrasonography.

TCs can be categorised by histotype, with the papillary (PTC) and the follicular (FTC) ones representing 90% of all TCs [2]. PTC and FTC share the same therapeutic strategies and have similar prognoses; for this reason, they are categorised within the same group known as differentiated thyroid carcinoma (DTC).

The medullary TC (MTC) represents the third most common histotype. According to the American Thyroid Association (ATA) guidelines [3], total thyroidectomy with or without subsequent remnant ablation with radioactive iodine therapy (RIT) is adequate to control the disease in 90% of patients presenting with a DTC; however, the remaining 10% of patients will develop a metastatic disease (especially affecting lung, liver and bones), thus needing further treatments including interventional radiological ones. In fact, in the setting of TC metastatic disease, the ATA guidelines [3] recommend local treatments including IR ones in two different scenarios:

• Prior to systemic treatments when a distant metastasis is symptomatic or at high risk of local complications.
• In case of a solitary metastatic lesion exhibiting an evolution despite systemic therapy.

Notwithstanding these relatively simple indications, therapeutic decision-making is often challenging due to the rarity, complexity and diversity of the real-life clinical scenario. Therefore, treatment selection often takes place following a deep per-case analysis performed by multi-disciplinary tumour boards in tertiary referral centres. Several factors are taken into consideration by the tumour board before referring the metastatic patient for treatment; these factors include the evaluation of the metastatic burden, its location and the associated cohort of symptoms, as well as the assessment of tumour sensitivity to the RIT, 18-FDG uptake, patients’ life expectancy, systemic disease progression rate, and local availability of physicians able to perform the treatment. Once the need for an interventional treatment and its purpose is established, the interventional radiologist in charge of such treatment may choose one or more percutaneous techniques including transarterial embolisation (TAE), percutaneous ablation and bone consolidation performed through percutaneous osteoplasty and osteosynthesis [4]. Although these techniques have long been widely applied in the field of interventional oncology, a substantial lack of experience exists with these techniques in the specific setting of metastatic TC.

Therefore, current practice is still somehow empirical, derived from experiences achieved with other tumour histotypes or from a few small retrospective case series dedicated to metastatic TC.

Nevertheless, there are some specific metastatic TC scenarios that may be reasonably suitable for interventional treatments. In fact, a slow-evolving, macro nodular (<3 cm) lung disease [5] may reasonably benefit from percutaneous ablation performed with a curative intent. Similarly, percutaneous ablation may be proposed in oligometastatic small-sized liver disease. On the contrary, in the case of diffuse liver disease, lipiodol- doxorubicin TAE has been proposed with promising results [6]. Concerning metastatic bone disease, a more extensive literature is available as compared to that regarding the lung and the liver; and such literature has highlighted that all the available interventional techniques may be applied alone or in combination with other treatments in patients with metastatic bone disease [4]. In particular, TAE has been largely applied for the treatment of painful bone metastases, and good clinical results in terms of symptom control and serum thyroglobulin decrease were noted, especially when TAE was combined with radiation therapy, surgery and RIT [7]. On the other hand, bone consolidation has also been largely applied to treat the weakened, often lytic, metastatic bone with good clinical results reported [4].

In conclusion, the metastatic disease from TC represents a rare but complex clinical scenario, often requiring a deep per-case analysis in multi-disciplinary tumour boards from tertiary referral centres. Direct localised treatments including interventional radiology procedures may play a key role in providing a timely palliative or curative treatment in accordance with patients’ clinical status. However, due to the substantial lack of data validating the interventional therapies in the specific setting of metastatic TC disease, dedicated prospective series are desirable to establish the exact role of interventional therapies with particular regard to percutaneous ablation applied with a curative intent in oligo-metastatic patients.

References:
1. NCCN Clinical Practice Guidelines in Oncology Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. J Clin Endocrinol Metab. 2006 Jul;91(7):2496–9.

Wednesday, September 11, 08:30-09:30, Room 113
The 20 most important studies on hepatocellular carcinoma

The 5 most important studies on ablation
Laura Crocetti (Pisa/IT)

The 5 most important studies on transcatheater arterial chemoembolisation
Katarina Malagari (Athens/GR)

The 5 most important studies on transarterial radioembolisation
Alban Denys (Lausanne/CH)

The 5 most important studies on systemic treatments
Yasuaki Arai (Tokyo/JP)

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FP 3008 Super Tuesday

Moderators: M.S. Johnson (Indianapolis, IN/US), T.J. Kroencke (Augsburg/DE)

3008.1 Impact of combined coiling and liquid sclerotherapy compared with coiling only on symptoms of pelvic congestion syndrome: a randomised controlled trial
M.A.H. Soliman; Mansoura/EG

3008.2 Randomised controlled trial comparing drug eluting balloon versus conventional balloon angioplasty for below the knee arteries in patients with critical limb ischemia
B.S. Tan1, A. Patel1, F.G. Irani1, U. Pua1, T.T. Chong1, S. Leong1, G. Tari1, E. Chari1, K. Damedhassari1, N.K. Kanaddi1, L.H.H. Quek1, Y. Wei1, S. Chandramohan1, P. Kumar1, J.M.E. Chua1, B.H.G. Lo1, K.-H. Tay1; 1Singapore/SG, 2Leiden/NL

3008.3 Totally percutaneous deep foot veins arterialization: a single centre experience
B. Migliara; Peschiera Del Garda/IT

3008.4 Viable allograft intervertebral disc augmentation: preliminary results and safety data in the first 24 patients
E. Yoon1, D.P. Beall2, D. Wagoner1; 1Edmond, OK/US, 2Oklahoma City, OK/US

3008.5 Intra-operative and post-operative pain management of conventional transarterial chemoembolization (cTACE) for hepatoocellular carcinoma (HCC) by different route of intraarterial lidocaine administration: a randomized controlled trial
Y.-D. Xiao; Changsha/CN

3008.6 A comparison of retrievability and indwelling complications of Celect and Denali infrarenal vena cava filters: a randomized controlled trial

3008.7 MR-guided focused ultrasound (MRgFUS) versus external beam radiation therapy (EBRT) for the treatment of painful bone metastases: a multicenter, phase III, randomized case-control trial
S. Dobahou, A. Napoli, C. Marracchio, R. Scipioni, G. Alferi, D. Fiore, C. Catalano; Rome/IT
Massive pulmonary embolism during thrombectomy

Paul E. Andersen, EBR

Venous thromboembolism (VTE) includes deep vein thrombosis (DVT) and pulmonary embolism (PE) and is associated with a high morbidity and mortality. VTE may result in long-term complications including post-thrombotic syndrome (PTS) for DVT, post-pulmonary embolism syndrome and chronic thromboembolic pulmonary hypertension for PE, and death [1]. VTE is the third most common cardiovascular-related mortality after myocardial infarction and stroke [2].

The immediate risk from inferior vena cava (IVC) thrombosis is PE, which occurs in over 30% of cases [3], while long-term complications are chronic venous insufficiency and PTS, and occur in up to 20-50% of non-resolved thromboses.

Malignancies may cause tumour DVT. Enhancement of thrombus on CT, PET/CT or MRI may help make the diagnosis. A tumour thrombus is not expected to respond to anticoagulation (AC), whereas AC is the appropriate treatment for traditional or bland thrombi.

When VTE is suspected, anticoagulation with low molecular heparin followed by oral AC should be initiated unless there is a contraindication like an increased bleeding risk, and a risk assessment should be performed before and during AC therapy [4]. In addition to AC, systemic thrombolytics in the case of PE, catheter-directed thrombolysis (CDT) or pharmacomechanical catheter-directed therapies (PMCT), surgical intervention (pulmonary embolectomy), or placement of inferior vena cava filter may be indicated.

Spontaneous recanalisation of iliofemoral deep-vein segments is very poor with AC alone [5] and the unfavourable risk/benefit ratio of systemic thrombolysis and surgical thromboembolectomy has led to the development and widespread utilisation of CDT with or without PMCT in the treatment. There are, however, no randomised trials or society guidelines for treatment of DVT, so careful selection and local experience and technical expertise in CDT and PMCT are essential for successful endovascular management of IVC thrombosis [6]. There are no trials comparing the different catheter-based treatments, but each have shown reasonable efficacy.

AC does not remove or destroy thrombus and the rationale for active rather than passive thrombus removal is that doing so improves luminal patency, restores valvular function and has the potential to reduce the severity of PTS [2]. The intention to treat DVT is to restore patency and preserve valvular function by removing the DVT and thereby avoid PTS. Thrombolysis and/or thromboembolectomy improves the rate of patency of the iliofemoral venous segment [7]. There is, however, no evidence that the addition of CDT or PMCT to AC results in a lower risk of PTS, but may result in a higher risk of major bleeding [8].

It is intuitive to assume that use of mechanical thrombectomy devices will increase the risk of distal embolisation, but it has not been possible to find any increased thrombus embolisation into IVC filters during CDT for proximal deep-vein thrombosis [9]. Many operators will, however, place a retrievable IVC filter only in high-risk patients, such as those with large floating thrombus and those with reduced lung reserve. IVC filters may be beneficial during the early course of an acute DVT in patients that cannot be anticoagulated, but later on, the filter is more likely to cause thrombosis of the cava than to prevent PE [10].

Surgical pulmonary embolectomy for the initial treatment of PE is reserved for patients with massive PE, shock despite heparin and resuscitation efforts, and failure of thrombolytic therapy or a contraindication to its use. There are no randomised trials evaluating this procedure. An operative mortality of 10-20% has been reported in these patients.

Table 1:

<table>
<thead>
<tr>
<th>Systemic AC</th>
<th>Indicated in all DVT</th>
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<tbody>
<tr>
<td>Systemic thrombolysis</td>
<td>Indicated in PE</td>
</tr>
<tr>
<td>Surgical thrombectomy (open or balloon)</td>
<td>Indicated in cases refractory to less invasive interventions</td>
</tr>
<tr>
<td>CDT</td>
<td>DVT with floating thrombus or big thrombus volume and/or PE</td>
</tr>
<tr>
<td>Mechanical thrombectomy</td>
<td>When thrombolyses are contraindicated</td>
</tr>
<tr>
<td>(combined) PMCT</td>
<td>Single-session treatment of DVT</td>
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References:
Building on yesterday's recommended session – an overview of trauma interventions

Traumatic injuries can arise from traffic accidents, violent encounters, falls or occupational injuries. They can affect anyone, regardless of age or health, and rapid treatment is often essential for survival. The best outcome depends on the speed, efficiency and skill of the trauma team, as well as the availability of the most appropriate medical technology. The role of IR’s catheter-based techniques is crucial, and can help reduce the frequency of tragic outcomes. The following overview will explore how IR is becoming a front-line treatment for traumatic injuries.

How IR can help
IR plays various roles in trauma management. Interventional radiologists are uniquely prepared to both perform and interpret diagnostic scans, and if indicated, can then deliver minimally invasive treatments. IR makes it possible to perform life-saving techniques throughout the body, from managing blood vessels to major organ groups. IR has been used to treat injuries of the abdomen, chest, limbs, neck, face and head, for both blunt and penetrating injuries.

Some injuries are more common than others, and some are more suited to IR treatment than others. IR is particularly well-suited to areas where it would be impossible or too risky to perform a surgical intervention, such as the pelvis, and many larger trauma units now include IR as a first-line treatment for certain injury categories.

Though the techniques offered are first-rate, many accident patients suffer with multiple injuries and may therefore need multiple therapies, including those outside of IR. Interventional radiologists must work together with traumatologists, surgeons and other specialists to ensure the best possible outcome for each individual situation.

Penetrating and blunt injuries
Across all ages, road traffic injuries are by far the most common injury type seen in accident and emergency departments, including any injury caused by blunt force, such falling from a height, or being hit by a car or blunt object. Penetrating trauma, which includes injuries such as bullet or stab wounds, is comparatively rare in Europe, but still occurs frequently.

IR in solid organ trauma management
Solid abdominal organs, such as the liver, kidneys or spleen, are an essential area of specialisation for the trauma IR. Abdominal surgery is risky for patients, as there is an increased chance of infection and/or additional blood loss. Additionally, it’s often just not suitable for the situation – if a force to the liver has caused bleeding throughout the organs, a surgeon will not be able to do much solve the problem. An IR can use minimally invasive techniques to assess the problem, locate and selectively embolise the main source of bleeding.

Penetrating and blunt injuries
In trauma, many patients die from complications rather than the injury itself, so choosing the treatment method that involves the least number of complications is logical, and conservative treatment should be used if it’s at all possible. If a CT shows an enlarged haematoma or large vessel injury, IRs can block it off using coils and diagnostic catheters to treat puncture wounds.

To summarise!
Interventional radiology has a great deal to offer the field of trauma management. Not considering IR treatments for trauma patients can result in serious consequences and complications. If these benefits are to be realised, their use in common practice must become more widespread. It is crucial to have centres with full diagnostic and treatment capacity, and multidisciplinary teamwork with a planned workflow at the centre is vital in ensuring the best possible outcomes for patients.

Keep learning about IR after CIRSE 2019!

1. CIRSE Publications
   Students can get acquainted with CIRSE and interventional radiology through CIRSE publications which are intended to inform the IR community about current happenings and support interventional radiologists in their daily practice. The society newsletter, IR News, is available to access online. Likewise, all current and past editions of the Congress Newspaper can be read online year-round.

2. CIRSE Journals
   Founded in 1978, CardioVascular and Interventional Radiology (CVIR), is CIRSE’s official journal. CIRSE student members enjoy free online access! Selected free articles are also available through CVIROnline.org. CVR Endovascular, a new journal focusing on the growing endovascular field, is a multidisciplinary open access and open peer-reviewed journal. Articles from CVR Endovascular can be read online at CVREndovascular.org.

3. CIRSE’s online educational resources
   The CIRSE Library and CIRSE Academy provide online, on demand knowledge at your fingertips. CIRSE student members enjoy full access to the library, where they can follow this year’s congress and catch up on the previous years as well. They are also eligible for reduced fees on CME certified courses through the CIRSE Academy.

4. Social Media
   Students can stay connected with the CIRSE community by following CIRSE’s social media channels. Facebook, Twitter, LinkedIn and YouTube will all provide up-to-date information on what’s going on in the world of interventional radiology. CIRSE’s YouTube channel engages audiences with special topic segments and commentaries on IR’s newest innovations. Through Facebook, CIRSE also offers content tailored to students (CIRSE students) and residents (European Trainee Forum).

5. National IR Society
   Looking to get involved in IR on a national level? CIRSE strives to forge strong partnerships with European and international IR societies, with the objective to advance interventional radiology worldwide. Medical students wishing to increase, improve, or get involved in the IR opportunities available to them in their country should reach out to their national society for support. For a list of national IR societies, visit the CIRSE website.
Students in the Spotlight

Maria Ioannidi  
Athens, Greece  
National and Kapodistrian University of Athens

Sorin Nicolae Blaga  
Cluj-Napoca/Romania  
University of Medicine and Pharmacy “Iuliu Hațieganu”

Why did you decide to study medicine and why are you interested in IR?
Ioannidi: I chose medicine due to a variety of reasons. I was always keen on science and challenges. I felt that I had the interpersonal skills required in order to work with and understand the needs of patients, and I was thrilled by the idea that medicine offers you the scientific basis to improve the healthcare of the population. Moreover, I believe that IR can offer a dynamic career, where ‘cutting-edge’ scientific innovations have a practical application in various medical conditions.

Ioannidi: During the 5th year of medical school, I decided that IR could be a potential specialty for me, so I tried to figure out how I can get involved as a student in this field. I reached out to my professors at the 2nd Department of Radiology of the General University Hospital “ATTIKON”, who strongly advised me to join CIRSE and its annual conference. I think that the Student Programme especially is a great opportunity for medical students to get to know IR and its advantages as a future career.

Why did you choose to study medicine in your country? Have you ever considered studying medicine in another country?
Ioannidi: The University of Athens is the largest public institution of higher education in Greece, and the Athens Medical School is considered to be among the best medical schools in Europe, with a strong tradition in the medical field and a very high research output. It is considered extremely challenging to enter the Athens Medical School, since candidates should achieve the highest grades possible at the final examinations.

So when I achieved a place at this medical school, no thought crossed my mind to study elsewhere! Needless to say, of course, that after concluding my studies in Athens, I will be more than willing to experience healthcare systems in other countries.

When did you hear about IR for the first time?
Ioannidi: I was informed about this medical specialty before I joined med school, but it was not until the 4th year of medical school and during my radiology rotation that I had the chance to become familiar with the applications of IR and visit the IR suite for the very first time! I still remember that there was a carotid arterial stenting procedure taking place at that moment, and I was more than excited!

What fields or topics in IR do you find most interesting?
Ioannidi: Although I really admire every different field of IR, I am extremely interested in interventional oncology. Interventional oncology remains a disruptive innovation challenging the traditional methods of cancer treatment with minimally invasive, well-tolerated cancer treatments that rely on the most advanced medical technologies to precisely target tumours and have promised to change the status of current cancer therapy. The most interesting fields are arterial applications of IR, such as introducing TAVI and the Rehabilitation County Hospital of Cluj–Napoca, at the Emergency Institute.

When did you hear about IR for the first time?
Blaga: I heard about IR for the first time two years ago, at the Medicalis Congress of students and young doctors which takes place every year at my university. There was a doctor there who talked about IR, especially the techniques used in interventional neuroradiology, approach routes, materials used, the procedure itself, etc.

Why did you decide to attend the Student Programme?
Blaga: Colleagues informed me that the CIRSE Congress is the biggest meeting between interventional radiologists and doctors from other related specialties like interventional cardiology, interventional oncology, etc. I decided to attend the Student Programme because I’m a general medicine student, I want to gain more knowledge about this domain of IR, to get more practical skills, to meet experienced physicians in this field, to make new friends from all over the world and have a lot of fun in the incredible city of Barcelona.

Why did you choose to study medicine in your country? Have you ever considered studying medicine in another country?
Blaga: I chose to study medicine in my country because I live in a large university centre of Romania, Cluj-Napoca, whose university has a long medical tradition, marking 100 years this year. There are many foreign students in our university which creates an ample, unique multiculturalism in Eastern Europe. If I were to study in another country, I would like to do an internship in a French-speaking country like France, Belgium, Switzerland or even Canada.

What kind of exposure do you get to IR at your university and within your undergraduate studies?
Blaga: In my university, interventional cardiology has the largest exposure. There are 3 angiography laboratories at the Heart Institute of Cluj-Napoca, at the Emergency County Hospital of Cluj-Napoca, and at the Rehabilitation County Hospital of Cluj-Napoca, where students are trainees or can go to summer internships. There are a wide range of interventions such as implantation of aortic endoprostheses, angioplasty on lower limb arteries, etc. TAVI is also practiced at the Heart Institute.

What would be the destination where you would like to do your IR training?
Blaga: As I said above, the main destination where I would like to do IR training is France, a country where there are a lot of IR centres, and where many IR techniques have been practiced for the first time, especially in the field of cardiology, such as introducing TAVI by the renowned professor Alain Cribier.

What fields or topics in IR do you find most interesting?
Blaga: The most interesting fields are arterial interventions and aortic interventions. Topics that I find very interesting are real world endovascular management of claudication and diabetic foot, carotid artery disease, because today these pathologies are more and more common. EVAR-related topics are also very interesting to me, because I hope to be a cardiologist in the future and I want to find out more about the techniques behind these interventions.

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1 Dohse et al. 2014 EJNMMI
2 Dassen et al. 2015 CIRSE Abstract
3 Braat et al. 2017 Eur Rad
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