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REPORT ON THE SYMPOSIUM ORGANIZED IN ANTWERP ON 23.05.2013: NEW MILESTONES IN VASCULAR INTERVENTIONS

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During the last decade, we have witnessed nothing short of a revolution in angiography and vascular (neuro)interventional radiology. Developments in technology and equipment have opened a fascinating world of near-limitless possibilities. Minimally invasive endovascular treatments have been developed and optimized for numerous indications where, previously, open surgery was the only option. Thanks to the implementation of new angiographic equipment and new materials (such as stents, coils, catheters, etc.), we are now able to treat patients with less invasive means. In order to deal with complex vascular lesions, multidisciplinary teams (with active participation of various medical specialists) have found their way to the angiography suite and vascular intervention unit, which has become a viable alternative to the operating room (OR). This has led to a significant increase in the number of vascular procedures and interventions performed in the department of radiology.

The department of radiology at Antwerp University Hospital has invested in the installation of two new angiography suites, to accommodate the diverse caseload, with optimal flexibility and workflow control. One room contains a biplane high-resolution angiography unit, which is mainly used for interventional neuroradiology procedures; the other suite is equipped with an articulated robotic arm, which makes hybrid procedures possible, and is mainly used for non-neuro applications. Both installations have allowed our specialists to provide excellent clinical patient care, with superb image clarity, while lowering the radiation dose. The success of this project, and the growing interest for minimally invasive multidisciplinary approaches to (neuro)vascular diseases, has encouraged us to organize a symposium entitled "New milestones in vascular interventions". This event took place on 23rd May 2013 at Antwerp University Hospital, and the faculty highlighted the latest developments in vascular interventions. Speakers from the department of radiology (angiography and vascular intervention unit (Fig. 1)) joined forces with specialists from various clinical disciplines to present an overview of new milestones in vascular interventions.

Fig. 1. — Vascular interventional radiologists at Antwerp University Hospital in the angiography suite with the robotic C-arm. From left to right: Dr J. Maes, Prof Dr P.M. Parizel (chair, Dept of Radiology), Dr O d'Archambeau (section chief angiography and vascular interventional radiology), Prof Dr M. Voormolen, Dr F. De Belder and Dr T. van der Zijden (Dr H. Fransen and Dr F. Delrue are absent).

Prof Paul Parizel (professor and chair, Dept of Radiology) opened the symposium, welcomed the participants, and thanked the audience for their interest and support. The first keynote speaker, prof Phillipe Jorens (chief of the Medical Council at Antwerp University Hospital, chair Dept of Intensive Care) emphasized that investing in equipment and human resources for angiography and interventional radiology is expensive, but ultimately provides a positive cost-benefit balance, for the patient and for the hospital. One of the missions of an academic center is to develop new treatments and to provide the setting in which this can be achieved. The current and (future) possibilities of the angiography equipment were highlighted by Dr Heinrich Kolem (CEO angiography and interventional X-ray systems business unit, imaging and therapy systems division, Siemens Healthcare, Germany). Optimized X-ray programs for various procedures, 3D angiography, CT angiography, flow- and perfusion imaging, help to improve diagnostic and therapeutic vascular procedures, with limited radiation exposure for both patient and performing staff. In this new era of invasive vascular procedures and multidisciplinary teams, support from our colleagues from the department of anesthesiology is crucial. Dr Luc Sermeus (senior staff member, Dept of Anesthesia, medical coordinator operating theater) emphasized the difficulties and risks of performing procedures under general anesthesia outside the OR.

The last decade has seen a progressive change in the type of procedures performed in the angiography suite. It is not so long ago that the majority of examinations were diagnostic (digital subtraction) angiography procedures. They were mainly used to diagnose various vessel diseases, such as stenoses and occlusions of the major peripheral arter-

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ies. Nowadays, diagnostic catheter angiography has been largely replaced by other, non-invasive modalities such as CT-angiography or MR-angiography. Continuous improvements in multi-detector CT-technology have made it possible to scan a large area with thin slices, at high speed, and with a limited radiation exposure. These sections can be computer processed on a workstation in order to generate volume rendered images and 3D images in every plane. Thus, in many centers CT-angiography has become the method of first choice for imaging of vascular diseases. Disadvantages of CT-angiography remain the need for iodinated contrast agents, and the radiation dose. These shortcomings can be (partially) avoided by performing MR-angiography, which has the great advantage over CT that no ionizing radiation is used. MR-angiography can be performed with intravenous injection of a Gd-chelate contrast agent, but, in many cases, MR-angiography images can be produced without the use of a contrast medium (time-of-flight angiography, either in 3D or 2D mode).

The technological improvements of CT- and MR-angiography have led to a decrease in the number of diagnostic catheter angiography procedures for imaging vascular diseases. However, the decrease in the number of diagnostic procedures has been more than compensated by the spectacular growth of therapeutic procedures, and vascular interventional (neuro)radiologists are busier now than ever before. During the last decade, vascular interventional treatments of all kinds of vessel diseases, from head to toe, have become the procedure of choice, thereby replacing certain types of surgical procedures (e.g. neurosurgery, vascular surgery). The fast-paced development in interventional vascular (neuro)radiology has also opened new indications, most notably in the treatment of cerebral and peripheral vascular diseases, and more recently also in oncologic diseases.

The success of vascular interventions is driven by the improvement of materials, such as (micro-) catheters, guide wires, balloons, stents, (micro-) coils etc, which have made access to and treatment of vascular diseases possible. At the same time, improvements in the design and capabilities of angiography units have provided more detailed imaging options with greater spatial and contrast resolution and 3D imaging. Thanks to the implementation of flat panel technology in new generation equipment, it is also possible to generate CT-like images with the angiography unit.

Interventional (neuro)radiologists have come out of the dark, and have entered a brave new world that was traditionally the hunting ground of neurosurgeons, vascular surgeons and other medical specialists. This evolution has led to a more and more multidisciplinary approach to vascular diseases, where radiologists have both a diagnostic and a therapeutic role. At Antwerp University Hospital, interventional neuroradiologists are not only the mere purveyors of a technical procedure, but are also involved in the selection of patients, choice of treatment, and follow-up. Our interventional neuroradiologists have out-patient consultations, and take full responsibility for patient management before, during and after the procedure. Of course, this is done in close collaboration with neurosurgeons, and for each patient the best therapeutic option is discussed.

During the symposium "New milestones in vascular interven-

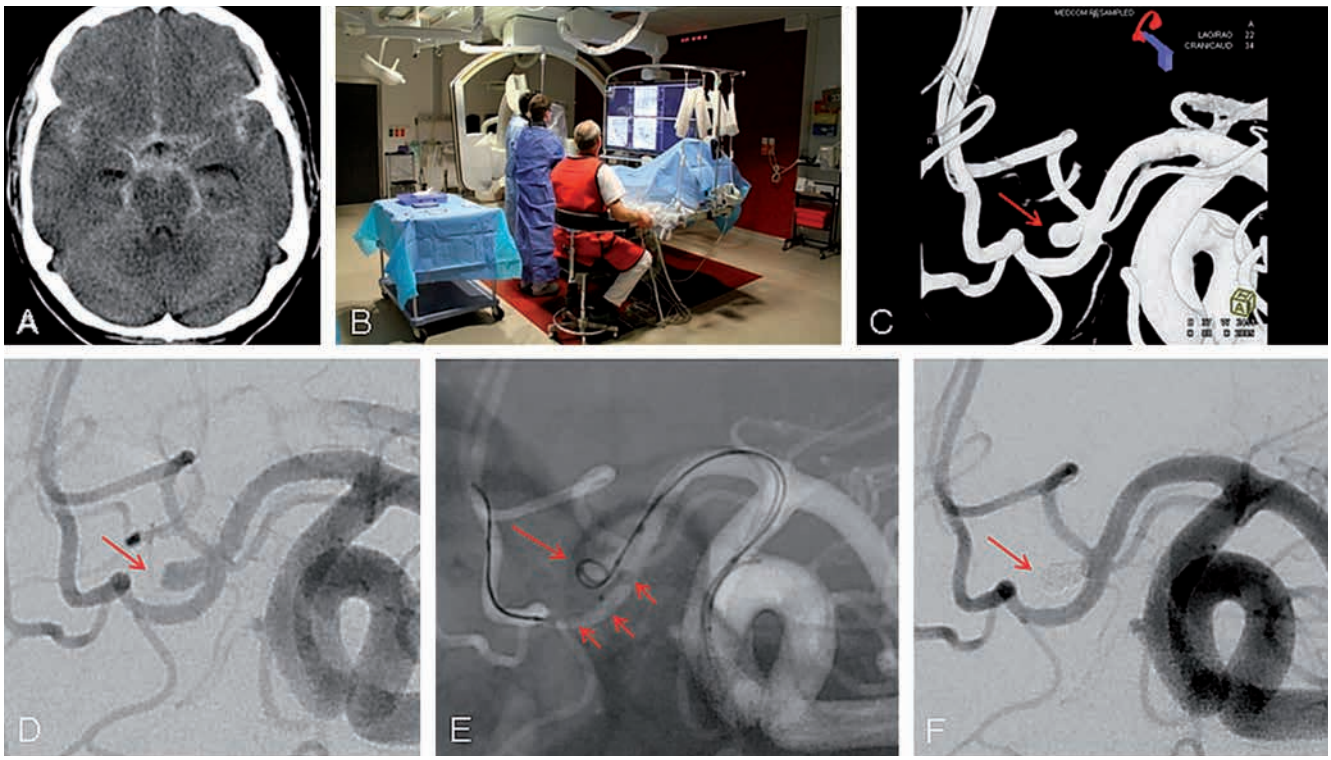

Fig. 2. — A. Axial slice of a brain CT scan showing a subarachnoid hemorrhage in a 43-year old woman who presented with acute headache. B. The patient is transferred to the biplane angiosuite. C. Cerebral 3D angiography of the left internal carotid artery is reconstructed on the workstation showing a 5 mm saccular aneurysm on the anterior communicating artery (arrow). D. Selective angiography shows the aneurysm (arrow) in the optimal work projection. E. The first coil is inserted through a micro catheter (small arrow). A supportive balloon micro catheter (large arrow) was placed to help occlude the aneurysm with coils. F. Angiography after occlusion with 6 micro coils shows that the aneurysm (arrow) is excluded from the circulation.

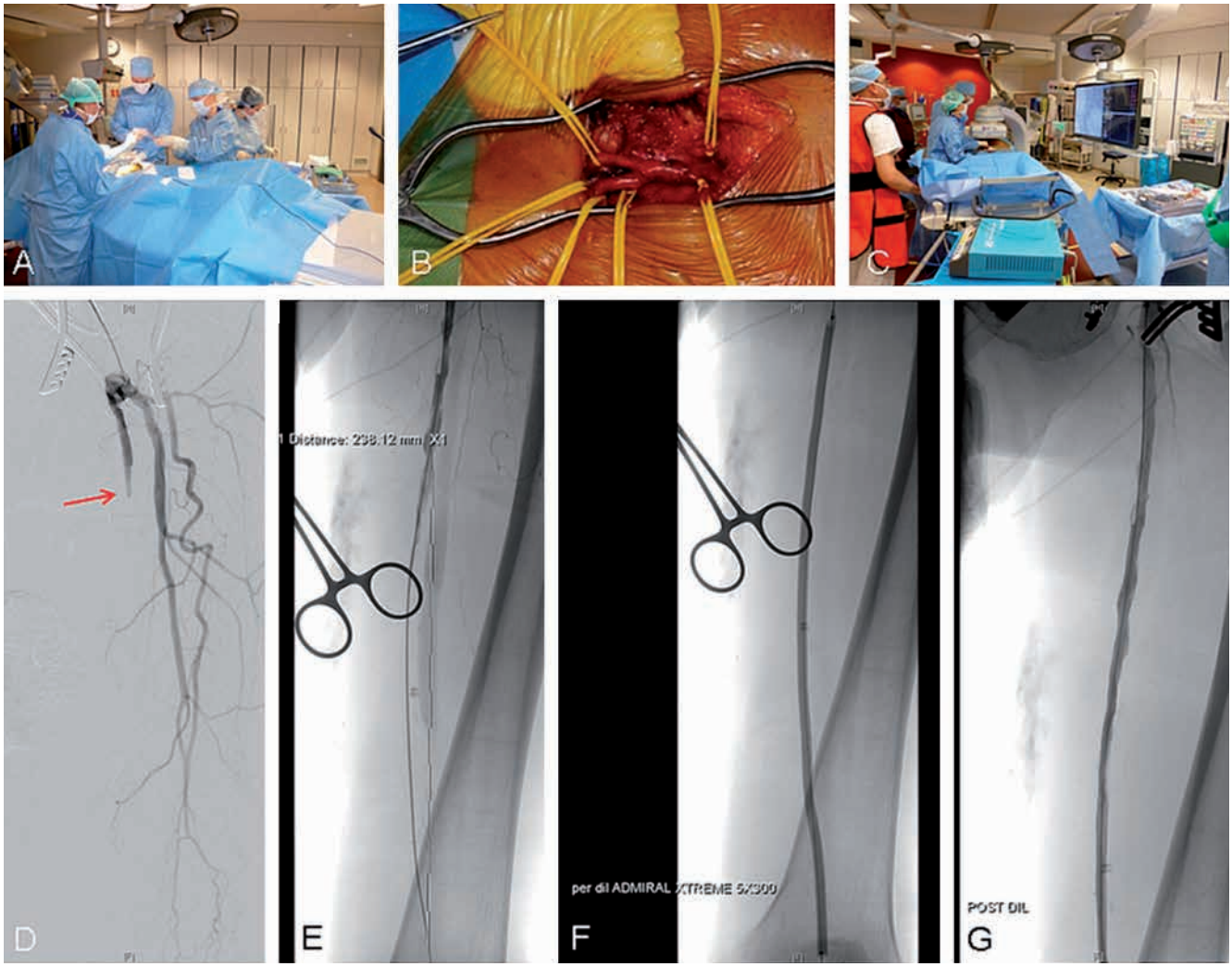

Fig. 3. — A. Hybrid procedure performed in the angiography suite in a 72-year old man with a left "cold leg" due to arterial occlusion of the femoral artery. B. First, surgical endarteriectomy of the left common femoral artery was done. The left femoral artery bifurcation is exposed. C,D. Subsequent catheter angiography of the groin and upper left leg shows a patent femoral bifurcation, but an occlusion of the proximal left superficial femoral artery (SFA) (arrow). The deep femoral artery is patent. E. Recanalisation of the SFA with a guide wire. F. Percutaneous transluminal dilatation with a 5 mm diameter and 30 mm long balloon catheter. G. Control angiography of the left leg shows reopening of the SFA.

tions", several speakers highlighted the most frequently performed vascular interventions in the department of radiology. During the first session, the close collaboration with vascular neurosurgeons was presented by several speakers. Prof Tomas Menovsky (vice-chair, Dept of Neurosurgery) emphasized that the integrated interdisciplinary treatment approach has resulted in a steady increase of the number of patients with neurovascular disorders referred to our department. He presented an overview of the latest developments in neurosurgical vascular techniques. A close collaboration between neurosurgery and interventional neuroradiology, in a non-competitive environment, improves patient care, and offers our patients the best-suited treatment option. Prof Menovsky gave two examples to illustrate this joint approach: the combined treatment of complex intracranial aneurysms by surgical vascular bypass techniques and endovascular vessel or aneurysm occlusion, and the combined approach of stepwise endovascular occlusion of intracranial arteriovenous malformations (AVMs) and subsequent surgical excision was shown. The next speaker, Prof Maurits Voormolen (senior staff member, Dept of Radiology, interventional neuroradiologist), presented an overview of state-of-the-art endovascular treatment of intracranial aneurysms and illustrated the possibilities of the newest biplane angiography equipment (3D, CT etc). All techniques, from simple coil occlusion to balloon and stent assisted-coiling were reviewed (Fig. 2). The final speaker in this session was dr Thijs Van der Zijden (staff member, Dept of Radiology, interventional neuroradiologist), who showed the increasing use of mechanical thrombectomy in stroke patients, for opening blocked blood vessels. In patients with acute ischemic strokes, who do not respond to intravenous thrombolysis, mechanical thrombectomy with endovascular removal of the clot in the intracranial artery, can be very useful in selected stroke patients. He presented an overview of the indications, techniques, complications, financial implications, and future developments, as well preliminary results of the first 25 patients treated at Antwerp University Hospital.

The next session was dedicated to the collaboration with vascular surgeons, with a focus on peripheral

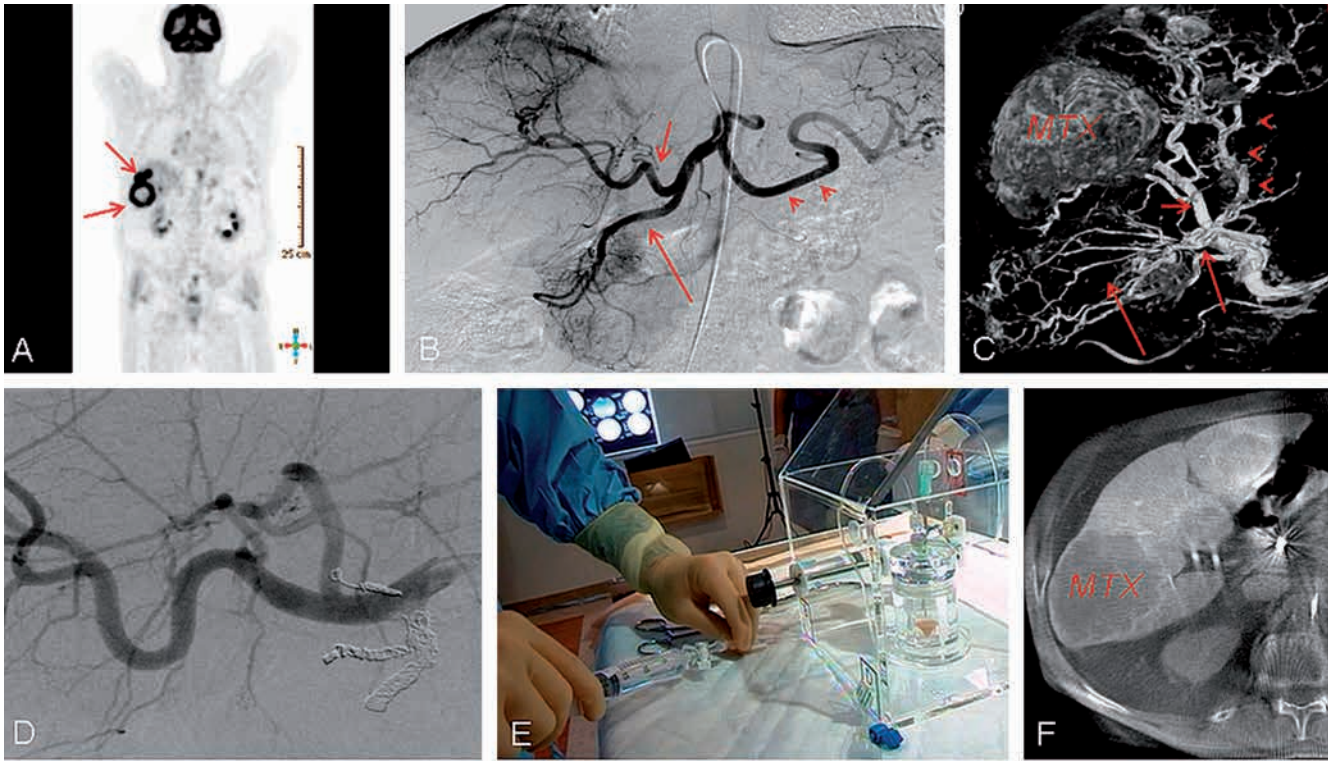

Fig. 4. — A. Nuclear PET scan with 18FDG in a 71-year old man with colorectal cancer shows multiple liver metastases (arrows). Normal uptake in the brain and kidneys. B. Selective angiography of the celiac trunk showing the arterial vascular anatomy of the upper intestinal organs with the hepatic (small arrow), gastroduodenal (large arrow) and spleen arteries (arrowhead). C. Volume rendered image of a 3D angiography of the common hepatic artery showing the hepatic artery (small arrow), the large liver metastasis (MTX), gastroduodenal artery and sidevessels (large arrow), and the left gastric artery (arrowheads). D. Angiography after proximal coil occlusion of several arteries originating from the hepatic artery (including the gastroduodenal artery) to ensure that the radioactive microspheres are selectively delivered to the liver and not to other organs. E. Manual injection of the radioactive microspheres. F. CT control with the angiography C-arm (axial slice in the upper abdomen) during embolization shows that the large liver metastasis (MTX) is treated (no enhancement).

vascular interventional procedures. Prof Paul Van Schil (chairman, Dept of Thoracic and Vascular surgery), emphasized the importance of partnership between interventional vascular radiology and surgery, and the importance of an up-to-date angiography unit with OR facilities. The next speaker, dr Patrick Lauwers (senior staff member, Dept of Thoracic and Vascular surgery), presented the evolution of peripheral and hybrid vascular procedures, from basic percutaneous transluminal angioplasty (PTA) to the most recent EVAR (EndoVascular Aortic aneurysm Repair). In hybrid procedures the patient undergoes both (minimal) vascular surgery and endovascular treatment during the same operative session under general anesthesia (Fig. 3).

The final session of the meeting was dedicated to the multidisciplinary management approach in oncologic patients, for example for the treatment of hepatic tumors. Dr Ivan Huyghe (senior staff member, Dept of Nuclear medicine), explained the contribution of nuclear medicine in preparing and monitoring radioactive drugs used in endovascular embolization of liver tumors. Dr Olivier d'Archambeau (senior staff member, Dept of Radiology, section chief angiography and interventional radiology) illustrated advanced techniques in chemo-embolization in patients with liver tumors (Fig. 4). He explained in detail the (angiographic) diagnostic examinations and extensive vascular interventions, needed for the treatment of patients with liver tumors by endovascular radio-embolisation with radioactive micro-particles. This technique is known by the acronym SIRT (Selective Internal Radiation Therapy). Prior to selective SIRT embolization of the liver, all collateral arterial connections have to be occluded. This can be checked by performing an abdominal CT scan while using the flat panel detector in the angiography suite. Next, the radioactive SIRT is administered in the angiography suite. Afterwards, the room needs to be checked for remaining radioactive material and decontaminated if necessary. This new multidisciplinary treatment approach illustrates the immense evolution of the vascular interventional possibilities.

At the end of the symposium, Prof Paul Parizel, summarized that the astounding developments in vascular and interventional radiology serve to confirm the pivotal role of the vascular interventional radiologist in multidisciplinary treatment teams. The disadvantage of this evolution is the huge investment to be made in equipment and staff, while most of the discussed vascular interventions receive only limited reimbursement in Belgium, or, in some cases, no reimbursement whatsoever. In conclusion, up-to-date angiography equipment offers a unique opportunity for multidisciplinary collaboration with specialists from other departments. Such a partnership creates a win-win situation for all the medical specialists involved, but especially for our patients who receive the best care, in a minimally invasive working environment.