Editorial

Why “Neuroendovascular Surgery”?

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For several years a discussion has revolved around the identity of so-called interventional neuroradiology. The real nature of endovascular operations is a crucial issue because it may provide important insights into the evolution of guidelines for improved training and the future development of this specialty. Furthermore it may also determine a potential review of the terminology related to this identity.

Scientific terms should express a precise meaning, avoiding confusion. Moreover they should reflect rationalism, based on science, etymology and history.

Could a term like “pharmaceutical neurosurgery” make any sense? What about “pharmaceutical and diagnostic neurosurgery”? Imagination can create endless combinations of names and adjectives. This can be artistic but not necessarily scientific. Terminology of course cannot be the main issue but obviously is not a by-product. Precision, clarity and distinction are some of the science’s features and scientific language should not be disregarded. As lack of clarity in expression most likely corresponds to lack of clarity in thought, likewise confusion in terminology is a reflection of confusion in theory and therefore with no clear theoretical foundation, no effective and rational action can be undertaken. On the other hand, science is not an isolated field of human activity. History inevitably affects this process and loads scientific terms with the course of the

concept’s development it represents. Discussion about terminology is often very helpful and an opportunity to re-evaluate not just the terms but what they actually represent.

In recent decades all physicians have become accustomed to the term “embolization” in close relation to the so-called subspecialty of “interventional neuroradiology”. It is noteworthy that “neuroradiology” is not (yet) established as a separated specialty in many countries around the globe. What could “interventional neuroradiology” actually mean? As I am not a neuroradiologist, I think I am eminently qualified to discuss the topic as this is definitely not a question of neuroradiology or any other kind of radiology.

Moreover, based on my personal experience while training in neuroendovascular operations in three departments of different origin for nearly three years – neurosurgical, neuroradiology and endovascular surgery – I should emphasise that in all these places I met only surgeons!

An analysis of the basic characteristics of endovascular operations actually helps us realize the true nature of these therapeutic actions.

What are the characteristics of neuroendovascular operations?

1) Minimal **skin incision** over a particular vessel, made either by a blade or a sharp needle. This is a constant first step of every en-

dovascular operation and any surgical operation. The location of this skin invasion depends on the vessel, either artery or vein which gives access to the lesion.

2) Therefore that particular vessel defines – and this is a second characteristic – the **approach** that can for instance be transarterial or transvenous and furthermore for instance transfemoral – transcarotid or transradial or direct percutaneous – trans(venous)sinus, etc. Approach characterizes any surgical operation.

3) The targets of such therapeutic action are mainly an aneurysm, an arteriovenous shunt or a vascular tumour. Successful occlusion of an aneurysm either selectively or with the parent artery, results in an inflammatory process with final exclusion of the sac from the circulation, shrinking and fibrous tissue with new endothelium formation. A similar process occurs in cases of AVM endovascular ligation of the nidus or tumour devascularization.

Inflammation and scar tissue formation is also a typical characteristic of any surgical operation.

4) Another constant characteristic of endovascular operations and absolutely significant regarding its nature is the **change to the pre-existing anatomy**.

Every surgical operation is characterized by anatomical interference.

5) “Χειρουργική” (chirurgike) and all derivative words like Chirurgie, Chirurgia or Quirurgia which mean Surgery have something in common. The implication of a **hand (“χειρᾶ”)** **operated action**. Endovascular operations like surgical operations are characterized by hand manipulation of some highly sophisticated instruments which, like traditional surgical instruments, have been invented, developed and adjusted to this particular endovascular use, being a prolongation of the hand. This direct physical contact and interaction of the operator with the patient’s body happens only in surgical therapy.

6) The vision of the operating field is obtained using radiation. Thus both a real either opacified or not and virtual (road map) field are depicted on a monitor. This **vision** constitutes a **prolongation of the eye** similar to the vi-

sion through the surgical microscope and/or navigation systems. In the future we might be able to use real endoscopic vision too through angioscopes.

7) **Purpose to cure** is another crucial characteristic shared by endovascular operations and traditional surgery. This characteristic pushes endovascular operations well beyond the borders of any diagnostic process and highlights the clinical nature of so-called embolization. In other words, it emphasises the fact that an endovascular operation is not just an action performed by a technician who is not in direct contact with the patient and ignores his/her clinical course and the disease itself.

8) Although **complications resulting in morbidity and mortality** are also common characteristics of any therapeutic action and any (mainly) invasive diagnostic intervention, in combination with 5 and 7 note also the clinical and surgical nature of endovascular procedures.

9) **Follow-up** is a factor that signifies mainly the clinical and only secondarily the surgical nature of endovascular operations.

Since the term “embolization” has a Greek origin, it makes sense to examine its etymological roots and meanings based on a reliable dictionary like for instance the “Demekakos” dictionary.

Generally the corresponding original word “εμβολισμός” in the Greek language implies a targeted and somehow aggressive action. It comes from the word “εμβολον” (emvolon) which means: 1. A sharp object which can be thrust in / driven in somewhere – a wedge; 2. A sort of ship attacking other ships by direct collision; 3. A piston; 4. A door lever/bar; 5. Penis (comic); 6. A wedge-shaped battle array; 7. An object that can provoke occlusion of a vessel (med). The latter meaning gives origin to the term “εμβολή” (emvole) which means embolism. Correspondingly, “εμβολισμός” (emvolismos) means 1. Thrust of a bullet by the ramrod into the gun chamber; 2. Complete course of an engine piston; 3. Attacking a ship by direct collision. In Greek it is often confused with the word “εμβολιασμος” (emvoliasmos) which means vaccination. In English it is easily confused with “embolism” which has a negative meaning being actually related to a disease rather than a treatment.

The Greek medical term for therapeutic occlusion of a blood vessel is “απολίνωσις” (apolenosis) which actually means tying around (ligation) using a linen thread. This of course reflects some historical elements but clearly highlights the concept of a deliberate occlusion of a vessel for therapeutic purposes using an available tool. Therefore “endapolenosis” sounds a more appropriate term for most endovascular procedures. It cannot be applied of course in operations to recanalize occluded vessels either mechanically or chemically.

The conclusion emerging from the combination of all the above characteristics makes it clear that neuroendovascular operations

1) consist of minimally invasive surgery. Minimally invasive surgery does not mean “minimally risky” surgery as often misconstrued by non-surgeons. Invasiveness refers just to the approach.

2) “Interventional neuroradiology” as a term is nonsense. In any case, a tool like the angiographic machine should not be the crucial link in the chain. Just as for instance the introduction of the microscope in neurosurgery could not turn neurosurgeons into pathologists, in the same way no instrument can transform any therapeutic action into radiology. The tool was actually transformed into an interventional angiomaachine by the action and not the opposite.

Why not “Endovascular Neurosurgery” then?

Actually it could and should be “endovascular neurosurgery”! In some countries neuroendovascular operations were actually developed in neurosurgical departments and therefore are considered a regular branch of traditional neurosurgery. Summarizing the particularities of neuroendovascular operations it becomes clear that their only technical difference from traditional vascular neurosurgery is the approach! Instead of breaking the walls of the “temple” called the skull, some thought that it would be more rational to open the natural vascular “door”! That’s how a new subspecialty was actually born! But this is not how a new subspecialty was developed. Somebody would notice the paradoxical development of these operations outside the body of most neurosurgical departments. So why, despite the significant contribution of distinguished neurosurgeons in the genesis and development of the endovascu-

lar approach and its tools, were endovascular operations not embraced and systematically developed mostly in neurosurgical departments around the world?

That’s a very interesting question. I can think of two good reasons. One is certainly the issue of “who possesses the tool”, in this case the digital angiographic machines. But this can only partially explain why since it is well known that for a long time in the past surgeons used to perform diagnostic angiograms.

Another reason surely is the inflexibility and therefore the inability of the main body of the neurosurgical family (and especially of its leading part) to foresee and promptly embrace and develop what could very nicely be a regular branch of neurosurgery. Some brilliant exceptions who pioneered this field and opened the way to cooperation and coexistence with neuroradiologists and neurologists actually saved the “honour” of neurosurgical family. But why did not this happen in a regular and general fashion? Was it an unfortunate event? I do not think so. It is widely known that in history there is no “whether” or “if”. What is written is written and often it is done in the best possible way.

The body of “interventional neuroradiology” or whatever we want to call it is now more than a different surgical approach. The fact that physicians from different relative specialties were involved and met in the same field created the opportunity for renovation, revision, comparison, expansion of knowledge, invention, enforcement of interdisciplinary communication, going back to basic sciences, re-evaluation of old assumptions and overall a better understanding and management of cerebrovascular disease. This mixture was a very fortunate encounter since, as often happens with mixtures, it can work miracles!

Some arguments for the term “interventional neuroradiology” coming from the neuroradiology camp are mainly historical and/or political in nature focusing on their huge contribution in this field and the “leadership” in the process of its further development. They actually represent a real and justified concern. Voices from the neurosurgical side against the surgical nature of neuroendovascular operations mainly carry the message of complete refusal to accept it but without any serious argument. It is surprising that sometimes they seem to enjoy treating their own scientific limbs in an extreme “surgical” by amputating them!

Coming back to terminology, for the same reasons "neuroendovascular therapy" as a term is in reality a "political" word game and/or a shy way of saying half the truth. By saying "therapy" some neuroradiologist colleagues try either to exorcise the "surgical evil" or to avoid arrows/attacks from both radiology and neurosurgery. From the radiology side these arrows would mean not just accusations of "betrayal" but mainly active reactions defending guild interests. From the neurosurgery side this would mainly mean accusations for an oblique claim to surgical titles and "splendour"! The crucial question actually is whether this new specialty is still a newborn that should grow up with fairy tales or whether it is already an adult that no longer needs myths. By definition and regardless of purposes, names, titles and terms, traditional vascular neurosurgery is a first degree relative of neuroendovascular surgery.

Despite all these arguments, potential difficulties and accusations the main issues remain 1) the establishment of prerequisites for training and 2) rules and environment of function for trained physicians now and in the future.

Strategies are required to make significant improvements to the clinical content of training and in particular to preserve the benefits of the contribution of relative medical specialties

and basic sciences for a patient-oriented development of this discipline in the future. As has been emphasised many times by several colleagues, these strategies would most likely be applied successfully in an environment of coexistence of relative subspecialties under the same "roof" of neurosciences.

In conclusion, regarding terminology, the main characteristics of endovascular operations confirm that they consist of minimally invasive surgery. Neuroendovascular surgery is the term best reflecting the real nature of this therapeutic action in a scientific way and simultaneously differentiates it from traditional neurosurgery taking into consideration the current situation regarding its application in combination with particular historical aspects of its development.

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