Pelvic arteries embolization (PAE) can be described as an obstetric procedure effective in emergencies, to use especially in managing uncontrollable acute uterine hemorrhage, if resistant to medical therapy. This procedure leads to immediate control of hemorrhages and restores cardiovascular status, especially in critical patients. PAE can be used as an alternative to removing organs.

Purpose of Study: To utilize the PAE in local anesthesia for management of acute uterine hemorrhage for cervical myoma in a critical patient, a fertile woman with concomitant cardiovascular stroke and in high-dosage of anti-thrombosis therapy, with severe anemia.

Material and Methods: This procedure was used in an University affiliated Hospital, by a selective catheterization of the left hypogastric artery with an a-magnetic coil and super-selective catheterization of the right uterine artery, instilling a mixture of micro-particles and an absorbable haemostatic gelatin.

Results: Authors have successfully completed this procedure in 40 minutes in local anesthesia, showed by stopping of iodated contrast fluid in vascular myoma network, with subsequent cervical myomectomy, whilst preserving uterus.

Conclusion: PAE allows, through super-selective catheterization of both uterine arteries or selective catheterization of hypogastric arteries, to instill a mixture of micro-particles, absorbable haemostatic gelatins or endovascular coils, mixed with iodated contrast fluid and, thereby, to stop bleeding. This procedure led to an immediate control of hemorrhages and restores cardiovascular status, as an alternative to removing organs.

Key Words:
Uterine myoma, Fibroid, Leiomyoma, Myomectomy, Uterine artery embolization, Uterine artery occlusion, Pelvic embolization, Microspheres, Nanospheres, Pelvic coil, Absorbable haemostatic gelatins, Cardiovascular stroke, Anti-thrombosis therapy.
permitting the immediate exclusion of the uterine vascular circle. Thus, PAE prevents possible post-partum bleeding or surgical bleeding due to placental diseases, conditions which lead to hemorrhagic shock. Literature offers very significant post-embolization results, both for the mini-invasive procedure as well as for the immediate restoration of cardiovascular control in patients with hemorrhagic shock.

The Authors have successfully used a selective and a super selective PAE in local anesthesia, in a fertile patient with a hemorrhage for cervical fibroid and high-dosage of anti-thrombosis therapy for concomitant cardiovascular stroke.

Case Report

A 42 year-old patient, smoker, 70 kg in weight and 160 cm in height, was hospitalized in an University affiliated Hospital, in emergency conditions, in the Unit of Intensive Cardiologic Therapy (UTIC), for a significant cardiovascular stroke with wide thrombosis of the whole interventricular anterior artery (IVA), which did not re-vascularize at a first attempt.

Clinicians began anti-thrombosis treatment with low molecular weight heparin (LMWH) at 16000 UIs/day, with the INR at 1.27. A coronaryography performed 24h after the cardiovascular stroke showed, in fact, only a partial blood vessel recanalization during LMWH treatment. The medical intent was to reduce the LMWH to 8000 UIs /day in the following days. However, after four days, the woman still showed massive genital bleeding leading to menorrhagia.

Despite the transfusion of 4 bags of concentrated red cells, the arterial pressure began to be unstable with a constant cardiac frequency of 110 beats per minute (bpm). The gynecological consultation detected the presence of a large, not stalked, bleeding cervical-myoma, of about 5 cm diameter, on the surface of the external uterine orifice.

The patient was immediately moved from the UTIC to the Gynecology and Obstetrics Unit of the same Hospital, for a massive cervical menorrhagia.

Due to the elevated female surgical risk and the poor haematic parameters (Hb 6, Hct 21.2% and GR 2,150,000), after a discussion among consultants (anesthesiologists, cardiologists, radiologists and gynecologists) and with the patient’s signed informed consent, it was decided to perform the embolization of the cervical-myoma, to stop cervical bleeding and restore suitable clinical conditions for a possible subsequent vaginal myomectomy.

The woman was immediately submitted to radiological interventionist procedure in local anesthesia with 20 cc of 2% diluted Carbocain, locally injected near the right groin, next to the access of the right femoral artery.

The arterio-graphic examination consisted of a percutaneous puncture of the right femoral artery and the intravascular introduction of various devices for intra-vascular catheterization, under direct fluoroscopic control.

Clinicians quickly performed the selective catheterization of left hypogastric artery by a 5F angiographic catheter VS1 (Cook Medical, Winston Salem, NC, USA), by means of an iodated contrast fluid water-soluble injection, Iomeron 400 (Bracco Pharmaceuticals, Milan, Italy). The catheterized artery was then obstructed, in its sub-ostial part, by a non-reabsorbable 12-60 mm diameter amagnetic Tungsten Nester® Embolization endoclip of 12-60 mm (Cook Medical, Winston Salem, NC, USA) excepting only the superior buttock artery, leaving free the distal micro circle, in order to facilitate a possible late revascularization of the uterus, the left ovary and the bladder (Figure 1).

Clinicians subsequently performed another super-selective micro-catheterization of the right uterine artery by means of a coaxial 3-F T3 Teflon catheter (Cook Medical, Winston Salem, NC, USA), checked by iodated contrast fluid water-soluble injection in the vase. The super-selective angiographic control made it possible to see the cervical-myoma as a round-shaped vascular network fibroid. The myoma bleeding probably

Figure 1. Closing of the hypogastric artery in the sub-ostial by a Tungsten 12-60 mm endoclip, downstream from the superior buttock artery.
being due to the breakup of the peripheral vascular network during expulsion from the cervix.

Hence, clinicians introduced a mixture of non absorbable micro-particles of 300-500 microns (Bead Bock Medical Corporation, Biocompatibles International plc, Farnham, Surrey, UK) of Polivinilpirrolidon (PVP), a plastic compound, of a solution of xilocaine (2 mg%) and iodated contrast fluid in the uterine artery, directly in the vascular network of the cervical-myoma.

Subsequently, a mixture of larger particles of 500-700 microns was again administered – under fluoroscopic control – in the distal part of the right uterine artery, to stop the residual microcirculation of the myoma (Figure 2).

The reduction of the arterial flow of the left uterine artery, due to the ostial occlusion of homolateral hypogastric artery, allowed the injection of the particles only from the right with consequent fibroid “flood” of the left cervical-myoma portion.

The puncture of the left femoral artery was no longer necessary for the catheterization of the right uterine artery (also referred to as “comfort catheterization”), since the right uterine artery had been catheterized with a catheter looping, through a standard radiological movement. The critical performance status of the patient did not require contra lateral groin puncture.

The procedure was completed in 40 minutes, with the infusion of three pockets of concentrated red cells. At the end of the procedure the woman referred pelvic pain from the vascular spasm and ischemia following the embolization. She was immediately treated and sedated with i.v. ibuprofen and tramadol diluted in 500 ml of physiological solution.

She was subsequently submitted to a 7-day antibiotic therapy with cephalosporin (ceftriaxone, 2 g daily).

After gynecological, clinical and instrumental check-ups, performed with transvaginal ultrasounds (Figure 3), after two and seven days, the patient was considered in good clinical conditions. In order to prevent further problems, gynecologists, therefore, performed intravaginal cervical myomectomy after 8 days from myoma embolization, without complications. The patient was discharged without further gynecological therapy and clinically and instrumentally followed up at 15, 30 and 60 days, without complications. The long term follow up of 3 years not reported any complications.

**Discussion**

Arterio-venous embolization was introduced in 1973 by Rosch et al\(^2\) for the correction of massive intestinal bleeding. The first uterine artery embolization dates back to 1975 and was performed by Goldstein et al\(^3\). The first author to perform an embolization in obstetric urgency for cervical pregnancy bleeding was Lobel et al in 1990\(^4\).
However, many things have changed in intervention radiology thanks, amongst other things, to the development of new materials, the production of miniaturized radiological instruments and experimentation in complex and high-transportable biocompatible biotechnologies.

Angiographic materials are currently much more flexible and biocompatible, radiological equipment is more sophisticated, with excellent digital amplifiers, computerized interface, and totally automated software management at high resolution. Moreover, these instruments are widely available in Italy and throughout Europe, thanks to experienced experts and surgeons being able to support the interventionist radiologists’ work.

Currently, emergency embolization in the presurgical phase is attracting more and more interest, being inserted in the "flow chart" amongst codified and routine clinical and surgical procedures, for immediate use in uncontrollable hemorrhage and obstetric-gynecological high-risk disease with high mortality5,6.

From the methodological point of view, the execution of a pelvic vascular diagnostic examination does not differ from any other angiographic examinations, except for small variations7.

The access is almost always right or left femoral, rarely brachial, and almost never axillary. The latter two accesses are preferred in case of external iliac arteries occlusion and require few manageable "devices"8.

Subsequently, catheterization is performed with a catheter such as “Cobra” (Cook Medical, Winston Salem, NC, USA) or “Simmons 1” (Meditech/Boston Scientific Corporation, Watertown, MA, USA), “Hook (curved J)” (by Terumo Medical Corporation, Somerston, NJ, USA) or “VS1” (by Cook, USA), primarily into the hypogastric artery and then on the other side. After visualization of the pelvic arteries, the selective catheterization of the descending branch of the hypogastric artery can be performed, after which the super-selective uterine artery catheterization can be performed with a coaxial micro-catheter such as "Progreat" (by Terumo, USA). After introducing and positioning various devices into the blood vessels, they can be occluded by embolization, using various devices9.

In obstetric gynecological emergencies, if the bleeding is massive and the patient has already been submitted to hysterectomy, a biological glue can be used (1 cc between 2 ml of glue and 8 ml of LUF, or Lipiodol ultrafluid)10. Otherwise, nano-particles or “micro-spheres”, from 100 up to 700 micron (Bead Bock Medical Corporation, Biocompatibles International plc, Farnham, Surrey, UK) can be used, depending on the blood vessel diameter and the entity of the bleeding.

If the particles are not enough to stop the bleeding and determine the definitive vascular embolization, two or three “micro-coils” or “endoclips”, generally made in Tungsten can be subsequently used11.

It is worth remembering that glue, micro-spheres and micro-coils are materials of definitive embolization and cannot be removed. If the bleeding is not dramatic and the patient is young, the gelatin-based absorbable haemostatic compound can be injected as temporary material, and it will re-open the blood vessel after 24-56 hours12.

If the bleeding reappears, it is mandatory to locate a micro-coil in the hypogastric vessel, rather than using micro-spheres, since micro-coils obstruct only the afferent artery and leave the outskirts of blood vessels free, improving the micro-collaterally circle, after a short time13.

It is not advisable to use biological glue or gelatin in young patients, especially if haemodynamically stable and if the bleeding is not massive, since it is enough to stop the blood vessel through a super-selective embolization of the micro circle by the microspheres14.

On the other hand, Spongostan is not recommended if the bleeding is massive and if the patient has already been submitted to hysterectomy, because the bleeding generally reappears after 12-24 hours and often it is more significant and serious than before12-14.

Spongostan is a material for temporary embolization or for pre-operative embolisation, and preferably used in pelvic traumas with diffused micro-bleeding, since in these cases it is possible to perform a complete embolization of both hypogastric arteries, determining the haemostasis and avoiding the ischemic complications on uterus, bladder, ovary and pelvic muscles15.

Due to the possible bad reproductive prognosis, in the case of embolization as a pre-surgical decision in a delicate clinical situation, it is preferable to use super-selective embolization in both uterine arteries, by means of a microspheres injection16.

Two or three days after the procedure, in the aforesaid cases bleeding can reappear and it can be stopped with the same techniques and at the same time13, even if a recent study does not re-
ommend the repeated selective arterial embolisation for the treatment of life-threatening post-partum haemorrhage\textsuperscript{17}.

In the case of haemoperitoneum after hysterec- tomy, the endovascular procedure consists in a definitive embolization of the arterial stump, with Gianturco’s coils or biological glue injection\textsuperscript{18}.

Pre-surgical embolization has several benefits: to give the surgeon feel safe during subsequent surgery, such as revision of the uterine hollow or removal of cervical myoma, or to prevent possible post-surgical bleeding, with possible positive advantages also in medico-legal field, and with less complications or possible damage due to wrong procedures\textsuperscript{19,20}.

The disadvantages of this method are, essentially, patient and personnel exposure to the ionizing radiations and the high costs of the material to be injected, of the micro-catheters and of the radiological instrumentation, which however do not significantly or totally affect general procedures, considering the sizeable savings in hospitalization expenses and complications related to mortality.

The costs of urgent embolization procedures in pre-surgical assessment are surely not exaggerated. If angiographic multidisciplinary materials are available, catheters and micro-catheters can cost up to 500 Euro (guide cost only). If micro-catheters, spirals and micro-particles are used, costs can relatively increase but they never exceed 2,000 Euro.

Actually, these materials significantly reduce the procedure times and also personnel and patient RX-exposure, up to 3 minutes in total.

Embolization complications are rather rare and may be the haematoma near the femoral puncture, possible arterial dissection, uterine or vesical necrosis and pelvic abscess, even if literature describes rare cases of uterine necrosis after PAE\textsuperscript{21}.

Embolization pain is, instead, the only problem and differs in every patient. It is easily managed by using morphine-similar drugs during the procedure, anti-inflammatory drugs and corticosteroids for three days. Experimentation of the use of micro-spheres for drug releasing (as Ibuprofen) is being studied, and the first results on the animals are surprising.

**Conclusions**

Selective and super-selective embolization of pelvic arteries is a very effective obstetric and gynaecological procedure, especially in emergencies. The embolization in emergency of a bleeding cervical myoma, in a patient under anti-thrombosis therapy, made it possible to pharmacologically stop uncontrollable massive uterine bleeding. Moreover, in association with transfusion of packed red cells, fresh frozen plasma and platelets, the selective and super-selective embolization of pelvic arteries could promptly correct the patient’s cardiovascular status. This treatment can be also performed in local anesthesia before or after surgery, giving the clinician maximum control of the patient’s clinical conditions. Despite the high cost of the materials used, the benefits are the greater satisfaction of the patient and few forensic problems. This procedure can reduce both risks, especially in young patients in hemorrhagic shock, candidates for dangerous emergency surgery, with problems of potential fertility preservation.

**References**


