

## Spontaneous Haematomas and Embolization: The Challenging Choice of the Embolic Agent

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Spontaneous soft tissue hematomas are a common and serious complication of anticoagulant therapy that can become life-threatening for patients.

The exact pathogenesis is complex and still not perfectly understood; however, dysfunction of the physiological coagulation status in association with microangiopathy may predispose patients to bleeding. Arteriosclerosis, chronic renal insufficiency, dialysis, heart failure and hepatic insufficiency may represent predisposing factors [1].

In the last few years, all emergency services have been dealing with COVID-19 patients with spontaneous bleeding. Several factors make patients with COVID-19 prone to bleeding, including thrombocytopenia, hyperfibrinolytic state, consumption of coagulation factors, and thromboprophylaxis administration of low molecular weight heparin (LMWH), recommended by the International Society on Thrombosis and Haemostasis (ISTH) [2]. A potential cytokine storm, prolonged tissue hypoxia, and direct invasion of affected tissues are other possible causes [3]. The latter characteristics would make COVID-19 patients more prone to haemorrhagic events than anti-coagulated non-COVID patients.

In this issue of CVIR, Lopez-Martinez et al. [4] showed the results of a single-centre retrospective study of COVID-19 patients who experienced bleeding complications that were successfully managed with trans-arterial embolization (TAE). TAE is a safe and effective technique, less invasive and more selective than surgery, with a high technical success rate (90%).

To date, there are not guidelines about the embolization technique and how to select which embolic agent to use. The selection of the embolic materials depends on the encountered anatomy, tortuosity and caliber of the arteries, the technique chosen (i.e. sandwich technique, proximal embolization) and operator's confidence with the materials available. Each embolic agent is characterized by its respective strengths and weaknesses and can be used alone or in combination with others to enhance its embolic power.

The presence of coagulopathy should influence effectiveness of embolization; in fact, recurrence usually occurs in patients with severe consumptive coagulopathy [4].

Solid agents, such as coils and plugs, are easy to use, cheap, and their release should be controlled using detachable devices, but in any case, the occlusion power depends on the coagulation status [5].

Liquid embolic agents, like glue and polymers, work well even when the coagulation capabilities are missing. Glue is an adhesive embolic agent (AEA), characterized by high and immediate occlusive power, but a correct handling requires a long learning curve and anyhow be associated with technical complications (microcatheter entrapment, non-target embolization) [5].

In recent years, non-adhesive embolic agents (NAEA), ethylene vinyl alcohol copolymer (EVOH), polyvinyl alcohol (PVA), polylactide-co-glycolide (PGC) and

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**Fig. 1** Multiple arterial bleedings from a branch of the profunda femoral artery in a COVID-19 patient (A), successfully embolized with EVOH (B–D)



hydroxyethylmethacrylate (HEMA), have gained more and more popularity due to their “magma-like” flow, thus enabling good control of the embolic material and representing an advantage compared to glue. EVOH is the most used and by now, supported by solid literature compared with others. Nevertheless, some disadvantages must be reported: the need to use compatible microcatheters and to shake for at least 20 min before to be ready to use, the cost, and the mandatory use of dimethyl sulfoxide (DMSO) as a solvent. The mixer used to shake EVOH must be operated from the beginning of the procedure to ensure its ready availability when required. Previous injection of DMSO ensures the correct vehiculation up to the target vessel, but it may cause vasospasm and endothelial damage. Vasospasm scarcely influences vehiculation of EVOH, unlike adhesive agents. A discrete learning curve is required also to handle NAEA [5] (Fig. 1A–D).

As a summary, in situations like that described by Lopez-Martinez et al. [4], and in general in all the conditions associated with coagulation disorders, the use of AEA

or NAEA is strongly recommended due to the described characteristics and the positive reports in the literature.

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