Letter: Washing and Irrigation: Faithful Allies of the Neurosurgeon for Endoscopy Hemostasis

To the Editor:

Endoscopy has gained growing interest in neurosurgery. Over the last years, new indications for endoscopic neurosurgery have been largely accepted, including intracerebral hemorrhages, resection of intraventricular brain tumors, or skull base surgery. However, the bleeding caused by such a procedure together with the use of a camera for visualization poses special challenges during endoscopic operations. Blood obscures the surgical field and increases the risk of complications, including brain injury, nerve injury, and dramatic bleedings from major vessels (eg, internal carotid artery). Bleedings during such endoscopic procedures can be further complicated by the limited viewing area, which may indeed prevent localization of the origin of these bleedings.

As in conventional neurosurgery, achieving and maintaining hemostasis in endoscopic neurosurgical procedures is critical for the outcome. Thus, gelatin sponges, oxidized cellulose, fibrin glue, and, more recently, thrombin-gelatin hemostatic matrices, metal clips, and bipolar coagulation are being increasingly employed in various surgical disciplines.1,2

However, those approaches are practically inapplicable during endoscopic neurosurgical procedures. In addition, although the development of microsurgery has clearly helped control the bleeding of vessels that could be identified, the topical control of diffuse capillary bleeding in micro- and macroneurosurgical cases remains challenging. Thus, prevention of bleeding represents one of the major determinants of success of the extended endoscopic procedure, and uncontrolled extra/intradural bleedings are linked to intra- and postoperative ischemic and/or hemorrhagic complications.3

Over the past 20 years, a number of hemostatic agents and tissue sealants have been designed to promote hemostasis and tissue adhesion, and act to stop bleeding either mechanically or by activating the coagulation cascade. In addition, several methods can be used to deal with intraoperative bleeding during endoscopic neurosurgery, such as topical vasoconstrictors or total antifibrinolytic agents acting by competitive binding with the lysine-binding site on plasminogen, but with potential adverse effects.

Here we would like to emphasize the relevance of abundant irrigation with water or saline buffer to control the diffuse capillary bleeding from dura, mucosa, muscles, or parenchyma during endoscopic neurosurgical procedures.

Originally, irrigation to achieve hemostasis was introduced by Stangerup et al4,5 who showed that hot water irrigation was nearly as effective as surgical techniques for the treatment of epistaxis. How warm irrigation achieves hemostasis is unclear, but may include (1) edema and compression of the leaky vessels, and (2) decrease in blood flow and luminal blood pressure.4,5

It is, however, difficult to determine whether the temperature of washing irrigations effectively impact their hemostatic capacities. Indeed, even if cold solutions favor vascular constriction, the amount of vascular constriction that occurs is thought to be insufficient to provide effective hemostasis.5

We suggest that water/saline irrigation acts by direct modulation of the delicate balance between pro- and anticoagulant forces by diluting physiological anticoagulants. Notably, antithrombin (AT) is a major inhibitor of coagulation proteases (eg, thrombin and activated factor X) circulating at high concentration (2.3 μM) in the plasma.6

In the absence of heparin derivatives, AT is a very slow inhibitor of thrombin generation, which could be counteracted by the high circulating plasma levels of AT. Consequently, dilution of AT by abundant irrigation may dramatically affect the ability of AT to inhibit thrombin generation, which might constitute an important driving force allowing to achieve hemostasis after irrigation.

In in vitro thrombin generation assays, thrombin generation is strongly affected by plasma dilution, and the anticoagulant pathways are far more affected by dilution than the procoagulant pathways.8 Notably, tissue factor pathway inhibitor together with the anticoagulant protein C pathway (ie, thrombomodulin, activated protein C, and protein S) appeared to be particularly affected under these experimental conditions.8

However, in vitro assays to measure hemostasis either in plasma or whole blood are inadequate to mimic the complex interplay between prohemostatic and antihemostatic forces operating after vascular injury and water/saline irrigation during endoscopic neurosurgical procedures. In this context, experimental studies in rodents are highly needed.

To conclude, our clinical experience supports the efficacy of water/saline irrigation to achieve correct hemostasis and to differ and/or limit the use of hemostatic agents and tissue sealants, during endoscopic neurosurgical procedures. In addition, the temperature of irrigation fluids has no impact for stopping bleedings in our hands. Such observations warrant further experimental and clinical studies to evidence the relevance of irrigation during these neurosurgical procedures and to gain insight into how hemostasis is effectively achieved by water or saline irrigation.

Disclosure

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REFERENCES


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