



A new hemostatic procedure for full-endoscopic spine surgery (FESS)

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To achieve mastery of the surgical techniques required for full-endoscopic spine surgery (FESS), several hurdles must be overcome. One such hurdle is acquiring the techniques for hemostatic procedures. Depending on the source of bleeding (e.g., muscle, adipose tissue, ligaments, epidural vessels, and bone), the procedures are different. Among these, bleedings from epidural vessels and bone are the most troublesome and difficult to control for the FESS-surgeon.

For the former case, we can select two hemostatic procedures. One is a striction by absorbable hemostatic gauze. Among such hemostats, SURGICEL SNoWTM does not stick to forceps and is therefore easy to manipulate under saline irrigation in FESS (Video S1). Hemostatic gauze requires time to reach its effect and must be removed prior to the completion of the procedure so the surgeon must either wait or address a different region while hemostatic effect is achieved. Another hemostatic procedure for epidural vessels is using a bipolar coagulator. Longitudinal antero-external epidural vein [also called anterior epidural venous plexus (AEVP)] located beside the dural sac are sometimes relatively large (1,2), and injury to them can cause massive bleeding. Even such bleeding can be controlled with a bipolar coagulator. The electrode tip of the bipolar coagulators we generally use [TipControl RF Instruments (Richard Wolf GmbH), Trigger-Flex[®] (elliquence)] are relatively large. I recommend to use monopolar coagulators with smaller electrode tip such as FlextrodeTM (elliquence)

for hemostasis around nerve root and dural sac.

For bleeding from bone surface which was drilled by high-speed steel or diamond burr, there are three basic hemostatic procedures: (I) low speed drilling with a fine diamond burr (Video S2); (II) electrocoagulation using a bipolar radio-frequency electrode system; (III) collapse the bleeding cancellous bone using a Kerrison rongeur. Techniques II and III were demonstrated in our previous study (3). The technique proposed by Inoue *et al.* (4) is the 4th technique for hemostasis from removed bone surface. Inoue *et al.* used bone wax for hemostasis. This is not new concept but usage of a nozzle applicator seems to be quite a simple and effective method, while avoiding the risk of wax clogging the working channel or sticking to the lens of the endoscope. Although Inoue *et al.* could not show the reduction of operative time, it is promising that safety of FESS is extremely increased by this method. The hemostatic procedure described in Inoue's article may contribute to further developments in the field of FESS especially for the treatment requiring large extent of laminectomy such as lumbar canal stenosis.

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