Tumor devascularization by intratumoral ethanol injection during surgery

Technical note

RUSSELL R. LONSE, M.D., JOHN D. HEISS, M.D., AND EDWARD H. OLDFIELD, M.D.

Surgical Neurology Branch, National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, Maryland

Preoperative reduction in tumor vascularity has been accomplished previously by selective catheterization of tumor vessels and delivery of occlusive materials. The results of percutaneous infusion of vertebral hemangiomas and other vascular lesions led the authors to speculate that rapid devascularization of tumors by direct injection of ethanol (ETOH) could be used to reduce bleeding and facilitate resection during surgery. Thus, the use of intratumoral injection of ETOH and its effects on tumor hemostasis and resectability were examined. Four patients received direct injection of ETOH into either a spinal epidural (two renal cell carcinomas and one rhabdomyosarcoma) or a large cerebellar neoplasm (hemangioblastoma). Intraoperative perfusion of the tumors with ETOH produced immediate blanching and devascularization and enhanced visualization and resection.

Incremental tumor devascularization is achieved by careful injection of small amounts of ETOH directly into the lesion, producing immediate and complete regional tumor devascularization. Use of this technique reduces intratumoral bleeding and enhances the ease and effectiveness of resection.

KEY WORDS • ethanol • hemostasis • injection • surgery • tumor

The safe and effective resection of neoplasms, particularly those affecting the central nervous system, relies on excellent hemostasis. Ethanol (ETOH) is an effective devascularizing and sclerosing agent when percutaneously injected into various vascular lesions, endocrine tissues, and intraabdominal tumors, and it has also been used intravascularly to embolize vascular and neoplastic lesions successfully.1 Our results with percutaneous infusion of vertebral hemangiomas and other vascular lesions indicated that rapid devascularization could be accomplished by injecting ETOH directly into tumors during surgery, reducing bleeding and facilitating resection. We report our initial experience in four patients who underwent intratumoral injection of ETOH during resection of neoplasms affecting the central nervous system. Of the four patients, three had spinal epidural and one had a cerebellar neoplasm requiring resection (Table 1). One patient underwent partial intraarterial embolization of the tumor vasculature before surgery.

Technique

A 1-ml tuberculin syringe filled with dehydrated absolute ETOH (Abbott Laboratories, Chicago, IL) was used for injection. Leakage of ETOH from the puncture site and contact with the normal surrounding tissues was prevented by placing cotton patties at the tumor margin. To enhance ETOH retention in the tumor and to limit retrograde leaking around the needle, we used small-caliber (28-gauge) needles and slowly injected ETOH in small (0.1–0.2 ml) increments. The endpoint for injection at a specific site was visible tumor blanching. Suction was used to remove any ETOH that leaked at the site of puncture.

Results

In all four cases, slow direct intratumoral injection of ETOH produced immediate blanching of the mass and complete regional tumor devascularization. In contrast, the portions of the tumor that had not been injected bled actively during excision. Injection of ETOH into these regions arrested active hemorrhage and provided blanching of the lesion. The injected tissue instantly became soft (often semiliquid). These features enhanced the ease and effectiveness of resection in each instance and the procedure had no associated complications. Devascularization of the tumors required only small amounts of ETOH (Table 1).
**Discussion**

In one patient (Case 1), direct intratumoral ETOH injection was used successfully to augment preoperative embolization. Significant bleeding in the regions of the tumor supplied by nonembolized arteries occurred during resection in this patient. Direct ETOH injection effectively devascularized the regions of the tumor that had not been embolized, highlighting the potential of this technique to augment transvascular embolization. In cases in which partial or complete embolization of the blood supply to the tumor is not possible because of tortuous vessels or because a common feeding artery supplies both the lesion and normal neural tissue, devascularization of the tumor by direct perfusion with ETOH may be particularly useful. Likewise, patients who require immediate surgery that precludes preoperative embolic therapy should also be excellent candidates for direct injection of ETOH.

Because absolute ETOH is neurotoxic, proper use requires that its contact with normal tissue be prevented. Placement of cotton patts over the surrounding tissue to protect it against inadvertent spills, taking measures to reduce leaking of ETOH along the needle path (small-caliber needles, slow injection), and the immediate removal via suction of any retrograde flow of ETOH should alleviate this risk.

**Conclusions**

Direct intratumoral injection of ETOH is inexpensive, easily accomplished, and is universally available. Incremental injection of small amounts of ETOH can safely provide immediate and complete regional tumor devascularization. Careful use of this technique reduces intratumoral bleeding and enhances the ease and effectiveness of tumor resection.

**References**


Manuscript received September 15, 1997. 
Accepted in final form December 11, 1997. 
Address reprint requests to: Edward H. Oldfield, M.D., Surgical Neurology Branch, National Institute of Neurological Disorders and Stroke, National Institutes of Health, 10 Center Drive, 5D37 MSC-1414, Bethesda, Maryland 20892–1414.

---

**TABLE 1**

*Intraoperative injection of ETOH for tumor devascularization in four patients with central nervous system neoplasms*

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Preop Embolization</th>
<th>Tumor Location</th>
<th>Tumor Type</th>
<th>Total Volume of ETOH (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>partial</td>
<td>thoracic spine</td>
<td>renal cell carcinoma</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
<td>thoracic spine</td>
<td>renal cell carcinoma</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>no</td>
<td>thoracic spine</td>
<td>rhabdomyosarcoma</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>no</td>
<td>cerebellum</td>
<td>hemangioblastoma</td>
<td>3</td>
</tr>
</tbody>
</table>

---

R. R. Lonser, J. D. Heiss, and E. H. Oldfield