Use of Neuronavigation System for Superficial Vein Identification: Safe and Quick Method to Avoid Intraoperative Bleeding and Vein Closure: Technical Note

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■ BACKGROUND: **Contributions on using navigation in neurosurgery have been shared widely. However, few authors have reported their experience identifying superficial vessels before dural opening using indocyanine green–video angiography. Furthermore, this technique has shown some limitations.**

■ METHODS: **For many years, each time we planned a needle biopsy for brain tumors, we set the entry point and trajectory on the navigator before surgery. Regarding the target, we systematically chose both a trajectory, which should avoid any crossing with vessels, and an entry far from veins or granulations. Gadolinium-enhanced magnetic resonance imaging T1-weighted sequences have been demonstrated to be adequate for this purpose. Note that we used the Medtronic StealthStation S8 (Minneapolis, Minnesota, USA) and gadolinium-enhanced magnetic resonance imaging T1-weighted sequences to plan 4 different surgical procedures (needle biopsy, parasagittal meningioma, double metastases, and high-grade glioma). Intraoperatively, after craniotomy and dural exposure, a Passive Planar Blunt Probe and dermographic pen were used to mark superficial vessels on the basis of navigational images. The dura was opened far from any marked line, vessels were dissected, and the dura was opened by a Penfield dissector and Metzenbaum scissors.**

■ RESULTS: **The mean planning time length was 7 minutes, and the marking procedure time length was 3 minutes. Dural marks perfectly corresponded to the underlying vessels. The correspondence rate of marks to underlying vessels was 100%. No one vessel unmarked was noticed. No superficial vessel injuries were reported.**

■ CONCLUSIONS: **This technique provides a safe and fast method to avoid vessel injuries during dural opening. Furthermore, it could be useful as an educational tool.**

INTRODUCTION

Dural opening is one of the most common steps in neurosurgical procedures. However, some issues should be considered. Cortical vessel damage is a frequent complication during this phase.

During a standard procedure, if a cortical vein is present in the center of the surgical field, even a burr hole for a needle biopsy might cause bleeding. On the other hand, a larger craniotomy for biopsy is unacceptable. A safe technique would be useful for all practitioners. Furthermore, residents could experience a faster learning curve in neuronavigation.

Few authors have investigated a way to find subdural vessels before opening the dura. Indocyanine green–video angiography (ICG-VA), used in many neurosurgical procedures, has been performed by many practitioners and reported to be a safe and quick technique for this purpose.[1-10]

The purpose of this paper is to discuss an alternative technique for an efficient, quick dural opening sparing the superficial

Key words
- Bridging veins
- Durotomy
- Educational
- ICG-VA
- Neuronavigation
- Safe dural opening
- Superficial veins

Abbreviations and Acronyms
gh-MRI: Gadolinium-enhanced magnetic resonance imaging
ICG-VA: Indocyanine green video angiography
MC: % of marks that corresponded to a vein
MTL: Marking time length
PPBP: Passive Planar Blunt Probe
PTL: Planning time length

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vessels that does not require drug administration and/or additional instrumentation.

Institutional Background

During the past few years, the day before each brain tumor needle biopsy was performed, we planned on the navigator an entry point and a trajectory that would both avoid crossing vessels and avert superficial veins or granulations. Gadolinium-enhanced magnetic resonance imaging (gh-MRI) T1-weighted sequences have proven adequate for this purpose. These simple and useful procedures allow surgeons to reduce the intraoperative and postoperative risks of both superficial and deep bleedings.

MATERIALS AND METHODS

Patients

Our first case, a 69-year-old patient diagnosed with non-Hodgkin lymphoma in 2015, was managed at the Department of Hematology until March 2018, when he was admitted to the emergency department for drowsiness and vomiting. Cranial computed tomography scan and a subsequent brain gh-MRI showed a lesion with characteristics compatible with lymphoma. Elective surgery for needle biopsy was scheduled after a collegial discussion.

Our second case was a 72-year-old patient with right frontal parasagittal meningioma diagnosed in 2013 during follow-up after cutaneous melanoma resection. According to the evidence of growth, in April 2018, she was admitted to our Neurosurgery Department for elective surgery. Preoperative brain gh-MRI was performed. Her tumor dimensions were 3 × 2 × 2 cm, and moderate perilesional edema was noticeable.

In the third case, a 54-year-old patient presented with confusion and diffused asthenia. He underwent elective brain gh-MRI and received the diagnosis of high-grade glioma. Therefore he was admitted to our Neurosurgery Department for elective surgery in April 2018.

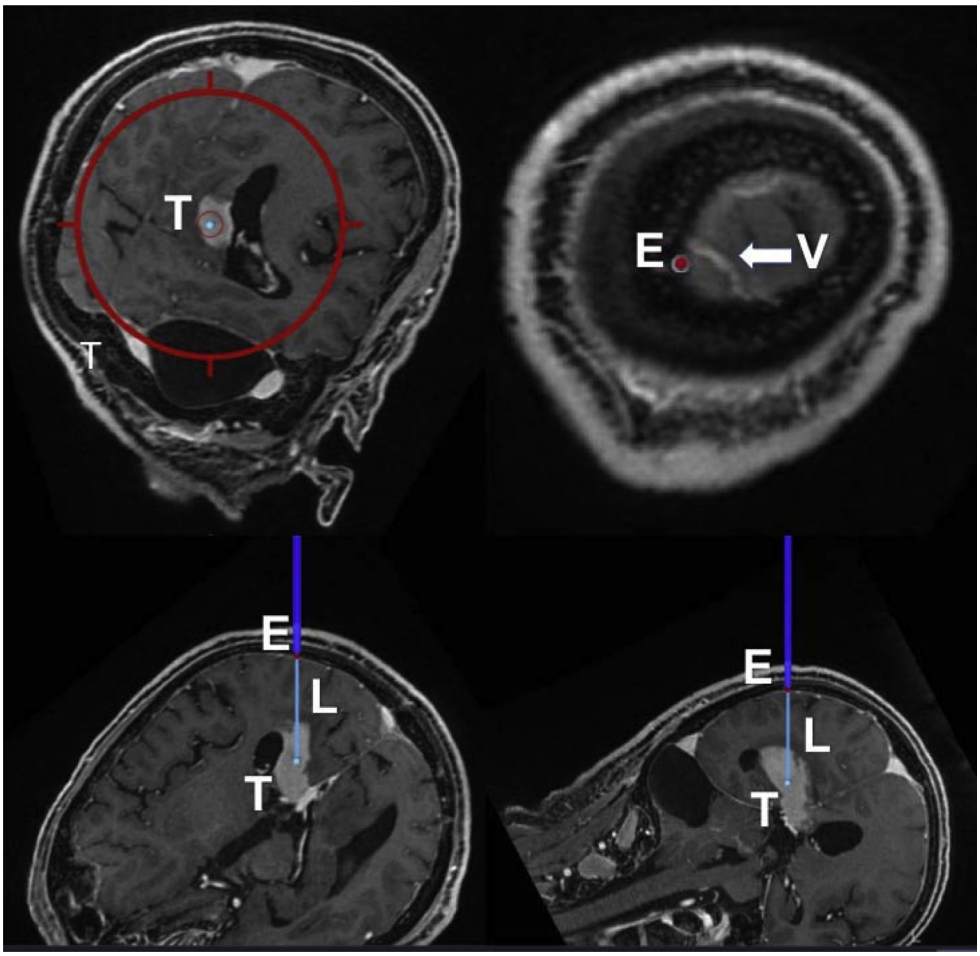

Figure 1. Preoperative planning. Needle biopsy for lymphoma. Setting of entry point (*E*), target point (*T*), trajectory line (*L*), and vein (V) identification.