

**ABSTRACT:** Little is known about the complications of needle electromyography (EMG) performed on anticoagulated patients, and no guidelines exist regarding its performance. We conducted an anonymous survey of academic EMG laboratories in the U.S. to understand current practices and complications with regard to anticoagulated patients and those receiving antiplatelet medications. Forty-seven (78%) of 60 EMG laboratories responded to the survey. Four laboratories (9%) reported at least one hemorrhagic complication requiring medical or surgical intervention in an anticoagulated patient, whereas none reported a hemorrhagic complication in patients receiving antiplatelet medications. Ten (21%) reported willingness to evaluate cranial, paraspinal, and all limb muscles in anticoagulated patients. This survey suggests that hemorrhagic complications from needle EMG of anticoagulated patients are rare. It also suggests that needle EMG of patients receiving antiplatelet therapy is not associated with increased reports of hemorrhagic complications.

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## **SURVEY OF ELECTRODIAGNOSTIC LABORATORIES REGARDING HEMORRHAGIC COMPLICATIONS FROM NEEDLE ELECTROMYOGRAPHY**

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**T**here may be an increased risk of bleeding complications associated with needle electromyography (EMG) of anticoagulated patients. The magnitude of that risk and how examinations should be modified to minimize the risk are unclear. Although there are no practice guidelines by the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM) with respect to needle EMG of anticoagulated patients, there is acknowledgement that patients with an elevated international normalized ratio (INR) or low platelet count may be at increased risk for bleeding complications. The AANEM suggests that when performing needle EMG on such patients, “. . . it is advisable to first examine the small, superficial muscles, and to watch for bleeding problems. Prolonged pressure over the needle site will usually produce hemostasis.”<sup>2</sup> Restrictions based on muscle location or depth are not specified.

There are only two case reports in the literature of symptomatic hemorrhage related to needle EMG of anticoagulated patients.<sup>4,8</sup> Based on this type of limited data, various strategies have been acknowledged including complete avoidance of all needle EMG,<sup>1</sup> restrictions based on location of needle insertion,<sup>1,2</sup> temporary interruption of anticoagulation,<sup>6</sup> and use of small gauge needles.<sup>1</sup> The goal of this study was to survey academic EMG laboratories regarding exclusions or special practices related to EMG of patients who are anticoagulated or receiving antiplatelet medications. Laboratories were also queried regarding previous complications in these same patient groups. Determining the majority practice may help the personnel of individual laboratories to examine their practices in a greater context. Examining current practice will also help to establish a baseline for future clinical studies.

**Abbreviations:** AANEM, American Academy of Neuromuscular and Electrodiagnostic Medicine; ACGME, Accreditation Council on Graduate Medical Education; EMG, electromyography; INR, international normalized ratio

**Key words:** anticoagulant; aspirin; complications of electromyography; electromyography; iatrogenic disease

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### **MATERIALS AND METHODS**

Through the Accreditation Council on Graduate Medical Education (ACGME) website, EMG laboratories associated with ACGME-approved neuromuscular fellowships were identified. A telephone survey was administered to the laboratory director or a

designee. Survey responses were recorded anonymously. The survey questions are found in the Appendix. Frequencies were calculated for all survey responses. S-plus 7.0 for Windows (Insightful, Seattle, Washington) was used for the analysis. This study was approved by our Institutional Review Board.

## RESULTS

A total of 60 EMG laboratories with ACGME-approved fellowships were identified. Forty-seven (78%) of the EMG laboratories responded. All questions were answered by each respondent. Only 17 (36%) of the laboratories reported having written protocols regarding EMG in the setting of anticoagulation.

Ten laboratories (21%) reported willingness to examine cranial/facial, paraspinal, and all limb muscles in anticoagulated patients. The frequency and percent of willingness and unwillingness to perform needle EMG on anticoagulated patients by muscle group were as follows: cranial or facial muscles—yes: 23 (49%), no: 21 (45%), “it depends”: 3 (6%); paraspinal muscles—yes: 13 (28%), no: 31 (66%), “it depends”: 3 (6%). Sixteen (34%) replied that there were some limb muscles that they were unwilling to examine by EMG, whereas 31 (66%) were willing to perform needle EMG on all limb muscles.

Four (9%) laboratories reported having at least one prior bleeding complication requiring medical or surgical intervention as a result of performing needle EMG on an anticoagulated patient. One laboratory reported having two previous complications; the other three recalled a single complication. Two of the four laboratories that disclosed a complication continue to perform cranial/facial EMGs on anticoagulated patients. None of the four laboratories perform paraspinal muscle EMGs on anticoagulated patients.

Nine (19%) of laboratories reported altering some portion of the EMG in patients taking antiplatelet agents. Most laboratories (87%) did not require patients to withhold antiplatelet agents prior to EMG evaluation. No laboratory reported a prior bleeding complication from EMG that required medical or surgical intervention involving a patient using antiplatelet agents.

## DISCUSSION

This survey suggests that the majority of academic EMG laboratories limit needle EMG examinations of anticoagulated patients. Paraspinal muscles were the most common muscle group avoided. Survey re-

sponses were quite varied and suggested significant heterogeneity in clinical practices among laboratories.

Serious hemorrhagic complications of needle EMG appear to be rare events in anticoagulated patients in the medical literature. The two reported cases of bleeding complications in anticoagulated patients includes an 81-year-old woman who presented 16 days after an EMG with a calf hematoma and calf artery pseudoaneurysm.<sup>8</sup> Her INR at the time of the EMG had been 2.5. The second case was a 64-year-old patient who presented 6 days after an EMG with subcutaneous bleeding severe enough to require a blood transfusion.<sup>4</sup> There was an additional case of symptomatic bleeding into the iliopsoas, and asymptomatic bleeding into the paraspinal muscles, in a patient who had received an EMG and was on subcutaneous heparin and aspirin; however, this patient additionally had external trauma that likely contributed to the bleeding.<sup>3</sup> The current survey identified only five serious bleeding complications in anticoagulated patients, supporting the concept that these are rare events.

Of the four symptomatic hemorrhages related to needle EMG in the literature (excluding the case confounded by trauma<sup>3</sup>), two occurred in non-anticoagulated patients: a paraspinal muscle hematoma,<sup>5</sup> and a calf muscle hematoma.<sup>6</sup> Additionally, in 17 MRIs performed incidentally after an EMG in non-anticoagulated patients, four small (<1 cm<sup>3</sup>) asymptomatic hemorrhages were identified among 45 muscles assessed.<sup>5</sup> These findings indicate that non-anticoagulated patients may also experience hemorrhagic complications of EMG, and that asymptomatic bleeding is not rare.

Although many more survey respondents avoid needle EMG of the paraspinal muscles than other muscle groups in anticoagulated patients, this is not supported by the literature. Reports of hemorrhagic complications are not clearly more frequent in the paraspinal muscle location. Of the four cases in the literature of symptomatic EMG-related hematomas (again excluding the case confounded by trauma<sup>3</sup>), two involved the paraspinal muscles,<sup>4,5</sup> and two involved the leg.<sup>6,8</sup> Furthermore, one of the two leg hematomas required surgical intervention, whereas both paraspinal hematomas were managed medically. None of the hemorrhages resulted in any lasting neurological impairment. As the risk of compartment syndrome in the leg exceeds that of the paraspinal muscles, theoretically needle EMG of the leg carries more risk than of the paraspinal muscles in both anticoagulated and non-anticoagulated pa-

tients. However, some electromyographers feel the likelihood of prompt recognition of hemorrhage into a paraspinal muscle seems substantially less than recognition in a limb muscle.

We found no reports in the literature of bleeding complications solely associated with EMG of a patient on antiplatelet therapy. The current survey supports this finding. Nonetheless, a sizable minority (19%) of laboratories limit EMG examinations in these patients. Given the highly prevalent use of antiplatelet agents, limiting EMG studies in this setting may deprive numerous patients of important electrodiagnostic testing.<sup>7</sup>

This study has several limitations. First, the survey responses may reflect the individual respondent's opinions and practice rather than that of the entire laboratory. Second, accurate recollection of all prior complications may have been contaminated by recall bias. Third, respondents may have been hesitant to disclose complications despite the anonymous recording of results. Last, the apparently low risk of complications from EMG of anticoagulated patients may be influenced by the limitations imposed by electromyographers on needle EMG, rather than representing an inherently low risk activity.

This survey of academic EMG laboratories suggests that hemorrhagic complications related to needle EMG of anticoagulated patients is rare. It also suggests that needle EMG of patients receiving antiplatelet therapy is not associated with increased reports of hemorrhagic complications. Lack of evidence-based guidelines or a consensus statement related to the approach to needle EMG of anticoagulated patient likely explains the heterogeneity of practices encountered in our survey. Electromyographers should weigh on a case-by-case basis the diagnostic value of the EMG with the apparently very low risk of hemorrhagic complications in anticoagulated patients. Furthermore, the development of a consensus statement by the AANEM related to the performance of needle EMG in anticoagulated patients would be helpful to electromyographers and would lead to more homogeneous practices.

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## APPENDIX

### Survey Questions

All questions require a “yes” or “no” answer except for questions 2 and 3, for which “it depends” can be answered.

1. Do you have written laboratory guidelines specific to needle EMGs performed on anticoagulated patients (meaning warfarin, IV heparin or heparinoids)?
2. Do you perform cranial or facial muscle needle EMG on patients receiving anticoagulants?
3. Do you perform paraspinal muscle needle EMG on patients receiving anticoagulants?
4. Are there any limb muscles you will not needle EMG in an anticoagulated patient? If answer is “no”, skip to question 6.
5. What is your justification for exclusion of limb muscles for needle EMG in these patients?
6. To your knowledge, has any anticoagulated patient had a bleeding complication from an EMG in your laboratory requiring medical or surgical intervention?
7. (If answer is “yes” to question 6) How many estimated patients?
8. Do you alter any portion of your needle EMG for a patient on antiplatelet therapy?
9. Do you require patients to withhold antiplatelet therapy prior to needle EMG?
10. To your knowledge, has any patient receiving an antiplatelet agent had a bleeding complication from an EMG in your laboratory requiring medical or surgical intervention?
11. (If answer is “yes” to question 10) How many estimated patients?