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~~Vascular residents lack adequate practical training; theoretical teaching about peripheral artery disease diagnostic tools is not sufficient~~

Vascular medicine residents lack adequate training for limb pressure measurement: A nationwide

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Title: Vascular residents lack adequate practical training: theoretical teaching about peripheral artery disease diagnostic tools is not sufficient

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Dear Editor,

Ankle-brachial index (ABI) is the standardized test for diagnosis of lower extremity peripheral artery disease (PAD) with high specificity and sensitivity for a resting-ABI threshold of 0.90 or lesser [1]. In some clinical conditions (i.e., diabetes, renal insufficiency, and advanced age), the resting-ABI measurement can be falsely within the normal range and, in these cases, the use of post-exercise ABI (PEABI) or the toe-brachial index (TBI) are recommended to diagnose PAD [2]. For PEABI, the diagnostic criteria are pressure decrease of more than 30mmHg or ABI decrease of more than 20% from the resting values. For TBI the threshold value to diagnose the presence of PAD < 0.70. We have previously shown that vascular medicine residents from 4 medical schools lack of training to perform pressure measurement for the diagnosis of lower extremity peripheral artery disease (PAD) [3]. This study was performed on only nineteen residents and it was not possible to know whether or not these results would have been similar in the whole country. Therefore, we conducted another study in the whole country to assess the knowledge of all 1-year vascular French residents. During a one-day training in Paris, all 44 1-year vascular medicine residents from 22 French medical schools completed a survey concerning knowledge and training about peripheral artery disease diagnostic tools. All vascular medicine residents completed a French multiple-choice questionnaire specifically developed to evaluate each resident prior experience and knowledge about the three main noninvasive tools for PAD screening (Resting-ABI, Post-exercise ABI and TBI). This study was conducted according to the French Health Research Authority guidance. A proportion comparison test, the Fisher Exact Probability Test (R Software 3.6.0) was used to compare the number of vascular medicine residents knowing each task according to the procedure. A two-tailed p value <0.05 was considered as statistically significant. All residents accepted to fill the questionnaire. Vascular medicine residents who had previous performing one measurement at least were considered as experienced. Competent residents were defined as having more than 50% good answers at questionnaire. Figure 1 displays the results [Insert Figure 1]. Thirty-eight residents (86%) have already performed a resting-ABI, only 6 residents (14%) have performed a PEABI and 15 (34%) have previously performed a TBI. Experienced residents were statistically ($p<0.001$) more competent (defined as having more than 50% good answers) to perform ABI (78% versus 50%), PEABI (66% versus 42%) and TBI (53% versus 31%). The number of residents who have performed more than twenty measurements is higher regarding ABI at rest than PEABI and TBI (84%, 5%, 37% respectively; $p<0.001$ and $p= 0.006$ respectively) and significantly less often in PEABI than TBI (5% versus 37%; $p=0.04$).

This study based on a national survey underscores that a significant lack of knowledge exists among French vascular medicine residents from these 22 medical schools regarding not only the ABI procedure, but also the TBI and especially PEABI procedures. Chaudru et al. have suggested that practical teaching would improve this competency [4] but this nationwide assessment shows that vascular residents lack adequate practical teaching of pressure measurements. The lack of high-level evidence-based literature could explain it, especially for PEABI: the AHA recommends two diagnostic thresholds but a recent study shows that these two criteria are discordant in 20% of the patients evaluated [5].

According to the literature, we suggest bedside teaching instead of theoretical teaching, first about ABI at rest and then to learn the technical aspects of TBI and PEABI.

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3 **Figures legends**
4
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8 **Figure 1.**

9 1.A : Competence and experience of vascular residents

10 1.B : Competence of vascular residents according to their experience

11 Experimented residents: residents who had previously performing 1 measurement at least.

12 Competent residents: residents having more than 50% good answers at questionnaire.

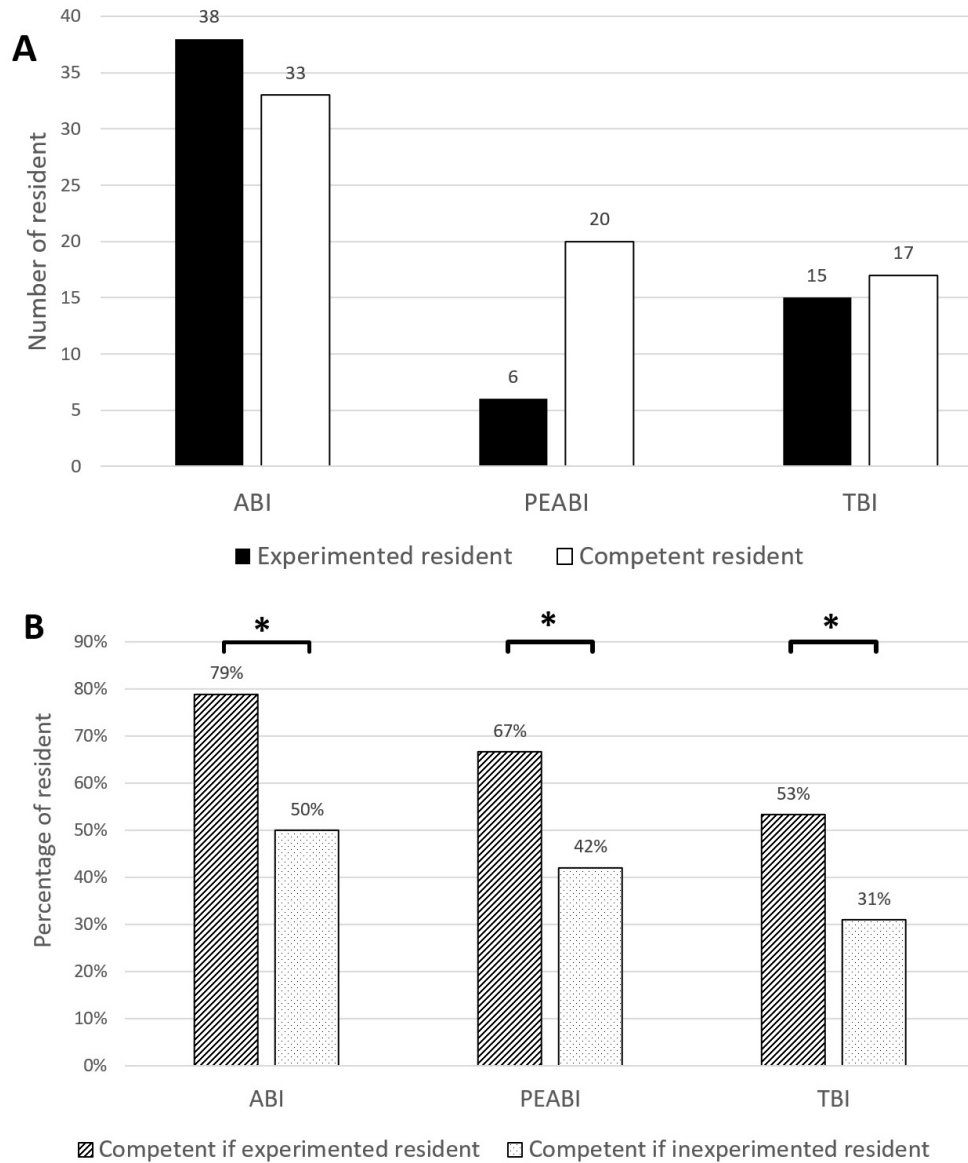
13 Abbreviations: ABI, Ankle-Brachial Index; PEABI, Post-Exercise Ankle-Brachial Index;

14 TBI, Toe-Brachial Index.

15 Data are shown as percentage and number of resident.

16 * $P < 0.05$.
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For Peer Review



1.A : Competence and experience of vascular residents. 1.B : Competence of vascular residents according to their experience. Experimeted residents: residents who had previously performing 1 measurement at least. Competent residents: residents having more than 50% good answers at questionnaire. Abbreviations: ABI, Ankle-Brachial Index; PEABI, Post-Exercise Ankle-Brachial Index; TBI, Toe-Brachial Index. Data are shown as percentage and number of resident. * P < 0.05.

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