



To analyze the specificity and sensitivity of the modified microbubble test in identifying the peripherally inserted central venous catheters (PICC) tip based on the chest X-ray location as the “gold standard”, and to find out an accurate and noninvasive PICC tip positioning method that can save time and cost” Zhang et al (2019).

Abstract:

**OBJECTIVE:** To analyze the specificity and sensitivity of the modified microbubble test in identifying the peripherally inserted central venous catheters (PICC) tip based on the chest X-ray location as the “gold standard”, and to find out an accurate and noninvasive PICC tip positioning method that can save time and cost.

**METHODS:** Convenient sampling method was conducted. The patients under PICC guided by ultrasound in intensive care unit (ICU) or PICC clinic of the First Affiliated Hospital of Nanchang University from August 2017 to February 2018 were enrolled. All patients were followed up by ultrasound guided PICC catheter placement, modified microbubble test and chest X-ray localization. The relationship between the density of microbubbles in modified microbubble test and the location of PICC tip in chest X-ray localization was analyzed. Using chest X-ray localization as the “gold standard”, the diagnostic evaluation indexes such as specificity and sensitivity of PICC tip identification by modified microbubble test were

calculated.

**RESULTS:** A total of 120 patients were enrolled during the study period, excluding those who refused to participate in the study, unclear right atrial ultrasound, conscious intolerance, unclear chest X-ray, and finally 108 patients completed the modified microbubble test and chest X-ray tip localization. According to the chest X-ray localization results of 108 patients, 69 patients (63.9%) were in ideal locations, 33 (30.6%) were in dissatisfactory position, and 6 (5.5%) were in malposition. There was no significant difference in gender, age, tube placement, depth of catheterization, placement of catheterization room, and catheterization among the three groups. In the modified microbubble test, there were 74 patients (68.5%) with grade I microbubble, 25 (23.2%) with grade II microbubble, and 9 (8.3%) with grade III microbubble. There was a correlation between microbubble density and the tip position of the catheter, showing a moderate intensity correlation, and the contingency coefficient was 0.662. The sensitivity of the modified microbubble test for PICC tip positioning was 95.7% (66/69), the specificity was 89.7% (35/39), the rate of missed diagnosis was 4.4% (3/69), the misdiagnosis rate was 10.3% (4/39), the positive predictive value was 94.3% (66/70), the negative predictive value was 92.1% (35/38), and the Youden index was 0.85. The consistency between the two methods was good, and the Kappa value was 0.86.

**CONCLUSIONS:** Compared with the chest X-ray localization method, the modified microbubble test method has high sensitivity and specificity in identifying PICC in the position, and the operation is simple, noninvasive, with less time and low cost. The modified microbubble test can be used as a screening test for PICC tip position, especially in ICU. When there are technical limitations or suspicious patient, further chest X-ray is necessary.

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Reference:

Zhang, J., Zhao, N., Liu, F., Qian, K. and Jiang, R. (2019) Application of modified microbubble test in peripherally inserted central venous catheters tip positioning. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue.* 31(9), p.1149-1153. doi: 10.3760/cma.j.issn.2095-4352.2019.09.018. .

