Volume of Blood Cultured and APACHE II Score: an Intriguing Diptych for Diagnosis of Bloodstream Infections?

In a recent issue of the Journal of Clinical Microbiology, Bouza et al. provided interesting insight into the putative effect that the volume of blood cultured per patient had upon the rate of detection of bloodstream infections (BSI) (1).

According to the authors, in the total of the sample, the volume of blood cultured was not an independent predictor capable of affecting blood culture results. On the other hand, the acute physiology and chronic health evaluation II (APACHE II) score was associated with the obtention of a low-volume specimen. Subsequently, the authors conducted a subanalysis of the cases with APACHE scores higher than 18, which concluded that “higher volumes were associated with better yields of detection of BSI.”

This intriguing observation may be worth explaining and investigating further. Concerning the subanalysis, an interesting question arises: within the APACHE >18-score subgroup, has the APACHE score per se been retained in the multivariable model? This has not been explained in Materials and Methods and seems of particular interest, as the APACHE score may not lose its predictive power in the aggregated APACHE >18-score subgroup; for instance, a patient with an APACHE score near 30 may represent a completely different entity than a patient with an APACHE score near 18. In other words, the division-stratification of the sample into <18 and >18 subgroups may not be sufficient for the omission of the APACHE score as a putative predictor.

In a case a putatively significant predictor is not included in the subanalysis model, other less significant factors and confounders may become significant. If the APACHE score has not been included in the subanalysis, would its introduction into the model lead to the disappearance of the effect mediated by the volume of blood? On the other hand, if the APACHE score has been included in the model but has not been reported for reasons of brevity, has it retained its predictive power (as in the total of the sample)? In this scenario, reporting the odds ratio (OR) of the APACHE score in the subanalysis may be desirable.

In any case, in regard to the total of the sample, a simple maneuver might have been invaluable, i.e., the introduction of the statistical interaction of the APACHE score multiplied by the volume of blood cultured in the full model. If this interaction proved to be statistically significant, it would be a reliable proof that the APACHE score modifies the effect of the volume of blood upon BSI detection. It remains for the authors to proceed to such further and detailed analyses in the future.

Authors’ Reply

We appreciate the interest of Sergentanis and Mariolis in our paper, regarding the importance of volume of blood cultured in the yield of bacteremia from those samples. Our paper originated when we found that in blood cultures inoculated with less blood, the yield was higher. Our paper basically shows that the low volume was a confounding variable because lower blood volumes were obtained from patients with more severe disease, who were more prone to have sepsis, and who presented with more difficulties for blood drawing.

We were pleased to reanalyze our data, including the APACHE II variable, as suggested by our colleagues in their letter. Our previous results hold true after that reanalysis, and the variable volume remains an independent predictor of blood culture positivity, with an OR of 1.042 (95% confidence interval [CI], 1.002 to 1.085; \( P = 0.040 \)) in this subgroup of patients, confirming the data in our paper.

The APACHE II score was not retained in this logistic regression model (OR = 0.934; 95% CI, 0.773 to 1.127; \( P = 0.475 \)). This may be due to the fact that the APACHE II score may not discriminate the probability of a positive result in this subgroup of patients or alternatively that the statistical power decreases in the subanalysis (consider that the OR of the APACHE II score may be too low because it represents the increase in the yield of blood cultures for each point of the score).

After the inclusion of the interaction of the APACHE score multiplied by the volume in the global model, we observed a trend in which the yield of blood culture positivity increased with the volume for high values of the APACHE II score that almost reached statistical significance (OR = 1.002; 95% CI, 1.000 to 1.004). This may be due to the fact that the majority of our patients belong to the group with lower APACHE II scores.

We appreciate the thoughtful comments from Sergentanis and Mariolis, and we are happy to report that after the statistical amplification of our study, following their request, our conclusions hold true.

Emilio Bouza*
Servicio de Microbiologia Clinica y E. Infecciosas
Hospital General Universitario Gregorio Marañón
Esquero 46
28007 Madrid, Spain

Dolores Sousa
Division of Infectious Diseases
Hospital Juan Canalejo
La Coruña, Spain

*Phone: 34-91-5868453
Fax: 34-91-3721721
E-mail: ebouza@microb.net

REFERENCE


Theodoros N. Sergentanis
Anargiros Mariolis*
Health Center of Vyronas
1st Health Care Regional Administration of Attica
Athens, Greece

*Phone: 302107608051
Fax: 302107608053
E-mail: anargirosm@yahoo.gr