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Importance of using proper post hoc test with ANOVA

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Ebstein’s anomaly and tetralogy of Fallot are congenital heart diseases which have deleterious effects on right ventricular functions. Recent article written by Chen et al. investigated the possible physiologic determinants of exercise capacity in these patients. They reported reduced cardiac index in Ebstein’s anomaly patients and concluded that this cardiac index reduction is due to physiologic complexity of the anomaly [1]. We have some contributions to statistical methodology of the study.

In Table 2 authors reported cardiac magnetic resonance findings and pairwise comparison results. Though they did not report the method of comparison it is consistent with ANOVA with post hoc comparison with Student’s t test. Analysis of variance (ANOVA) is a widely used statistical test. It is used to analyze differences among three or more groups. Roughly ANOVA has three major assumptions; all samples are drawn from normally distributed populations, all populations have a common variance and all samples are drawn independently of each other. We think that this study is suitable for ANOVA design. If authors conducted ANOVA test they should report it in statistical methodology section. Secondly making multiple comparisons inflates a Type I error rate. SPSS does eighteen different post hoc tests for ANOVA to control a Type I error rate. Bonferroni correction is the most widely used method to control Type I error. The Bonferroni correction states that if an experimenter is testing m hypotheses, then one way of maintaining the familywise error rate is to test each individual hypothesis at a statistical significance level of 1/m times what it would be if only one hypothesis was tested. According to Bonferroni correction Chen et al. must consider a P value smaller than $P_{0.016} = 0.05 / \text{number of comparisons}$ = 0.016. This correction effects the results of some comparisons such as left ventricle end systolic volume index (LV-ESVi) and resting heart rate.

Analysis of variance is the most commonly-used technique for comparing means, and it is important to understand ANOVA and post hoc tests to make appropriate analyses and to correctly report results. Statistics is the grammar of science. We have to speak language of science with proper grammar.

Conflicts of interest

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