Comment on “Body mass index and contralateral ratio predict outcome following unilateral adrenalectomy in primary aldosteronism”

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We were interested to read the article “Body mass index and contralateral ratio predict outcome following unilateral adrenalectomy in primary aldosteronism”, authored by Bokuda K and colleagues and published recently in *Hypertension Research* [1]. The authors sought to investigate the preoperative factors contributing to postoperative blood pressure (BP) outcome in patients with primary aldosteronism who had undergone unilateral adrenalectomy. This study was interesting; however, some methodologic issues should be noted.

First, all continuous variables in the study were expressed as the mean $\pm$ s.d. and analyzed by Student’s *t*-test. It is widely recognized that the mean $\pm$ s.d. is suitable only for data that follow the normal (Gaussian) distribution [2]. However, the authors ignored the normality of continuous variables in this study (some continuous variables listed in Table 1 clearly did not follow the normal distribution). Medians and interquartile ranges may be more appropriate than means and standard deviations when continuous variables are not normally distributed. We note that the normality assumption can be checked by graphical and statistical methods such as the Kolmogorov–Smirnov test. Nonparametric tests should be used when the normality assumption does not hold. The normality assumption should be considered seriously, as it is impossible to draw accurate and reliable conclusions when the assumption does not hold [2].

Second, the authors constructed a multivariate logistic regression model including all preoperative variables that demonstrated statistical significance (P -value < 0.05) between the “cured” and “not cured” groups for the BP outcome following unilateral adrenalectomy. First, bivariate correlations among preoperative variables should be assessed to identify potential multicollinearity before multivariate logistic regression analysis; second, a multivariate logistic regression model should be constructed using backward stepwise selection for those variables found to be associated with factors in univariate analysis with P -values less than 0.2. In the study conducted by Bokuda K and colleagues, bivariate correlation between preoperative variables was not assessed, and the preoperative variables with P -values less than 0.05 were entered into the multivariate analyses by the author, which can introduce estimation bias into the results [3, 4].

Finally, postoperative systolic BP and postoperative diastolic BP fluctuate within individuals over time, and we suggest that the mean of three or more measurements should have been used in this study. Instead, the authors used only one BP measurement per subject; overlooking within-person variability in this manner can lead to regression dilution bias in the findings [5].

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Table 1 Patient characteristics by cured and not cured

	All (<i>n</i> = 96)	Cured (<i>n</i> = 46)	Not cured (<i>n</i> = 50)	<i>P</i> -value (cured vs. not cured)
Age at surgery, years	51 ± 11	47 ± 12	55 ± 10	0.0009
Male, <i>n</i> (%)	40(41.7)	13 (28.3)	27 (54.0)	0.0106
BMI, kg m ⁻²	23.3 ± 3.5	21.8 ± 3.4	24.6 ± 3.0	<0.0001
Complication of DM, <i>n</i> (%)	4 (4.2)	2 (4.4)	2 (4.0)	0.9321
Complication of DL, <i>n</i> (%)	18 (18.8)	5 (10.9)	13 (26.0)	0.0587
Past history of CVD, <i>n</i> (%)	5 (5.2)	2 (4.4)	3 (6.0)	0.7159
Smoking, <i>n</i> (%)	32 (33.7)	12 (26.1)	20 (40.8)	0.129
Alcohol, <i>n</i> (%)	32 (33.7)	15 (32.6)	17 (34.7)	0.8298
Family history of HTN, <i>n</i> (%)	67 (69.8)	33 (71.7)	34 (68.0)	0.6902
Preoperative systolic BP, mm Hg	140 ± 17	138 ± 13	142 ± 21	0.3419
Preoperative diastolic BP, mm Hg	85 ± 12	84 ± 11	86 ± 13	0.5771
Number of antihypertensive medications	1.3 ± 0.9	1.1 ± 0.7	1.5 ± 1.0	0.0338
K ⁺ supplementation, <i>n</i> (%)	47 (49.0)	25 (54.4)	22 (44.0)	0.311
MRB medication, <i>n</i> (%)	65 (67.7)	29 (63.0)	36 (72.0)	0.3485
K ⁺ , mEq l ⁻¹	3.2 ± 0.5	3.2 ± 0.4	3.2 ± 0.6	0.5027
UA, mg dl ⁻¹	4.9 ± 1.4	4.4 ± 1.1	5.5 ± 1.4	<0.0001
eGFR, ml min ⁻¹ per 1.73 m ²	78.2 ± 20.8	81.7 ± 16.0	75.0 ± 24.1	0.1172
PAC, pg ml ⁻¹	362 ± 269	338 ± 179	384 ± 332	0.3999
PRA, ng ml ⁻¹ h ⁻¹	0.3 ± 0.4	0.3 ± 0.2	0.3 ± 0.5	0.3729
ARR	2545 ± 4331	2727.3 ± 5522.6	2374.7 ± 2843.2	0.6939
Urinary aldosterone excretion, µg per day	24.4 ± 15.2	25 ± 16	23 ± 14	0.6102
Urinary Na ⁺ /K ⁺ excretion	3.0 ± 1.5	2.9 ± 1.6	3.1 ± 1.3	0.4891
Tumor diameter, mm	14.6 ± 5.4	14.3 ± 4.6	15.0 ± 6.2	0.5019
Pathologic diagnosis				
Cortical adenoma, <i>n</i> (%)	76 (79)	37 (80.4)	38 (79.8)	0.8784
Nodular hyperplasia, <i>n</i> (%)	4 (4)	0 (0)	4 (8.3)	0.0454
Cortical adenoma + hyperplasia, <i>n</i> (%)	16 (17)	9 (19.6)	6 (12.5)	0.3498
Postoperative systolic BP, mm Hg	125 ± 12	122 ± 13	127 ± 11	0.0375
Postoperative diastolic BP, mm Hg	79 ± 8	78 ± 9	79 ± 8	0.7381
Postoperative antihypertensive medications	0.7 ± 0.8	0.0 ± 0.0	1.3 ± 0.6	<0.0001

Data are mean ± s.d. for continuous variables, and number (percent) for categorical variables. Bold values are those found to be significant; *P*-value < 0.05

ARR aldosterone/renin ratio, BMI body mass index, BP blood pressure, CVD cardiovascular disease, DM diabetes mellitus, DL dyslipidemia, eGFR estimated glomerular filtration ratio, HTN hypertension, MRB mineralocorticoid receptor, PAC plasma aldosterone concentration, PRA plasma renin activity, UA uric acid

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