Prevalence Rate, Predictive Factors and Predictive Scoring System of Primary Aldosteronism among Hypertensive Patients who had Aldosterone-Renin Ratio Screening in Southern Thailand: A Retrospective, Cross-sectional Study.

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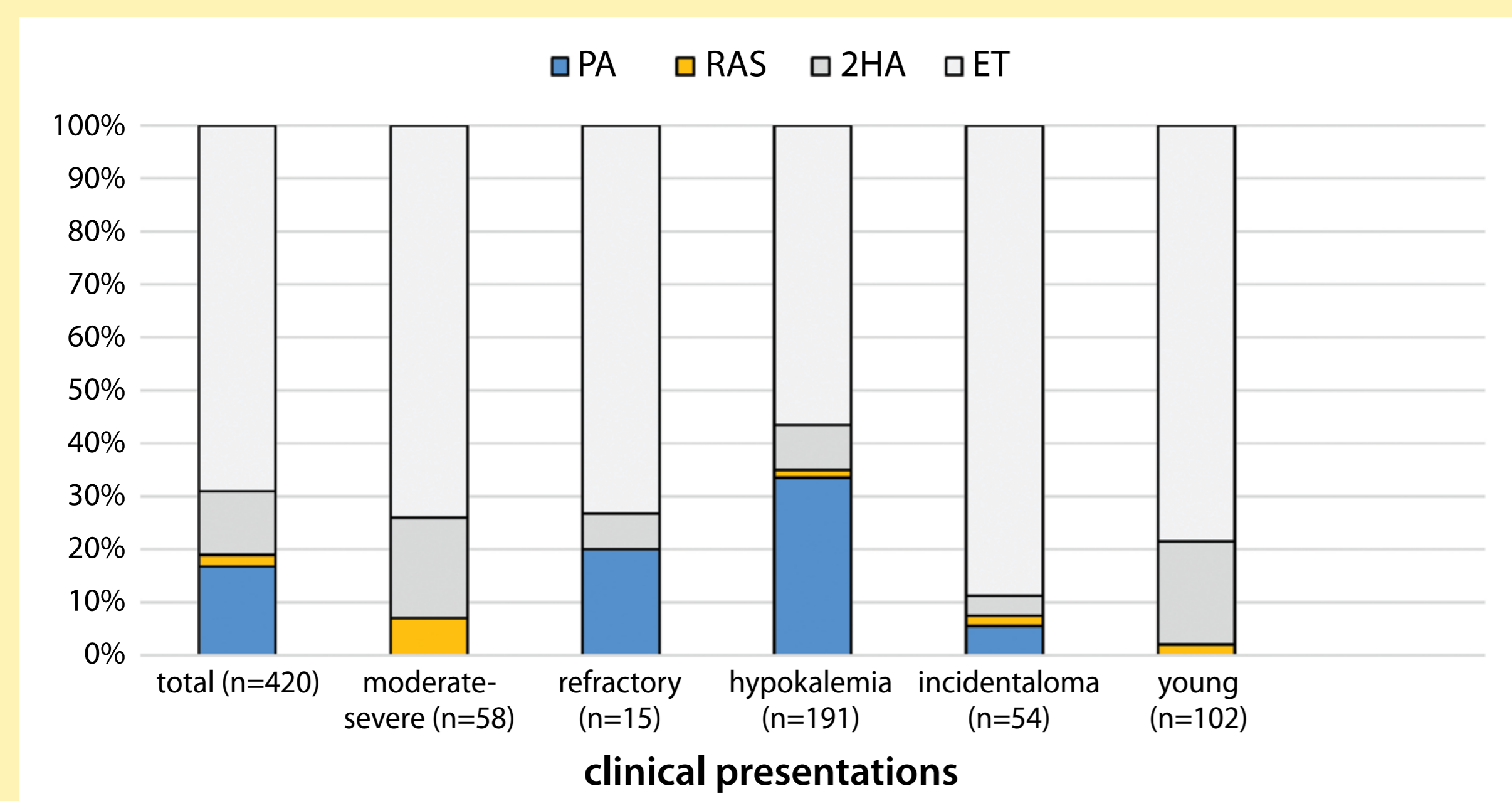
Introduction

Primary aldosteronism (PA) is the most common secondary hypertension which its prevalence varies from 5-30%. After the introduction of the Endocrine Society Guideline 2008, the disease recognition rate in Southern Thailand becomes dramatically noticeable. However, the prevalence rate of PA in this region is still unknown and aldosterone-renin ratio screening is not widely available.

Objective

1) To determine the prevalence of primary aldosteronism among high risk patients,
2) To identify predictive factors for primary aldosteronism and to generate a predictive scoring system

Materials and methods

All patients who underwent the aldosterone-renin ratio (ARR) test, during January 2011 to December 2016 were selected from the electronic database. Eligible cases were including the patients aged over 15 years old who had both of plasma aldosterone concentration and plasma renin activity.

Results

Total 420 cases were enrolled. Female patients are accounted as 58.8%, mean age is 48.61 years old, median BMI is 24.98 kg/m^2 and median HTN duration is 3.31 years. The overall prevalence rate is 16.7% whereas the prevalence rates by the presentations are varied from 5.6% for adrenal incidentaloma to 33.5% for hypokalemia. The predictive factors for PA diagnosis are age <60 years old (adjusted OR: 4.77, (95% CI: 2.12 – 10.75), BMI<25 kg/m^2 (adjusted OR: 1.97, 95% CI: 1.03 – 3.77), DM (adjusted OR: 0.25, 95% CI: 0.09 – 0.74), number of anti-hypertensive agents>3 (adjusted OR: 5.21, 95%CI: 2.56 – 10.62), serum sodium≥141 mmol/L (adjusted OR: 3.55, 95%CI: 1.68 – 7.50), and serum potassium <3.5 mmol/L (adjusted OR: 9.15, 95%CI: 4.75 – 17.61). The predictive scoring system is generated by their coefficients which the AUC of the ROC curve is 0.865 [95%CI: 0.820 – 0.911]. A total score of less than 4 provides the most acceptable negative predictive value (sensiticity,0.971; specificity,0.483; NPV,0.988; PPV,0.273, test prevalence 59.29%)

Conclusion

The prevalence rate of PA in the clinical practice was established. The predicting factors for PA were identified and the total score of less than 4 from the predictive scoring system indicated that ARR screening was not required.

Prevalence of Primary aldosteronism categorized by clinical presentations.
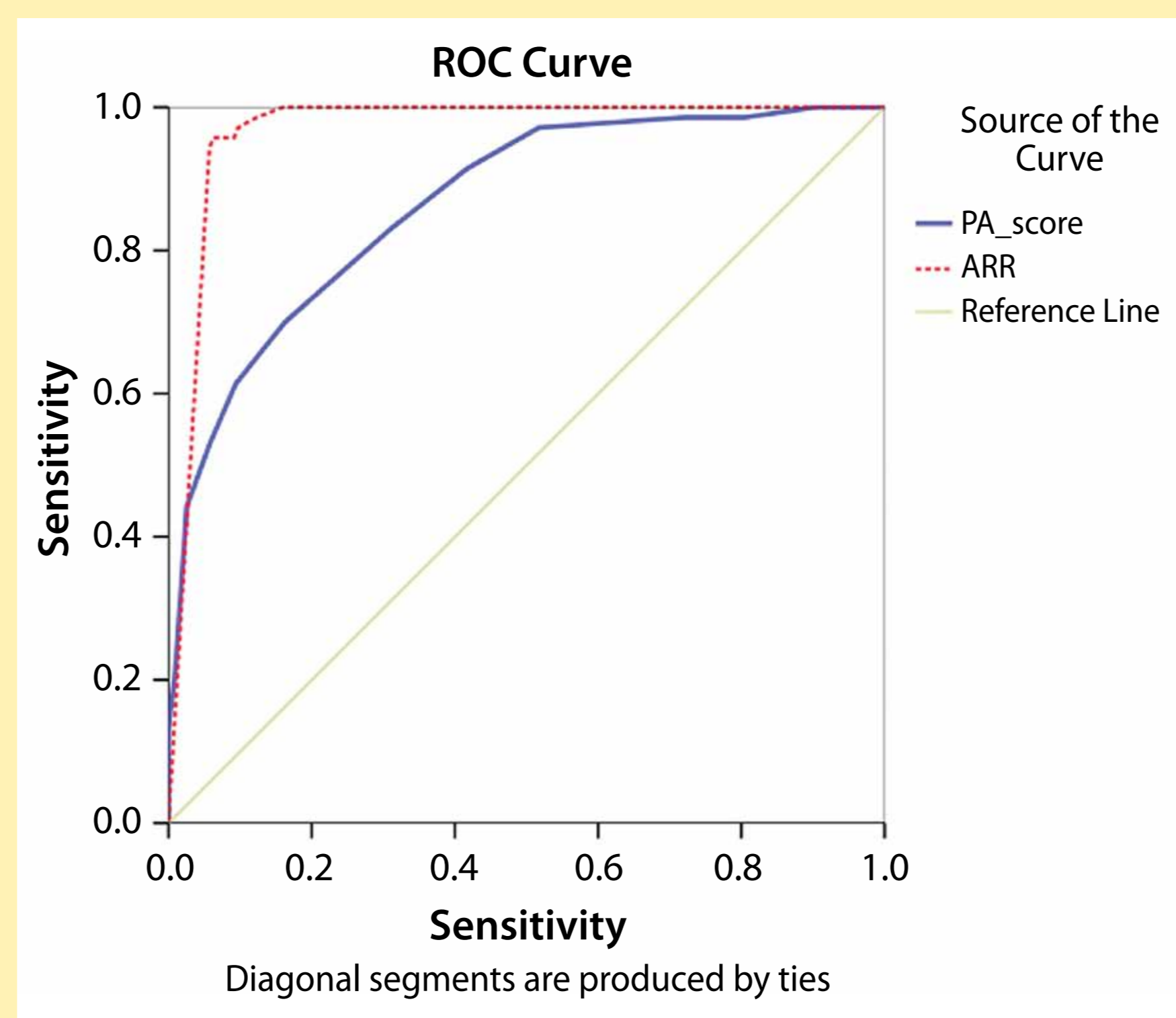
comparison of ROC curves between PA scoring system and ARR screening. *(AUC of PA scoring system = 0.865 [95% CI: 0.820-0.911], AUC of ARR = 0.967 [95% CI: 0.952-0.983])*

Items	Points
Age 30-59.9 years	+3
BMI <25 kg/m^2	+1
DM	-2
Anti-HTN ≥3	+3
Na$^+$ ≥141 mmol/L	+2
K$^+$ <3.5 mmol/L	+4

Indices of predictive scoring system for PA screening among the hypertensive patients whom ARR screening test is indicated

Parameter	Crude OR [95% CI]	P-value	Adjusted OR† [95% CI]	P-value	coefficient
Age<60 yr	5.39 [2.18-13.33]	<0.01	4.77 [2.12-10.75]	<0.01	1.56
Sex, female	1.84 [0.88-3,86]	0.11	1.93 [0.96-3.85]	0.06	
BMI <25 kg/m^2	1.95 [0.99-3.82]	0.05	1.97 [1.03-3.77]	0.04	0.68
DM	0.25 [0.08-0.75]	0.01	0.25 [0.09-0.74]	0.01	-1.39
CKD	0.37 [0.07-2.05]	0.25			
CAD	1.23 [0.18-8.31]	0.83			
CVA	1.26 [0.36-4.39]	0.72			
SBP, mmHg	1.01 [0.99-1.03]	0.42			
DBP, mmHg	0.99 [0.96-1.02]	0.49			
Anti-HTN ≥3	5.57 [2.65-11.71]	<0.01	5.21 [2.56-10.62]	<0.01	1.65
Creatinine,mg/dl	0.98 [0.55-1.77]	0.96			
Na$^+$ ≥141 mmol/L	2.99 [1.38-6.50]	0.01	3.55 [1.68-7.50]	<0.01	1.27
K$^+$ <3.5 mmol/L	9.17 [4.59-18.32]	<0.01	9.15 [4.75-17.61]	<0.01	2.21
CO3$^-$ ≥25mmol/L	1.43 [0.72-22.85]	0.31			

logistic regression analysis determines parameters associated with PA

PA score	Sensitivity	Specificity	NPV	PPV	Test prevalence (%)
≥0	1.000	0.003	1.000	0.171	97.62
≥1	1.000	0.010	1.000	0.181	91.90
≥2	0.986	0.194	0.986	0.197	83.57
≥3	0.986	0.280	0.990	0.215	76.43
≥4	**0.971**	**0.483**	**0.988**	**0.273**	**59.29**
≥5	0.914	0.583	0.971	0.305	50.00
≥6	0.829	0.691	0.953	0.349	39.52
≥7	0.837	0.700	0.933	0.462	25.24
≥8	0.614	0.906	0.922	0.566	18.1
≥9	0.529	0.943	0.909	0.649	13.57
10	0.443	0.974	0.897	0.775	9.52

Cut-point of the predictive scoring system in the hypertensive patients whom ARR screening test is indicated (n=420)

PA score	Sensitivity	Specificity	NPV	PPV	Test prevalence (%)
≥7	0.702	0.750	0.375	0.922	61.45
≥8	0.612	0.938	0.366	0.976	50.60
≥9	**0.522**	**1.000**	**0.333**	**1.000**	**42.17**
10	0.433	1.000	0.296	1.000	34.94

Cutoff value in the predictive scoring system in a subgroup of the hypertensive patients with PAC > 15 ng/dl and PRA <1.0 ng/ml/hr (n=83)

Keywords

primary aldosteronism, secondary hypertension, prevalence rate, predicting factors