A cross-sectional review of office and ambulatory blood pressure in children with renal diseases

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Background and Aims: Ambulatory blood pressure monitoring (ABPM) is an important tool for evaluation of blood pressure (BP) among high risk children including those with renal diseases. Our study aims to review the office BP and reports of ABPM performed in children with various renal conditions.

Method: We performed a cross-sectional review of the office BP records and ABPM reports of patients followed up in the paediatric nephrology clinic of Queen Elizabeth Hospital, Hong Kong from year 2013-2017. The diseases categories included congenital anomalies of kidney and urinary tract (CAKUT), glomerular diseases, cystic kidney diseases, renovascular hypertension, neurogenic bladder / bladder dysfunction and other conditions.

Results: Table 1 showed the demographic data and clinical characteristics of the 67 patients enrolled. Altogether 62.7% of subjects had ABPM hypertension (ABPM systolic or diastolic hypertension in either wake or sleep periods), and 40.3% of subjects had nocturnal dipping <10% (non-dippers) (Table 2). Elevated blood pressure and hypertension by office BP were found in 21.9% and 35.9% of subjects respectively. There were 25% of subjects having masked hypertension (Figure). The highest ABPM indices and BP loads were found among those with renovascular hypertension, while those with CAKUT, glomerulopathy and neurogenic bladder / bladder dysfunction had significantly higher diastolic than systolic BP indices or load in both wake and sleep period (p<0.05).

Distribution of hypertension category

- No hypertension
- Prehypertension
- White coat hypertension
- Masked hypertension
- Ambulatory hypertension

Table 1: Baseline characteristics of the study population

Characteristics	Values
Age (years)	14.5 (11.8, 17.2)
Age > 18 years	4 (6%)
Male sex	42 (62.7%)
Body mass index (kg/m²)	19.3 (17.6, 22.6)
Renal diagnosis	
CAKUT	28 (41.8%)
Glomerular pathology	16 (23.9%)
Cystic kidney disease	4 (6.0%)
Renovascular hypertension	5 (7.5%)
Neurogenic bladder / bladder dysfunction	9 (13.4%)
Others	5 (7.5%)
Estimated GFR (ml/min/1.73m²)	96.3 (77.0, 111.6)
Taking medications that increase BP	8 (11.9%)
Taking anti-hypertensives	21 (31.3%)

Table 2: Ambulatory blood pressure monitoring parameters

Characteristics		Values
Wake	Systolic BP index [#]	0.89 (0.84, 0.94)
	Diastolic BP index [#]	0.90 (0.80, 0.97)
	Systolic BP load (%) [^]	5.1 (0.0, 25.0)
	Diastolic BP load (%) [^]	16.1 (3.1, 37.2)
	ABPM systolic BP hypertension	17 (25.4%)
	ABPM diastolic BP hypertension	23 (34.3%)
Sleep	Systolic BP index [#]	0.88 (0.84, 0.97)
	Diastolic BP index [#]	0.91 (0.85, 1.02)
	Systolic BP load (%) [^]	5.6 (0.0, 25.0)
	Diastolic BP load (%) [^]	25.0 (7.1, 50.0)
	ABPM systolic BP hypertension	19 (28.4%)
	ABPM diastolic BP hypertension	34 (50.7%)
ABPM hypertension [§]		42 (62.7%)
Nocturnal dipping (%)		11.3 (8.5, 16.6)
Non-dippers*		27 (40.3%)

Table 3: ABPM characteristics among children with different conditions

Variables	CAKUT (n=28)	Glomerular (n=16)	Cystic kidney disease (n=4)	Renovascular hypertension (n=5)	Neurogenic bladder / bladder dysfunction (n=9)	Others (n=5)	p-value
Age (years)	13.4 (10.0, 16.4)	15.3 (13.3, 18.2)	13.6 (9.4, 14.8)	14.9 (12.9, 17.8)	15.7 (13.4, 17.4)	14.8 (13.3, 20.0)	0.26
BMI (kg/m²)	19.0 (15.7, 22.1)	19.9 (18.6, 23.8)	19.9 (14.6, 22.8)	17.9 (17.3, 26.7)	19.0 (15.7, 22.9)	21.1 (19.1, 31.4)	0.57
Taking anti-hypertensives	4 (14.3%)	9 (56.2%)	1 (25%)	3 (60.0%)	1 (11.1%)	3 (60.0%)	0.02

ABPM parameters

Wake	Systolic BP index [#]	0.88 (0.83, 0.93)	0.87 (0.83, 0.96)	0.84 (0.79, 0.85)	1.02 (0.95, 1.08)	0.88 (0.86, 0.94)	0.87 (0.81, 0.94)	0.03
	Diastolic BP index [#]	0.86 (0.78, 0.95)	0.90 (0.84, 1.00)	0.80 (0.78, 0.88)	1.04 (0.96, 1.16)	0.95 (0.91, 1.02)	0.91 (0.83, 0.93)	0.01
	Systolic BP load (%) [^]	3.1 (0.0, 15.1)	7.8 (0.0, 38.8)	1.4 (0.0, 4.5)	57.5 (20.3, 86.8)	6.4 (1.0, 32.3)	5.3 (0.0, 19.1)	0.06
	Diastolic BP load (%) [^]	4.7 (2.6, 26.9)	19.3 (5.9, 46.9)	6.4 (1.3, 14.9)	67.5 (45.0, 76.7)	25.5 (15.2, 45.5)	13.6 (7.9, 21.1)	0.02
Sleep	Systolic BP index [#]	0.86 (0.83, 0.90)	0.88 (0.83, 1.01)	0.91 (0.88, 0.93)	1.00 (0.97, 1.04)	0.87 (0.83, 0.96)	0.87 (0.80, 1.11)	0.07
	Diastolic BP index [#]	0.91 (0.82, 0.97)	0.92 (0.87, 1.01)	0.93 (0.84, 1.02)	1.09 (0.96, 1.18)	0.92 (0.84, 1.06)	0.92 (0.83, 1.12)	0.23
	Systolic BP load (%) [^]	0.0 (0.0, 17.6)	4.8 (0.0, 38.7)	11.2 (2.6, 17.4)	50.0 (27.7, 66.7)	5.9 (1.8, 36.9)	5.0 (0.0, 69.4)	0.06
	Diastolic BP load (%) [^]	18.4 (6.7, 35.8)	27.5 (10.1, 66.7)	20.3 (3.0, 45.6)	66.7 (50.0, 70.6)	29.4 (18.8, 9.1)	15.4 (4.0, 64.0)	0.26
Non-dippers [*]		11 (39.3%)	6 (37.5%)	4 (100%)	2 (40.0%)	2 (22.2%)	2 (40.0%)	0.21
ABPM hypertension [§]		14 (50.0%)	11 (68.8%)	2 (50.0%)	5 (100%)	7 (77.8%)	3 (60.0%)	0.28

#: BP Index is defined as average BP values divided by the respective 95th percentile values / [^]: BP load is defined as percentage of readings that exceeds the respective 95th percentile values

*: Non-dippers: nocturnal dipping <10% / §: ABPM hypertension: any ABPM systolic or diastolic BP hypertension in wake or sleep period

All values were expressed in either median (25th percentiles, 75th percentiles) or number (%)

Conclusion: Masked hypertension and non-dippers were common among children with kidney diseases. The highest ABPM indices and BP loads were found among children with renovascular hypertension. Children with CAKUT, glomerulopathy and neurogenic bladder / bladder dysfunction also had significantly higher diastolic than systolic BP indices or load. ABPM should be recommended for children with renal conditions.