HYPERTENSION: Impedance Guided Hypertension Treatment

NICaS provides highly accurate real-time data of the patient's cardiovascular status in 3 minutes

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Impedance Cardiography Guided Individualized Hypertension Treatment

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OBJECTIVE

To systematically review the implementation of an individualized hypertension management and a QA project with many CKD patients.

BACKGROUND

- Approximately 1 of 3 U.S. adults have high blood pressure (BP), and only about half of those treated have their BP and recommended target range.
- CKD is a common causes and consequences of uncontrolled hypertension.
- Achieving target BP in CKD patients can be challenging.

METHODS

Patients: Subjects treated at a general nephrology clinic.

Period: 6 months.

Type: Consecutive patients already assigned to MDs in Treatment (individualized) or Control (standard) protocol arms.

Measurements: NICaS hemodynamics parameters (stroke volume, SV, cardiac output, CO, cardiac power CP, and total peripheral resistance TPR); all parameters are indexed, I, using body surface area); total body water, and SphygmoCor CP (central BP, augmentation index, AIX).

Analysis: Continuous variables were summarized by means and SD; Categorical variables were summarized by counts and percentages; Differences in means; Student's T-test; Differences in counts: Chi-Square test (Fisher's exact test, N<5).

Individualized Protocol: Arrows indicate recommendations for medication class change based on hemodynamics category (vasoconstricted, hyperdynamic, mixed).



RESULTS

Results are based on delivered treatment rather than the intention to treat analysis as clinical, logistical, and medication factors impacted the ability to follow the protocol (53 patients from treatment arm ended up in Control arm).

Variable	Treatment	Control	P-value	
N	74	77		
Age (Mean, SD)	62.7 (15.6)	62.1 (13.3)	0.804	
Women (N, %)	37 (50%)	36 (47%)	0.690	
BMI (Mean, SD)	31.3 (7.8)	31.2(5.6)	0.927	
Race (N, %) White Black Hispanic Other/unknown	44 (59%) 8 (11%) 6 (8%) 16 (22%)	38 (49%) 6 (8%) 13 (17%) 20 (25%)	0.262	
CKD	47 (64%)	54 (54%)	0.388	
Diabetes Mellitus	20 (27%)	36 (38%)	0.012	

Blood Pressure Changes						
Variable	Treatment	Control	P-value			
SBP (Mean,SD)		1				
Baseline	163.4 (17.1)	160.2 (15.6)	0.237			
Endpoint	139.4 (16.3)	155.4 (17.4)	< 0.001			
Difference	-24 (17.4)	-4.8 (15.9)	<0.001			
DBP (Mean,SD)						
Baseline	91.6 (111.9)	87.0 (14.0)	0.034			
Endpoint	78.9 (11.8)	84.9 (14.1)	0.005			
Difference	-12.7 (10.0)	-2.1 (8.8)	< 0.001			
In Range						
Baseline						
<140/90	0 (0%)	0 (0%)	1.000			
Endpoint						
<140/90	38 (51%)	10 (13%)	<0.001			
<130/80	17 (23%)	5 (6%)	0.004			
Variable	Treatment	Control	P-value			
Central SBP						
Baseline	143.8 (16.6)	142.4 (14.0)	0.590			
Endpoint	124.6 (17.0)	140.6 (15.1)	< 0.001			
Central DBP						
Baseline	93.1 (13.9)	90.0 (13.5)	0.208			
Endpoint	79.5 (13.9)	86.3 (14.2)	0.010			
AIX						
Baseline	23.6 (15.2)	21.5 (12.3)	0.380			
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Medications	Treatment		Control	
	Baseline (# of patients)	Endpoint (# of patients)	Baseline (# of patients)	Endpoint (# of patients)
ACEI ¹	17 (23%)	24 (32%)	19 (25%)	13 (17%)
ARBs	19 (27%)	24 (32%)	17 (22%)	15 (19%)
Direct acting	2 (3%)	4 (5%)	3 (4%)	1 (1%)
CCB: dihydropyridine ²	27 (36%)	53 (72%)	37 (48%)	41 (53%)
CCB: nondihydropyridine	2 (3%)	1 (1%)	3 (4%)	1 (1%)
Loop diuretics	8 (10%)	10 (14%)	13 (17%)	12 (16%)
Thiazides	15 (20%)	20 (27%)	16 (21%)	13 (17%)
Aldosterone antagonist	11 (15%)	14 (19%)	9 (12%)	10 (13%)
Beta blockers	24 (32%)	44 (59%)	25 (32%)	34 (44%)
Alpha blockers	6 (8%)	6 (8%)	5 (6%)	8 (10%)



CONCLUSION

Knowledge of hemodynamic parameters significantly improved hypertension management.



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