

Challenges & Strategies to Improve BP Measurement During COVID-Era

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Disclosure of Potential Conflicts of Interest

Dr. Nadia Khan	 Organizer and speaker for national conference: CCRN Canadian Cardiovascular Research Network (not for profit) Peer review grants – CIHR, MSFHR SPOR (not for profit) Guideline author, Board Member, Board Chair – all unpaid volunteer positions – President Hypertension Canada (2016-2020) Diabetes Canada Guideline Author
Dr. Laura Kuyper	 Speaking Honoraria: Servier, AstraZeneca, Valeant HF Advisory Board: AstraZeneca Small Clinical Grant: Servier
Dr. Marcel Ruzicka	No conflicts to declare
	Hypertension Canadian Society of Nephrology/ Société canadienne de néphrologie CANADA



Challenges & Strategies to Improve BP Measurement during the COVID-era

Moderator:

Nadia Khan MD MSc

Professor and Head, Division of General Internal Medicine, University of British Columbia

Immediate Past President Hypertension Canada (2016-2020)

International Society of Hypertension Council

American Society of Hypertension Clinical Specialist in Hypertension



Is There an Interaction Between ACE inhibitors/ARBs and COVID-19?





Reinhold Kreutz, et al. European Society of Hypertension COVID-19 Task Force Review of Evidence, Cardiovascular Research, 2020

Impact of RAAS Inhibitors on COVID-19 Patient Outcomes

Author (Publication Date)	Country	N (HTN*)	Type of Study	Agent	Outcom	Endpoints
Peng et al ³² March 2, 2020	China	112 (92)	Retrospective Cohort	ACE-I/ARB	Neutral	No effect on morbidity or mortality
Meng et al. ³³ March 17, 2020	China	417 (51)	Retrospective Cohort	ACE-I/ARB	Positive	Lower rate of severe disease
Huang et al. ³⁴ March 30, 2020	China	50 (50)	Retrospective Cohort	ACE-I/ARB	Neutral	No difference in in-hospital mortality
Feng et al. ³⁵ April 10, 2020	China	476 (113)	Retrospective Cohort	ACE-I/ARB	Positive	Increased ACE-I/ARB use in moderate vs severe COVID-19 group
Zhang et al. ²⁴ April 17, 2020	China	1,128 (1,128)	Retrospective Cohort	ACE-I/ARB	Positive	Decreased all-cause mortality
Li et al. ³⁶ April 23, 2020	China	1,178 (362)	Retrospective Cohort	ACE-I/ARB	Neutral	No association with severity of illness or mortality
Yang et al. 37 April 29, 2020	China	126 (126)	Retrospective Cohort	ACE-I/ARB	Neutral	Lower proportion of critically ill and lower death rate with ACE-I/ARB use
Mancia et al. ²⁵ May 1, 2020	Italy	6,272 (3,632)	Population Based Case Control Study	ACE-I/ARB	Neutral	No association with number of patients or severe/fatal disease
Reynolds et al. ²⁶ May 1, 2020	USA	12,594 (2,573)	Retrospective Cohort	ACE-I/ARB	Neutral	No increase in likelihood of positive test or risk of severe disease
Mehra et al. 38	Asia, Europo,	8,010	Retrospective	ACE-I/ARB	Neutral	No increased risk of in-hospital death
May 1, 2020	North America	(2,346)	Cohort			
Mehta et al. ³⁹ May 5, 2020	USA	18,472 (7,312)	Retrospective Cohort	ACE-I/ARB	Neutral	No association between ACE-I/ARB use and positive COVID-19 test
Conversano et al. 40 May 8, 2020	Italy	191 (96)	Retrospective Cohort	ACE-I/ARB	Neutral	ACE-I/ARB treatment not associated with increased mortality or worse clinical presentation.
de Abajo et al. ⁴¹ May 14, 2020	Spain	1,139 (617)	Population Based Case Control Study	ACE-I/ARB/ Aldosterone Antagonists/ Renin Inhibitors	Neutral	No increase in the risk of hospital or ICU admission, fatal cases

*with hypertension diagnosis and positive COVID-19 test

Society	Summary of recommendations	Last Statement Update
European Society of	Recommend continuing ACEis/ARBs due to lack of evidence to	March 12, 2020
Hypertension	support differential use in COVID-19 patients. In those with	
	severe symptoms or sepsis, antihypertensive decisions should be	
	made on a case-by-case basis taking into account current	
	guidelines	
European Society of Cardiology	Strongly encourage continuing ACEis/ARBs due to lack of	March 13, 2020
Council on Hypertension	evidence to support discontinuing	
Hypertension Canada	Recommend continuing ACEis/ARBs due to lack of evidence that	March 13, 2020
	patients with hypertension or those treated with ACEis/ARBs are	
	at higher risk of adverse outcomes from COVID-19 infection	
Canadian Cardiovascular Society	Strongly encourage continuing ACEis/ARBs and Angiotensin	March 15, 2020
	Receptor Neprilysin Inhibitors due to a lack of clinical evidence to	
	support withdrawal of these agents	
The Renal Association, United	Strongly encourage continuing ACEis/ARBs due to unconvincing	March 15, 2020
Kingdom	evidence that these medications increase risk	
International Society of	Strongly recommend that the routine use of ACEis/ARBs to treat	March 16, 2020
Hypertension	hypertension should not be influenced by concerns about	
	COVID-19 in the absence of compelling data that ACEis/ARBs	
	either improve or worsen susceptibility to COVID-19 infection	
	nor do they affect the outcomes of those infected	
American College of Physicians	Encourage continuing ACEis/ARBs because there is no evidence	March 16, 2020
	linking them to COVID-19 disease severity, and discontinuation	
	of antihypertensive therapy without medical indication could in	
	some circumstances result in harm	



Cardiovascular death rate per 100,000 in Canada from 2007 to 2017





Hypertension awareness, treatment and control rates in Canadian women from 2007 to 2017





BLOOD PRESSURE MEASUREMENT AND TREATMENT TARGETS IN THE COVID-ERA

Dr. Laura Kuyper

Dr. Nadia Khan Dr. Marcel Ruzicka

November 2020

LEARNING OBJECTIVES

- Understand importance of out-of-office diagnosis of hypertension
- Discuss BP monitoring strategies during COVID-era
- Review differences in office vs home BP measurement (HBPM)
 - Understand correct BP technique for each measurement method
- Discuss Hypertension Canada's Device Recommendations Program

BP MONITORING DURING PANDEMIC - CASE

- ► 46 yo M diagnosed with HTN prior to pandemic
- Still not below target of <135/85 at last in-person visit → antihypertensives were increased
- During current telehealth visit he reports his home BPs over phone to you:
 - Uses hand-me-down home BP device borrowed from a family member older device that requires manual inflation
 - Provides you with 5 BP measurements taken over the last month, performed at random times
 - Often checks his BP at dinner table, with his young kids nearby

WHAT ARE YOUR RECOMMENDATIONS TO IMPROVE HIS HOME BP MEASUREMENT TECHNIQUE?

- A. Ensure his home BP device is recommended by Hypertension Canada
- B. Recommend checking BP in a.m. before breakfast and 2 hours after dinner, before taking meds
- C. Suggest sitting in a quiet location, ensure back supported, feet flat on ground
- D. Measure BP in non-dominant arm, or arm with higher BP if >10mmHg, difference between arms is known
- E. All of the above

WHAT ARE YOUR RECOMMENDATIONS TO IMPROVE HIS HOME BP MEASUREMENT TECHNIQUE?

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- E. <u>All of the above</u>

BLOOD PRESSURE MANAGEMENT DURING COVID PANDEMIC

More reliance on out-of-office BP measurement during pandemic

- GP/specialist office visits scaled back
- Appointments largely via Telehealth (may become more long term strategy)
- Reliance on home BP measurement significantly increased

Gerke, S., Shachar, C., Chai, P.R. *et al.* Regulatory, safety, and privacy concerns of home monitoring technologies during COVID-19. *Nat Med* **26**, 1176–1182 (2020).

 Hypertension Canada currently recommends out-of-office measurement for <u>diagnosis</u>; office BP measurement for <u>monitoring</u>
 however – recent evidence supports HBPM for monitoring also



Review

A New Algorithm for the Diagnosis of Hypertension in Canada

Lyne Cloutier, RN, PhD,^a Stella S. Daskalopoulou, MD, PhD,^b Raj S. Padwal, MD, MSc,^c Maxime Lamarre-Cliche, MD,^d Peter Bolli, MD,^e Donna McLean, RN, NP, PhD,^f Alain Milot, MD, MSc,^g Sheldon W. Tobe, MD, MSc(HPTE),^h Guy Tremblay, MD,ⁱ Donald W. McKay, PhD,^j Raymond Townsend, MD,^k Norm Campbell, MD,¹ and Mark Gelfer, MD^m

Published in 2015 to address 2 major <u>pitfalls of BP measurement</u> in previous Hypertension Canada recommendations

Reliance on auscultatory (manual) office BP measurements

Manual BP errors include hearing deficits, rounding errors, rapid cuff deflation; standardized manual technique usually not performed in routine practice

Lack of early identification of white coat hypertension

New algorithm put forth for <u>diagnosing</u> HTN in Canada ,



DIAGNOSING HYPERTENSION

- Out of office assessment is the preferred means of <u>diagnosing</u> HTN (ambulatory or home BP measurement)
- 2. Office measurement should be automated (AOBP), not manual



OUT-OF-OFFICE BP MEASUREMENTS IN DIAGNOSING HTN

 Out-of-office measurement identifies white coat hypertension (WCH) and masked hypertension (MH)



- WCH high office BP, normal out-of-office BP (no target organ damage)
 - Prevalence up to 30% of patients with high OBP (Huang et al J Hypertens 2017)
- MH normal office BP, high out-of-office BP (may have sig TOD ie. LVH)
 - Prevalence up to 20% of untreated adults (Ogedegbe et al, Curr Hypertens Rep, 2010)
- 24-hour ambulatory BP monitoring (ABPM) is recommended over HBPM for <u>diagnosis</u> but HBPM can be used if ABPM not tolerated or available, patient preference

BP <u>MONITORING</u> IN HYPERTENSIVE PATIENTS



- Hypertension Canada currently recommends AOBP for BP monitoring in known hypertensives on treatment, except for patients with white coat HTN (then HBPM, ABPM is recommended)
- However \rightarrow evidence mounting for utility of HBPM in monitoring
- Many GPs/specialists do rely on HBPM for monitoring esp. during pandemic times!
 - Tec4Home BP study team (K. Tran et al.; in progress) surveyed Vancouver specialists during pandemic – 42% report increase in HBP M for monitoring, 31% less BP measurement, 12% not measuring BP!
 - Vast majority of hypertension visits reported in this survey were conducted either by phone or video (AOBP not performed!)

ADVANTAGES OF HBPM

- ► HBPM improves adherence to antihypertensive therapy (Pickering et al Hypertension 2008) → encourages patients' active involvement in their own care
- HBPM more practical than 24-hour ABPM, preferred by patients (Nasothimiou et al J Human Hypertens 2014)
- HBPM leads to overall better BP control compared to OBPM...

Efficacy of self-monitored blood pressure, with or without telemonitoring, for titration of antihypertensive medication (TASMINH4): an unmasked randomised controlled trial www.thelancet.com Vol 391 March 10, 2018

Richard J McManus, Jonathan Mant, Marloes Franssen, Alecia Nickless, Claire Schwartz, James Hodgkinson, Peter Bradburn, Andrew Farmer, Sabrina Grant, Sheila M Greenfield, Carl Heneghan, Susan Jowett, Una Martin, Siobhan Milner, Mark Monahan, Sam Mort, Emma Ogburn, Rafael Perera-Salazar, Syed Ahmar Shah, Ly-Mee Yu, Lionel Tarassenko, F D Richard Hobbs, on behalf of the TASMINH4 investigators*

- 1182 hypertensive participants, not controlled, in UK across 142 primary care clinics, enrolled in study to assess 3 BP monitoring strategies:
 - ► self-monitoring of BP
 - self-monitoring of BP with telemonitoring
 - Readings sent to automated service alerting pts to high/low/insufficient BPs
 - usual care (AOBP-guided Tx)
- After 1 year, BP lower in both self-monitoring groups compared to usual care group (self-monitoring groups also taking more meds)
- "Self-monitoring can be recommended for the ongoing management of HTN"

MEAN BP AT BASELINE, 6 MOS, 12 MOS – LOWER IN SELF-MONITORING GROUPS COMPARED TO USUAL CARE

	Baseline	6 months	12 months	6-month adjusted mean difference (95% CI, p value*) vs usual care	12-month adjusted mean difference (95% CI, p value*) vs usual care			
Systolic blood pressure (mm Hg)								
Telemonitoring group	153·2 (14·3); n=389	139·0 (16·8); n=338	136·0 (16·1); n=327	-3·7 (-5·9 to -1·5), p=0·0012	–4·7 (–7·0 to –2·4), p<0·0001			
Self-monitoring group	152·9 (13·6); n=391	140·4 (15·7); n=349	137·0 (16·7); n=328	–2·1 (–4·3 to 0·1), p=0·0584	–3·5 (–5·8 to –1·2), p=0·0029			
Usual care group	153·1 (14·0); n=393	142·5 (15·4); n=358	140·4 (16·5); n=348					
Diastolic blood pressure (mm Hg)								
Telemonitoring group	85·5 (10·0); n=389	79∙8 (9∙9); n=338	78·7 (9·7); n=328	-1·2 (-2·4 to -0·01), p=0·0482	–1·3 (–2·5 to –0·02), p=0·0482			
Self-monitoring group	85·1 (10·5); n=391	80·3 (10·7); n=349	77·8 (10·1); n=328	–0·1 (–1·3 to 1·07), p=0·8421	–1·5 (–2·7 to –0·2), p=0·0209			
Usual care group	86·0 (10·3); n=393	81·1 (10·9); n=358	79·9 (10·7); n=348	••				
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Data are mean (SD), unless otherwise stated. *Significant at p<0.017.

Table 2: Mean blood pressure at baseline, 6 months, and 12 months for each group

Home Blood Pressure Monitoring Alone vs. Combined Clinic and Ambulatory Measurements in Following Treatment-Induced Changes in Blood Pressure and Organ Damage

George S. Stergiou,¹ Nikos Karpettas,¹ Antonis Destounis¹, Dimitris Tzamouranis,¹ Efthimia Nasothimiou,¹ Anastasios Kollias,¹ Leonidas Roussias,¹ and Ioannis Moyssakis²

- 2014 study devised to determine whether HBPM is as reliable as combined AOBP/ABPM in monitoring drug treatment and preclinical target organ damage
- 145 untreated subjects with elevated BP randomized to treatment initiation and titration of antihypertensives based on either a combination of AOBP/ABPM or HBPM alone
- Average follow up 13 months
- No sig. difference among either group in treatment-induced change in LV mass index on echo (primary outcome), pulse wave velocity, urinary albumin excretion or BP control rates



At end of follow up:

Sig. BP lowering seen with all 3 measurement methods (home, clinic, ambulatory) No sig. difference in **BP** lowering between HBP/M and AOBP/ABP measurement groups

Figure 2. Blood pressure changes during the study assessed using the 3 measurement methods in the 2 study arms (*P* < 0.001 for all changes, nonsignificant differences between arms; error bars for standard error).

PROPER HBPM TECHNIQUE



Recommended by Recommandé par Hypertension Canada Gold | Or

- Use Hypertension Canada validated device
- Use arm with highest BP if >10mmHg difference, otherwise nondominant arm
- Should be seated with arm at heart level, resting for 5 mins, with back and feet supported
- Take measurements before breakfast and 2 hours after dinner, before meds
- Discard first reading, average of second 2 readings, morning and evening for 7 days (1-2 min intervals between BP readings)
- Record BP measurements to smart phone app or written in an organized way!

CORRECT BP MEASUREMENT TECHNIQUE

BLOOD PRESSURE MEASUREMENT TECHNIQUE

Accurate diagnosis begins with accurate measurement:



Hypertension: What You Need to Know



Knowledge is power! Get the facts on hypertension – what causes it, how it's treated, what your numbers mean, and much more.

LEARN MORE ABOUT HYPERTENSION

hypertension.ca/hypertension-and-you

SAMPLE HOME BP LOG – DOWNLOADABLE FROM HYPERTENSION CANADA WEBSITE



Every year, with your health care professional, review the technique for measuring your blood pressure properly, and check that your device is in good condition.

My target blood pressure at home is less than:



Date		Time	Comments	Heart Rate (beats/min)	BP Reading #1		BP Reading #2	
					Systolic	Diastolic	Systolic	Diastolic
June 15	Sample Morning	8:00 a.m.	Meds at 9 a.m.		138	82	135	80
	Sample Evening	8:00 p.m.	Upset		157	92	154	90
	Day 1 Morning							
	Day 1 Evening							

WHEN IN CLINIC: UNATTENDED AUTOMATED OFFICE BP (AOBP) MEASUREMENT IS PREFERRED OVER MANUAL MEASUREMENT

- More closely approximates ABPM than manual office BPs (mitigates white coat effect)¹⁻³
 - Systolic AOBP may be >10mmHg lower than manual (Rinfret et al Can J Cardio 2017)
- Is more predictive of end organ damage than manual office BPs (LV mass index, proteinuria and carotid intima-media thickness)⁴⁻⁶



Beckett L, et al. BMC Cardiovasc Disord 2005;5:18;
 Myers MG, et al. J Hypertens 2009;27:280-6;
 Myers MG, et al. BMJ 2011;342;d286;
 Campbell NRC, et al. J Hum Hypertens 2007;21:588-90;
 Andreadis EA, et al. Am J Hypertens 2011;24:661-6;
 Andreadis EA, et al. Am J Hypertens 2012;25:969-73.

AOBP MEASUREMENT TECHNIQUE

- BP should be taken in both arms at least once, higher arm used for AOBP thereafter
- Use HC validated automated device
- Choose cuff with appropriate bladder size width 40% of arm circumference, length 80-100% of arm circumference
- Should be unattended in quiet room, feet on floor, back supported, no specified period of rest prior to measurements
- 3-6 measurements should be taken with 1-2 minute intervals between each measurement

IMPORTANT NOTE ON BP MEASUREMENT IN ACHIEVING INTENSIVE BP TARGETS (SBP <120)

BP Measurement in SPRINT: Automated Office BP (AOBP)

- Visit BP was the average of 3 seated office BP measurements obtained using an automated measurement device: Omron 907XL.
- Appropriate cuff size was determined by arm circumference.
- Participant was seated with back supported and arm bared and supported at heart level.
- Device was set to delay 5 minutes to begin 3 BP measurements research staff was trained to push start button and leave exam room during the 5 minute delay and measurements, during which time participant refrained from talking.
- BP was also measured 1 min after standing at screening, baseline, 1, 6, and 12 months, and annually thereafter. While standing, participants were asked about symptoms of hypotension.

WHICH DEVICE FOR HOME OR OFFICE?? HYPERTENSION CANADA RECOMMENDED BP DEVICE PROGRAM

- HC program allows you to confidently buy devices that are validated in studies
- Includes office, home, and ambulatory BP monitors in the list

What type of blood pressure monitor should I buy?

The blood pressure monitor you purchase should be proven accurate, and the monitor's cuff must properly fit your upper arm. Your health care professional can recommend a monitor and measure your arm to select the right cuff size. You should bring your monitor to your health care professional annually to have it checked for accuracy.

To help you in your purchasing decisions, Hypertension Canada provides a list of recommended monitors which have been proven accurate in research studies at **hypertension.ca**. Many of these recommended devices will carry the symbols shown to the right on their packaging.



Recommended by Recommandé par Hypertension Canada Gold | Or



Recommended by Recommandé par **Hypertension Canada** Silver | Argent

hypertension.ca/bpdevices

The Hypertension Canada blood pressure device recommendation listing: Empowering use of clinically validated devices in Canada

Raj Padwal MD¹ Angelique Berg² | Mark Gelfer MD³ | Karen Tran MD⁴ | Jennifer Ringrose MD¹ | Marcel Ruzicka MD⁵ | Swapnil Hiremath MD⁵ | for the Accuracy in Measurement of Blood Pressure (AIM-BP) Collaborative

- ► Accuracy in Measurement of Blood Pressure Collaborative (AIM-BP) → this group created HC recommended BP device listing
- Created to evaluate and ensure optimal blood pressure measurement and access to validated devices across Canada
 - Previous skepticism about automated devices due to number of low-quality, inaccurate devices being sold
 - Fewer than 15% of devices sold internationally are validated!
- Specific to Canada reflects our device market and ensures manufacturers continually re-validate machines

TAKE HOME MESSAGES



Out-of-office measurements recommended for <u>diagnosing</u> HTN

- Home BP measurement becoming more prevalent, evidence is mounting, for their use in BP diagnosis AND monitoring
- Ensure proper technique for home and office BP measurement
- Use a validated device Look for the Hypertension Canada Recommendation logo



Recommended by Recommandé par Hypertension Canada Gold | Or



Recommended by Recommandé par Hypertension Canada Silver | Argent
Role of 24-hour ambulatory blood pressure monitoring in diagnosis and management of hypertension

Marcel Ruzicka, MD, PhD, FRCPC

Division of Nephrology, University of Ottawa

Objectives

Review utilization of 24-hour ABPM for diagnosis and management of HTN in Canada

Relevance of 24-hour ABPM for diagnosis and management of White-coat HTN and Masked HTN

Relevance of 24-hour ABPM for diagnosis of abnormal nocturnal patterns of BP

Review 24-hour ABPM BP targets for diagnosis and management of HTN

How do family physicians measure BP in clinical practice?

BP measurement Method	Diagnosis	Follow-up	
Manual (mercury/aneroid)	21.4%	63.6%	
Automated Oscillometric Device	29.7%	59.1%	
Pharmacy BP	2.3%	36.2%	
24-hr ABPM	14.4%	23.0%	>
Home BP monitoring	22.4%	68.7%	

Kaczorowski et al. Can Fam Physcian 2017;63:193-199

Major disadvantages of office BP assessment

BP is taken under circumstances that may adversely affect the level of BP (overestimate - white-coat effect or underestimate – masked HTN) true BP.

It provides only a snapshot of BP (which could be misleading for management in patients with labile HTN).

It does not provide any information about nocturnal BP.

Advantages of 24-hour ABPM

24-hour ABPM simply gives more measurements (typically every 15-20 minutes during daytime and every 30 minutes during sleep) than conventional BP measurement, and provides information about BP variability.

Advantages of 24-hour ABPM

24-hour ABPM provides a profile of BP away from the medical environment, thereby allowing identification of individuals with a white-coat response or masked hypertension.

White Coat HTN/White Coat Effect

White-coat hypertension

definition – patients naive to hypertension therapy, office BP above 140/90 mmHg (by NAOBP device) or 135/85 mmHg (by AOBP device), whereas awake average BP by 24-hour ABPM is <135/85 mmHg

White-coat effect

definition – in patients with confirmed sustained HTN, office BP readings higher (by at least 10 mmHg) compared to BP readings outside office 58 y old male

Ref: Difficult to control HTN/Secondary HTN?

Hx of HTN 2 years

No Hx of IHD/Stroke/DM/CKD

Meds Amlodipine 10 mg/day, Perindopril 4 mg/day, Bisoprolol 5 mg/day,

HCTZ 25 mg/day

Non smoker/Not excessive alcohol intake/Treadmill 4x/wk

BMI 22

Of	fice BPs	casual	resting	standing
1.	Visit	175/88	156/77	169/87
2.	Visit	167/86	157/82	164/81

Labs: Scr 78/ACR N/ECG N

Home BP readings 115-140/65-85

24-hour ABPM



Dg: White coat effect. Normal BP during the day and sleep. Dipper.

White-coat HTN/White Coat Effect Clinical Relevance

These two patterns are highly prevalent (20-40%), in particular in elderly and very elderly patients.

White-coat HTN/White Coat Effect Clinical Relevance

Diagnostic method – 24-hour ABPM and self home BP monitoring.

These two patterns, white-coat HTN and white-coat effect clearly represent situation where treatment based solely on office BP reading will lead to "unnecessary" drug therapy or to overtreatment.

White-coat HTN - Prognosis

Patients with white-coat hypertension do require close follow-up (preferably with 24-hour ABPM or home BP monitoring) as they have higher risk of developing hypertension in the future and higher risk of adverse cardiovascular events.

(Huang et al. J Hypertens 2017;35:677-688)

Masked HTN/Masked Uncontrolled HTN

Masked Hypertension/Masked Uncontrolled HTN

Other terms used: reversed white coat hypertension, white coat normotension, work-related hypertension.

Definition of Masked HTN - patients naive to BP lowering therapy classified as normotensive by office BP measurements that are hypertensive by 24-hour ABPM (awake period or during sleep).

Definition of Masked Uncontrolled HTN – treated patients with sustained HTN with controlled office BP, but awake and/or sleep average BP on 24-hour ABPM >135/85 and > 120/70 mmHg, respectively. 48 y old male

Ref: HTN and MAU

Hx of HTN 10 years

No Hx of IHD/Stroke/

DM type 2 x 5 years/N Scr/ACR 55

Meds HCTZ 25 mg/day, Trandolapril 4 mg/day, Amlodipine 10 mg/day

Ex-smoker/No alcohol/Golf summer/Skiing winter

BMI 26

Offi	ice BPs	casual	resting	standing
1.	Visit	155/79	131/77	150/87

Labs: Scr 90/ACR 47.4/Echocardiogram LVH

Home BP readings 140-155/80-90

24-Hour ABPM



Dg: Systolic and Diastolic HTN during day. Normal BP during sleep. Extreme Dipper. Recommendation: Masked HTN. Titrate BP therapy to target BP.

Masked Hypertension

Prevalence is high (20-40% among hypertensive patients) *Franklin et al. Hypertension 2015;65:16-20*.

Diagnostic method – 24-hour ABPM and to limited extent self home BP monitoring (does not provide information on nocturnal BP).

PROGNOSIS OF MASKED HYPERTENSION

1332 subjects in Japan, 24-hr ABPM and office BP, cardiovascular mortality and cerebrovascular morbidity over 10 year F/U



Major disadvantages of office BP assessment

BP is taken under circumstances that may adversely affect the level of BP (overestimate - white-coat effect or underestimate – masked HTN, true BP).

It provides only a snapshot of BP (which could be misleading for management in patients with labile HTN).

It does not provide any information about nocturnal BP.

Advantages of ABPM

24-hour ABPM can demonstrate a number of patterns of BP behaviour that are relevant to clinical practice, such as nocturnal hypertension and nocturnal BP dipping, non dipping, reverse-dipping, extreme dipping.

Abnormal patterns of nocturnal BP

Nocturnal hypertension

Non-dipping

Reverse dipping

Extreme dipping

Morning BP surge

DIURNAL RHYTHM OF BLOOD PRESSURE (normotensive patient with normal nocturnal BP and dipping pattern)



time of the day (hours)

Patterns of BP related to nocturnal window

Nocturnal hypertension

definition – blood pressure during sleep > 120/70 mmHg

prognosis – strongest predictor of adverse cardiovascular outcomes

(Hansen et al. Hypertension 2011;57:3-10). (Salles et al. Hypertension 2016;67:693-700).

24-hr ABPM

(systolic daytime HTN, nocturnal systolic HTN, dipper)



time of the day (hours)

Patterns of BP related to nocturnal window

Non-dipping

definition – absence of decrease in nighttime BP by 10%
or more
prognosis – higher risk (compared to dippers) of adverse
cardiovascular events 1.40 (95% CI 1.227-1.597)

(Salles et al. Hypertension 2016;67:693-700).

24- hour ABPM

(normal daytime BP, nocturnal systolic HTN, non-dipper)



time of the day (hours)

Patterns of BP related to nocturnal window

Reverse dipping

definition - BP rises above daytime pressures rather than falling during the night

prognosis – increased risk of stroke and cardiac events 1.785 (95% CI 1.47-2.15)

(Salles et al. Hypertension 2016;67:693-700).

DIURNAL RHYTHM OF BLOOD PRESSURE (normal daytime BP, nocturnal HTN, reverse dipper)



time of the day (hours)

Patterns of BP related to nocturnal window

Extreme dipping and Morning surge in BP

definition - a marked nocturnal fall in BP (> 20%)

Extreme dipping is closely associated with an excessive (>55 mmHg for SBP) **morning surge in BP**

Extreme Dipper (>50 mmHg) and Morning SBP Surge (>60 mmHg).



Dg: Systolic and Diastolic HTN during day. Normal BP during sleep. Extreme Dipper with Excessive Morning Surge.

Patterns of BP related to nocturnal window

Extreme dipping and Morning surge in BP

prognosis - patients with atherosclerotic disease are at risk of nonfatal ischaemic stroke and myocardial ischemia, an excessive (>55 mmHg) morning surge in SBP is associated with an increase in risk for stroke and acute coronary event 1.203 (95% CI 0.821-1.763)

(Salles et al. Hypertension 2016;67:693-700).

Advantages of ABPM

24-hour ABPM is a much stronger predictor of CV morbidity and mortality than conventional measurement, and evidence is growing that nocturnal BP measured by ABPM may be the most sensitive predictor of CV outcome, from which it follows that the measurement of night-time BP should be an important part of clinical practice.

BP targets for general population and high risk patients in Canada

	General Population	High risk patients (eg. patients with CKD)
Office BP	<135/85 mmHg	<120/85 mmHg
24-hour ABPM		
Daytime	<135/85 mmHg	?
Nocturnal	<120/70 mmHg	?

SPRINT ambulatory blood pressure study

897 patients, 27 months f/u, 24-hour ABPM done within 3 weeks of office BP, intensive (<120 mmHg) vs standard (<140 mmHg)

BP	BP lowering to <120 mmHg	Standard BP lowering
Office BP	119.7±12.8 mmHg	135.5±13.8 mmHg
24-hour ABPM Daytime Nocturnal	126.5±12.3 mmHg 115.7±14.6 mmHg	138.8±12.6 mmHg 125.5±14.6 mmHg

Drawz et al. Hypertension 2017;69:42-50.

Conclusion

Given the limitations of office blood pressure assessment,

24-hour ABPM should be more utilized for diagnosis and

treatment of HTN (in agreement with the Canadian

Guidelines for Diagnosis and Management of Hypertension

and guidelines by other national professional organizations).


THANK YOU!



Evaluation and Certificate

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 - Your feedback helps shape future educational initiatives! Completion of the evaluation is appreciated!
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