Dipping Phenomenon
The Importance of Nocturnal Blood Pressure

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Introduction
Nocturnal hypertension has been shown to predict deaths and / or adverse cardiovascular events both independent of and often superior to daytime BP.
Continued

• Prevalence increased in older age, black race, DM, obesity, chronic kidney disease, and sleep-related disturbance

• Therapeutic strategies; dietary salt restriction, diuretic therapy, dietary potassium liberalization, weight loss, chronotherapy, and nocturnal CPAP have demonstrated restorative capacity for the normal circadian BP rhythm.

Recommended standards for normal and abnormal pressures during ABPM.

These pressures are only a guide, and lower pressures may be abnormal in patients whose total risk factor profile is high and in whom there is concomitant disease.

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>135/85</td>
<td>&gt;140/90</td>
</tr>
<tr>
<td>Night</td>
<td>120/70</td>
<td>&gt;125/75</td>
</tr>
<tr>
<td>24 hour</td>
<td>130/80</td>
<td>&gt;135/85</td>
</tr>
</tbody>
</table>
Dipping Definition

Overnight BP monitoring was arbitrarily divided into 2 parts:

**Baseline period** (“daytime”) from 8 PM to 10 PM

**Sleeping period** (“nighttime”) from 12 AM to 6 AM.

**Nondipping** was defined as a fall in average sleeping systolic BP 10% from baseline.

According to the American Heart Association Council on High Blood Pressure

Nocturnal BP < 115/65 is deemed optimal, < 120/70 is deemed normal and > 125/75 is deemed abnormal.

Non-dipping is commonly defined as a < 10% fall in nocturnal BP relative to diurnal BP = \([\text{daytime BP} - \text{night-time BP}] / \text{daytimeBP} \times 100\%\)
Classification of blood pressure levels of the British Hypertension Society

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic blood pressure (mmHg)</th>
<th>Diastolic blood pressure (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal</td>
<td>&lt;120</td>
<td>&lt;80</td>
</tr>
<tr>
<td>Normal</td>
<td>&lt;130</td>
<td>&lt;85</td>
</tr>
<tr>
<td>High normal</td>
<td>130-139</td>
<td>85-89</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 1 (mild)</td>
<td>140-159</td>
<td>90-99</td>
</tr>
<tr>
<td>Grade 2 (moderate)</td>
<td>160-179</td>
<td>100-109</td>
</tr>
<tr>
<td>Grade 3 (severe)</td>
<td>&gt;180</td>
<td>&gt;110</td>
</tr>
<tr>
<td>Isolated systolic hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 1</td>
<td>140-159</td>
<td>&lt;90</td>
</tr>
<tr>
<td>Grade 2</td>
<td>&gt;160</td>
<td>&lt;90</td>
</tr>
</tbody>
</table>
Impact of High-Normal BP on the Risk of CV Disease


Relationship Between Hypertension and IHD Mortality

Indications for ABPM

- Possible ‘white coat’ hypertension
- Informing equivocal treatment decisions
- Evaluation of nocturnal hypertension
- Determining efficacy of drug treatment over 24 hours
- Evaluation of symptomatic hypotension
- Unusual BP variability
- Diagnosis & treatment of hypertension in pregnancy
- Evaluation of drug resistant hypertension
Isolated Systolic HTN

Dipper status

- Dipping refers to drop in BP with sleep
  - At least 10% is expected

**Non-dipper** status is abnormal

- Blunted decline seen in sleep disordered breathing,
- Autonomic failure, elderly patients
- Associated with increased prevalence of
  - LVH
  - Albuminuria
  - Peripheral Arterial Disease
  - Cerebral Lacunae
  - Increased Cardiovascular Mortality
Dippers and Non-Dippers

- Dipper: Day/Night >10/5 mmHg
- Non-Dipper: Day/Night <10/5 mmHg

- Dipper: Stroke 3%
- Non-Dipper: Stroke 23%


Stage 1 hypertensive dipper
Stage 2 hypertensive dipper

Hypertensive Dipper (>SHTN)
Dipping Pattern and Decline in GFR

- 322 consecutive patients
- 137 dippers
- 185 nondippers
- Follow-up 3.2 yrs
- Dippers mean change in GFR 1.3%
- Nondippers mean change in GFR 15.9% (P<0.001)

Davidson et al Arch Intern Med. 2006;166:846-852

Increase in Nocturnal Blood Pressure and Progression to Microalbuminuria in Type 1 Diabetes

Lurbe E, NEJM 2002;347:797-805
Non-Dipper Status related to Cardiovascular Mortality

- Cohort study
- 1542 rural Japanese adults; mean age 61
- 41% on antihypertensive medications
- Baseline ABPM; average 5.1 year f/u
- Inverted dippers: Increased nocturnal BP
- Nondippers: 0-10% dip
- Dippers: 10-20% dip
- Extreme dippers: >20% dip
Conclusion

- **Nondipping** status was a risk factor for CV mortality among treated and untreated patients.
- **Nondipping** status may be a marker for other CV risk factors.
- Extreme dippers did not have elevated risk.
- Other studies have shown elevated stroke risk.
- Cohort design limits ability to make conclusions.
- No data about BP control rates among hypertensives.
- No data about comorbid conditions among normotensives.
- Other studies have not found that normotensives with nondipper status have increased.

**Hypertensive Non-Dipper**

[Graph showing time (hour) vs. systolic, diastolic (mmHg), HR (min) with data dimensions: Total: 70, Suppressed: 4, Meas: 56, Event: 1]
Stage 3 HTN Non-Dipper

CV Events that are Coincident with Morning Blood Pressure ‘Surge’

- Myocardial ischemia
- Myocardial infarction
- Sudden cardiac death
- Stroke:
  - Thrombotic
  - Hemorrhagic

Normal 24 hr ABP with morning surge

Overtreatment
Conclusion

ABPM was successful only in a small number of patients in geriatric stroke rehabilitation.

But, successful ABPM was of clinical relevance in the majority of patients.

Care must be taken, not to over treat high early morning BP.

ABPM is useful in predicting long term CV prognosis.

Non dipping is a potent predictor of CV mortality and is associated with autonomic dysfunction.

Continued…

Non dipping phenomenon is closely related to high incidence of CV disease and poor long term survival.

Non dipping has been associated with CV complications in those with type I DM.

Early documentation of an increase in nocturnal blood pressure might warrant the use of ACEIs or ARBs in patient with Type I DM.

On the other hand there is documentation might suggest there is no need for early therapeutic treatment over than optimal glycemic control.
The end

"If we have to do another one of those damn Coca Cola commercials today, I'm gonna puke..."