TITLE: Wrist Sphygmomanometry versus Upper Arm Sphygmomanometry: Clinical Effectiveness and Guidelines

DATE: 05 February 2013

RESEARCH QUESTIONS

1. What is the clinical effectiveness of wrist sphygmomanometry versus upper arm sphygmomanometry in adult patients in a clinical setting?

2. What are the evidence-based guidelines for the use of wrist sphygmomanometers versus upper arm sphygmomanometers in adult patients in a clinical setting?

KEY MESSAGE

Eight non-randomized studies regarding the clinical effectiveness of wrist sphygmomanometers compared with upper arm sphygmomanometers, in a clinical setting, were identified; no evidence-based guidelines were identified.

METHODS

A limited literature search was conducted on key resources including PubMed, The Cochrane Library (2012, Issue 12), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, and guidelines. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2008 and January 21, 2013. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

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RESULTS

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, and evidence-based guidelines.

Eight non-randomized studies regarding the clinical effectiveness of wrist sphygmomanometers compared with upper arm sphygmomanometers, in a clinical setting, were identified. No health technology assessment reports, systematic reviews, randomized controlled trials, or evidence-based guidelines were identified. Additional references of potential interest are provided in the appendix.

OVERALL SUMMARY OF FINDINGS

Eight non-randomized studies comparing wrist sphygmomanometry with upper arm sphygmomanometry, in a clinical setting, were identified. Overall, there was some variability in study conclusions regarding the accuracy of wrist sphygmomanometers. Validation studies\(^3,4,6,7\) agreed that measurement of blood pressure using wrist sphygmomanometers met validation requirements over a wide range of ages and blood pressure, although one study stated that systolic readings with wrist sphygmomanometers were less reliable.\(^7\) Evidence suggests that wrist sphygmomanometer blood pressure readings for obese patients or patients with large wrist circumference may not be accurate,\(^1,6\) although a third study stated that wrist sphygmomanometers met validation criteria for that patient group.\(^8\) Two studies\(^2,5\) concluded that elevated pulse pressure (as a marker of arterial stiffness) resulted in impaired accuracy of blood pressure readings by wrist sphygmomanometers.

Table 1 presents further details on the studies.

<table>
<thead>
<tr>
<th>First author, year</th>
<th>Type of wrist monitor</th>
<th>Number of patients (n)</th>
<th>Patient characteristics</th>
<th>Results (mean BP difference wrist compared with upper arm measurement) mmHg</th>
<th>Authors' conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saladini, 2010(^3)</td>
<td>UEBE Visomat Handy Device</td>
<td>n = 33</td>
<td>Age: 30 to 86 years SBP: 110 to 180 mmHg DBP: 68 to 110 mmHg Arm circumference: 21 to 38 cm Wrist circumference: 14.0 to 21.0 cm</td>
<td>SBP: -2.0 (SD ± 8.1) DBP: -0.9 (SD ± 4.1)</td>
<td>Wrist monitor met validation requirements and could be recommended for use with adults.</td>
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<tr>
<td>Palatini, 2009(^4)</td>
<td>Microlife BP W100</td>
<td>n = 52</td>
<td>SBP: &lt;130 to &gt;160 mmHg DBP: &lt;80 to &gt;100 mmHg</td>
<td>SBP: 0.1 (SD ± 5.3) DBP: 1.1 (SD ± 3.4)</td>
<td>Wrist monitor met validation requirements across a wide range of blood pressure.</td>
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<td>Zaetta, 2009(^6)</td>
<td>SAW-102</td>
<td>n = 88; n= 15 patients with large wrist circumference (&gt;19.5 cm) No other characteristics reported</td>
<td>Wrist circumference ≤ 19.5 cm SBP: 3.8 (SD ± 7.5) DBP: 1.5 (SD ± 6.0) Wrist circumference &gt; 19.5 cm</td>
<td>Wrist monitor met validation requirements with wrist circumference ≤ 19.5 cm. Large wrists resulted in dramatic decrease of accuracy.</td>
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</tbody>
</table>
Table 1: Summary of included studies

<table>
<thead>
<tr>
<th>First author, year</th>
<th>Type of wrist monitor</th>
<th>Number of patients (n)</th>
<th>Patient characteristics</th>
<th>Results (mean BP difference wrist compared with upper arm measurement) mmHg</th>
<th>Authors’ conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelson, 2008¹</td>
<td>Not reported</td>
<td>n = 94</td>
<td>Age: ≥ 19 years</td>
<td>Systolic measurements using wrist manometers were the most inaccurate.</td>
<td>Did not pass 1st phase of ESH protocol</td>
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<td></td>
<td></td>
<td></td>
<td>No other characteristics reported</td>
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<tr>
<td>Doshi, 2010¹</td>
<td>Not reported</td>
<td>n = 261</td>
<td>Obese patients (mean BMI 30.6 (SD ± 6.6) kg/m²)</td>
<td>SBP: 2.6 (SD ± 9.2) DBP: 4.9 (SD ± 6.6)</td>
<td>There was demonstrated inaccuracy for automated wrist manometers compared with mercury column manometers.</td>
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<td></td>
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<td>Mean upper arm size 30.7 (SD ± 5.1) cm</td>
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<td></td>
<td></td>
<td></td>
<td>Mean SBP: 131.9 (SD ± 20.6) Mean DBP: 71.6 (SD ± 12.6)</td>
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<td>de Senarcens, 2008²</td>
<td>Omron R6</td>
<td>n = 15 (lean patients)</td>
<td>n = 11 (obese patients)</td>
<td>SBP averaged 7 mmHg higher when measured at wrist of obese patients; 1 mmHg higher for lean patients DBP was same between groups</td>
<td>Validated wrist monitors were appealing for obese patients with large arm size.</td>
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<tr>
<td></td>
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<td></td>
<td>No other characteristics reported</td>
<td></td>
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<tr>
<td>Khoshdel, 2010²</td>
<td>Omron HEM-609</td>
<td>n = 50</td>
<td>Mean age: 65 years (SD ± 10) Patients at high risk for cardiovascular disease</td>
<td>Closest correlation for wrist monitor and arm monitors was when wrist measurements were taken with the patient’s elbow placed on a desk (compared with wrist at heart level or hand supported on opposite shoulder). SBP: 3.8 DBP: not reported</td>
<td>Wrist monitors underestimated BP, requiring an adjustment by 5 for SBP and 10 for DBP. Therefore, individual clinical validation was recommended.</td>
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<tr>
<td>Westhoff, 2009³</td>
<td>Not reported</td>
<td>n = 33, including patients with pulse pressure 50 mmHg and isolated systolic hypertension</td>
<td>SBP showed significant bias depending on pulse pressure, but there was no significant effect for DBP</td>
<td>Accuracy of wrist BP measurement may be impaired by arterial stiffness.</td>
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</tbody>
</table>

BP = blood pressure; DBP = diastolic blood pressure; ESH = European Society of Hypertension; n = number; SBP = systolic blood pressure; SD = standard deviation
REFERENCES SUMMARIZED

Health Technology Assessments
No literature identified.

Systematic Reviews and Meta-analyses
No literature identified.

Randomized Controlled Trials
No literature identified.

Non-Randomized Studies

PubMed: PM20167030

PubMed: PM20463830

PubMed: PM20729724

PubMed: PM19252436

PubMed: PM19092843

PubMed: PM19262198

PubMed: PM18755068

Guidelines and Recommendations
No literature identified.

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APPENDIX – FURTHER INFORMATION:

Non-Randomized Studies – no upper arm comparator

   PubMed: PM20505218

    PubMed: PM18618207