Twenty-four-hour ambulatory blood pressure monitoring in hypertension: an evidence-based analysis

Health Quality Ontario

CRD summary
This review found a two-fold increased risk of cardiovascular events over five years with conventional blood pressure monitoring relative to ambulatory monitoring. Patients who used ambulatory monitoring were more likely to have control of blood pressure and to discontinue drug therapy in the short term. Limitations of the evidence suggest that the conclusions should be regarded as provisional.

Authors' objectives
To determine the effectiveness of 24-hour ambulatory blood pressure monitoring in the management of hypertension.

Searching
The authors searched MEDLINE, EMBASE, CINAHL, The Cochrane Library and INAHTA for studies published between 1997 and August 2011. Search strategies were reported. Reference lists were scanned to identify additional studies. Only studies in English were included.

Study selection
It appeared that a wide variety of study designs were eligible although only randomised controlled trials (RCTs) were used to answer the research questions. Eligible studies compared 24-hour ambulatory monitoring with conventional (office or clinic) monitoring in adults with uncomplicated hypertension. Outcomes of interest included fatal and non-fatal cardiovascular events, control of blood pressure, changes in drug regimens and drug-related adverse events.

The included trials recruited patients with systolic blood pressure above 140mmHg and/or diastolic blood pressure above 90mmHg. Mean age ranged from 53 to 56 years.

Study selection was by a single reviewer at the title and abstract stage. Final decisions on inclusion were taken by consensus of two or more reviewers.

Assessment of study quality
Quality of evidence (high, moderate, low or very low) for each outcome was assessed using the GRADE system which included an assessment of risk of bias (adequacy of allocation concealment, blinding and follow-up). Results for each included trial were not reported explicitly.

The authors did not state how many reviewers performed the GRADE assessment.

Data extraction
Data were extracted to derive relative risks (RRs) for dichotomous outcomes and mean differences (MDs) for continuous outcomes, with associated 95% confidence intervals (CIs).

The authors did not state how many reviewers performed data extraction.

Methods of synthesis
Data were pooled by meta-analysis where possible. Statistical heterogeneity was assessed by the $X^2$ test. A random-effects model was used where significant heterogeneity ($p \leq 0.1$) was present and otherwise a fixed-effect model was used. Outcomes were assessed as short-term ($\leq 1$ year follow-up) or long-term ($>1$ year) based on the pool of included trials.

Results of the review
Three RCTs (1,882 participants) were included. Maximum follow-up times were 8.6 months, one year and six years. In the trial with longest follow-up, 447 out of 1,298 patients were lost to follow-up. Quality of evidence assessed using
GRADE ranged from moderate to very low.

**Short-term outcomes (two RCTs):** Compared with conventionally managed patients, patients managed by ambulatory monitoring were more likely to stop antihypertensive therapy (RR 3.61, 95% CI 2.11 to 6.18), more likely to have control of blood pressure (RR 1.72, 95% CI 1.18 to 2.52) and required less intensive drug therapy (MD 0.34, 95% CI 0.20 to 0.48). Conventionally managed patients were more likely to progress to sustained multidrug therapy (RR 1.57, 95% CI 1.20 to 2.06). All these outcomes were reported in one trial only. Other outcomes did not differ significantly between groups.

**Long-term outcomes (one RCT):** Compared with conventionally managed patients, patients managed by ambulatory monitoring were less likely to experience a fatal or non-fatal cardiovascular event (RR 1.76, 95% CI 1.03 to 3.02). Conventionally managed patients were more likely to have control of blood pressure (RR 0.90, 95% CI 0.81 to 0.99). Other outcomes did not differ significantly between groups.

**Cost information**
A systematic review of economic evaluations included two studies that compared conventional and ambulatory monitoring. One study reported savings for diagnosis and treatment with ambulatory monitoring that ranged from approximately $85,000 to $153,000 per 1,000 patients. The second study, performed in the UK, reported incremental cost-effectiveness ratios that ranged from about £3,000 to £26,000 per quality-adjusted life-year for 24-hour ambulatory monitoring compared with conventional monitoring. An economic evaluation from a Canadian perspective was included in the report.

**Authors' conclusions**
A two-fold increased risk of cardiovascular events over five years was associated with conventional blood pressure monitoring relative to ambulatory monitoring. Patients who used ambulatory monitoring were more likely to have control of blood pressure and to discontinue drug therapy in the short term.

**CRD commentary**
The review question was clear. Inclusion criteria for study design were rather unclearly stated but only RCTs were used to answer the review question, which was appropriate. The search covered a range of relevant sources. The restriction to studies in English meant that relevant studies may have been omitted. Unpublished studies were not sought specifically. Involvement of multiple reviewers to minimise errors and bias was reported for study selection but not for data extraction. Quality of evidence was assessed and the results were used in the synthesis. The statistical methods seemed appropriate although meta-analysis was only possible for some short-term outcomes.

The authors' conclusions reflect the evidence presented but the limitations of the evidence (a small number of trials and high loss to follow-up in the longer term trial) suggest that the conclusions should be regarded as provisional.

**Implications of the review for practice and research**
The authors did not state any implications for practice and research.

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