

Blood pressure manometers - checks and choices

Christine A'Court

GP, Broadshires Health Centre Carterton
Clinical Advisor Decision Support (MAAG)

Oxfordshire Medley of Learning 15 May 07

- Background
- South PCT sphygmomanometer project
- Recommendations

Hazards of mercury

- Neuropsychiatric and nephrotoxic
- No record of harm to health care workers
- Mayo Clinic 1993-1995, 50 mercury spills:
 - “several resulted from physical abuse by unruly patients, children, patients with dementia/other psychiatric problems.” Clean up costs \$26,000 not including loss of clinical area. Recommend selective usage
- Environmental concerns: toxic, persistent and bio-accumable: tons into the environment, esp marine, entering food chain
- Mercury sphygs banned in some EU countries
- Reluctant implementation in UK: phasing out ?

Accuracy of mercury sphygmomanometers

- St Thomas Hospital 2002, tested devices using BHS protocol; all devices in current clinical use
- Of 36 mercury devices
 - 5(14%) could not be tested (even after correction of cuff, tubing and inflation faults) eg oxidized mercury
 - 3 (10%) had at least one reading out by >10mmHg

Accuracy of aneroids

- bellows and lever system- lose accuracy over time
 - esp with increased use (bellows), or if jolted (levers)
- Columbia University Teaching Hospital 1991:
I/P and O/P 80/230 (34%) defective
 - 19% of wall mounted, and 70% portable units defective
 - Cracked face or zero drift makes inaccuracy more likely but not inevitable (40% and 80%)
 - In absence of physically obvious defects, inaccuracy still found (30%)
- St Thomas' 2002: tested 39 aneroids
 - 6 (8%) still untestable after fixing cuff/tubing (needle sticking). Remainder: 18 (50%) aneroids had ≥ 1 reading 'out' by ≥ 10 mmHg

Bailey et al 1991 Arch Int Med; 151;1409-12.

Waugh 2002 Blood Pressure Monitoring; 7:309-312

Accuracy of aneroids

- Mayo Clinic 1991 spot survey of in-patient **wall mounted** aneroid devices, where programme of 6 monthly servicing/replacement : 1/93 devices faulty. In out-patients, where no reg servicing: 3/35 (9%) faulty
- UK GP practice survey in 1996; only 50% had serviced devices within 1 year, 24% devices had never been serviced
- BHS recommend 6 monthly

Canzanello et al 2001 Arch Int Med:161:729-731

Hussain et al 1996 Bt J Gen Pract:50:136-7

Digital manometers

- Many reports of unacceptable inaccuracy (esp wrist) but popularity growing, with patients and professionals
- Validation possible by 3 protocols ;
AAMI/BHS/International: published on BMJ and BHS websites
 - A/A grading given to certain makes & models only
 - Maintenance and frequency of testing variable: some makes & models not possible

South PCT Pilot Project 2005-6

- To provide service & assess importance of manometer checks
- Pfizer funded, PCT backed, GP led
- Used 'PMS pressure tester' for all aneroid and mercury across range 50-250mmHg, and variety of strategies for digital
- Classified manometers as green (+/- 3mm), amber (4-9mmHg), red(≥ 10 mmHg)
- Dated & colour-coded stickers applied
- Practice report faxed within 5 working days
- Confidentiality & anonymity
- Arranged by emailing sarah.sanders2@tiscali.co.uk
- Plan was to continue yearly or 6 monthly.....

South PCT Project

- 19/33 practices agreed, 14/33 practices declined
 - 6/14 practices 'recent testing or scheduled testing'
 - 8/14 practices no reason given
- 5 community hospitals (58 devices)
- Total 441 devices identified, and 438 tested
 - unable to access 3
- Tested from 50-250mmHg as rec. by BHS
- Classification
 - 'green' if the result within 0-3mm Hg of reference BP
 - 'amber' if within 4-9mmHg of reference BP
 - 'red' if 10mmHg or more difference from reference BP

Overall Results in South PCT

- Of those tested:
 - 265 green (61%)
 - 114 amber (26%)
 - 56 red (13%)
- Maximum deviation was over 20mmHg
- No consistent tendency to over-estimate or under-estimate, and some devices did both at different points in the BP testing range.

Put another way....

- *In 4/19 practices (20%) patients have a 'less than evens' chance of getting a correct reading (+/- 3mm Hg)*
- *'Red' rate of 13% means that 1 in 10 BP readings are significantly wrong (>10mmHg)*

Mercury vs Aneroid vs Digital

	Mercury	Aneroid	Digital
Total number of devices	93 (but unable to test 2 devices)	203 (but unable to test one device)	145
'Green'	68 (73%)	139 (68%)	59 (41%)
'Amber'	19 (20%)	45 (22%)	51 (35%)
'Red'	4 (4%)	18 (9%)	35 (24%)

Whose manometers 'failed' ?

- All practices and community hospitals had at least one faulty BP manometer in apparent use
- Large and small practices were equally at risk
- The ownership/location of the device was no predictor: thus devices belonging to community hospitals, GPs, GP locums, practice nurses, district nurses or for loan to patients were all at risk of being faulty

When were they last tested?

- Proof of testing: a dated label on the device, or if the practice or hospital manager could specify a date of testing.
- Date of previous testing: 3 months - 6 years before
- No date of previous testing in 253/441 (57%)
 - includes 21 aneroid and digital devices - new or very recently acquired - amongst which 6 amber/red devices
 - Amongst 188 devices with a date of previous testing the results were better, but far from ideal

Recommendations

- Awareness-raising about unreliability of manometers and trade-off of 'mercury-free'
- Minimum annual checks
 - Ideally 6 monthly
 - Raise index of suspicion: if device seems faulty - label it + put aside until checked
 - If aware of dropping, knocking, fluid spillage -should be re-tested
- Many devices cannot be recalibrated and have to be replaced (eg all mercury, all old style aneroids, some digital)
- Care with replacement/new purchases

Recommendations-Testing

- Williams Medical
 - sales, & annual service of any medical equipment
 - www.wmsplc.co.uk or 01865 844739
 - £395/7hr day (May 07 offer), extras itemised
- Medisafe
 - sales, & annual service of any medical equipment
 - 01962 8857777
 - £150-£700 per practice (itemised pricing, or 1-3 yr fixed price contracts + discounted sales)
- PMS (Instruments) Ltd
 - Sales, + test equipment supplied
 - www.pmsinstruments.co.uk or 01628 773233

nGMS contract

- QOF 'Management 7' (3 points)
- be able to prove that the practice 'has systems in place to ensure regular and appropriate inspection, calibration, maintenance and replacement of equipment. It requires 'a defined responsible person, clear recording, systematically pre-planned schedule and reporting of faults'

Some suggestions

Replacement of mercury devices

Mercury-free 'UM-101' (£99 +VAT, incl 1 cuff)

- Uses auscultatory or 'Korotkov' method
- Appearance similar to mercury but mercury free
- Pulse rate displayed
- Switch on, & will switch off automatically after 2 mins
- You can 'mark' the measured BP readings (but human error)
- Can be used with any twin-tubed cuff in good condition or purchase one of 6 available sizes for £30.00 each
- Manufacturer and distributors recommend it be tested after first 2 years, and annually thereafter (PMS Instruments Ltd test for £20)
- Measures hours of usage to help guide frequency of testing
- A/A validation but publication awaited (in 'Blood Pressure monitoring', then later still, on BHS website).
- Been assessed and approved by medical instruments departments at various hospital trusts , & by various experts

Replacement of aneroids

- **Mandaus II manual sphygmomanometer**
 - £39 +VAT BHS+AAMI A/A validation but not on www
 - Lightweight, compact, portable ,v. robust: ‘AAMI SP9 shock and splash resistant’
 - Usual thumb wheel deflation - ‘bleed rate’ shown to help you obtain recommended speed of 2-3 mmHg/sec
 - Auscultatory method, LCD display, 1mm increments-reduce digit bias
 - Pulse rate displayed
 - Long battery life: approx 3000 measurements / set of batteries
 - 2 year warranty, 2 year service interval
 - Disadvantage: heart icon flashes once detected 8 pulses - at different level than SBP/DBP - potentially distracting
- **Maxi Stabil 3 (Welch Allen)**
 - Only aneroid on BHS web site, £74 + VAT, BHS A/A

Replacement of automatic (digital)

See BHS www.bhsoc.org for validated devices (does not list untested or failed)

- ‘Automatic digital suitable for clinical/home use’
 - 30 devices listed
 - mainly Omron, A&D, Microlife
 - Not all models have BHS validation (eg Boots’ Omrons)
 - £40 - £120 (A&D UA767-PC) - £176 (A&D UA767-BT)
- ‘Automatic for clinical use’
 - ambulatory £350-£2500
 - A&D TM-266P £1995 (‘waiting room’) BHS+AAMI A/A
- Wrist
 - not recommended nor been validated by BHS (errors-mainly concern re wrist at heart level)
 - but BHS web site lists 3 which have been validated by International Protocol: Omron R7; Oregon Scientific BPW 810; Omron 637 IT-£125- also validated for use in obese & elderly

Digital manometers

- Fared worst in south PCT study-but many old models having no maintenance
- Elimination of 'observer error' may help reduce overall error
- 'More honest' ?

Fundamentals of measuring BP

- Which arm : can differ (Refer if consistently $>20/10$) State L/R. Use highest.
- Brachial artery at heart level (mid sternum): if below- overestimates BP, and converse. Cushion?
- Support: isometric exercise raises DBP by 10%. Effect greatest if hypertensive or on b-blockers
- Posture: BP generally increases as lying->sitting->standing
- Convention: sitting 5mins. But in elderly/ DM: standing 1 min
- Cuff size: bladder should encircle at least 80% of upper arm (select on basis of arm circumference), no more than 100%
- Clothing
- Deflation speed: too fast under-estimates SBP and over-estimates DBP
- DBP-Korotkov phase V (disappearance) (IV in preg)
- Am or pm- 'consider impact of timing of medications'
- Recording - free text only justifiable if non-BHS conditions (still not ideal)
- Handover to P/Ns - "incorruptible"!