

STANDARDIZATION OF METHODS OF MEASURING THE ARTERIAL BLOOD PRESSURE

A JOINT REPORT OF THE COMMITTEES APPOINTED BY THE
CARDIAC SOCIETY OF GREAT BRITAIN AND IRELAND AND THE
AMERICAN HEART ASSOCIATION.

EDITORIAL

The genesis of the joint report that follows may be explained shortly. In September 1938 the American Heart Association appointed a committee to draw up recommendations for a standard technique for taking arterial blood pressure, and asked the Cardiac Society of Great Britain and Ireland if they would like to appoint a similar committee, which should if possible issue a joint report with the American Committee. The Council of the Cardiac Society approved of this course and appointed a Committee for the purpose.

The reader may feel that such recommendations are not needed and that everyone knows how to take the blood pressure and does it in the same way. The committee have learnt that this is not the case and that many physicians differ in small points of technique, often without realizing that their custom is not universally accepted.

The British Committee met on November 19 and had before them the results of various preliminary enquiries and the excellent short recommendations put forward by a committee of the Assurance Medical Society in May 1931 and published in their journal. The British Committee drew up some recommendations which were discussed with many members of the Council and with other physicians and physiologists. At a second meeting on January 21, 1939, these were put into final shape and were sent to America early in February.

The recommendations and report of the American committee were received about this time, and it was obvious there was a good deal of common ground, but a few outstanding differences. A composite report was drawn up incorporating these agreements and differences, and this has since been the basis for discussion in both countries. This was then brought before the Council of the Cardiac Society, who authorized their committee to publish an agreed draft within the compass of these recommendations.

The British and American committees have both accepted many suggestions where they thought the other had made useful additions or had expressed the

recommendations more clearly ; both, however, have retained to some extent their own phraseology where they thought this more appropriate to their country and have set forth with different emphasis the three remaining points in which agreement was not reached. Two of these three are simple—the British committee expressing a preference for the mercurial manometer as less likely to get out of order, and expressing no choice as to whether the patient is lying down or sitting provided he is comfortable ; the American committee preferring that he should be seated, but expressing no preference between the mercurial and aneroid instruments, provided they are in good condition.

The third more important difference is in the method of recording the diastolic pressure. Both committees agree that the point where the loud, clear sounds change abruptly to the dull and muffled sounds should be recorded. The British committee think this is the only point that should be recorded and that it can nearly always be detected accurately, though at times only with difficulty. The American committee, influenced perhaps by this difficulty, recommend that the point where the sounds disappear should also be recorded.

Apart from these three differences, which are dealt with in the report, and the phraseology, the reports and recommendations were in substantial agreement, and it has been agreed, therefore, that they should be published in each country over the joint signatures of both committees.

MEMBERS OF THE COMMITTEE FOR THE STANDARDIZATION OF BLOOD PRESSURE READINGS

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JOINT REPORT ON THE METHOD OF MEASURING ARTERIAL BLOOD PRESSURE

INTRODUCTION

It has long been realized by many teachers and practitioners of medicine that the wide variations in blood pressure records of a single subject were due not only to changes in the pressure from time to time under different conditions, but also to the different methods used by the observers. The interpretation of the sounds heard on auscultation is an important cause of divergent readings. A recent survey of Wright and others (*American Heart Journal*, **16**, 469, 1938) revealed a serious lack of agreement as to the correct technique for taking and interpreting the blood pressure. Similar uncertainty was found among insurance companies as to what they should require of their examiners in this regard. Experiments with multi-aural stethoscopes showed that recent years have brought little if any improvement, as the discrepancy among the recently qualified was as great as among their seniors.

The Committees for the standardization of methods of measuring arterial blood pressure appointed by the American Heart Association and by the Cardiac Society of Great Britain and Ireland have tried to bring about a crystallization of the best available thought on this subject. If feasible, the Committees were asked to make joint recommendations which might be accepted as a standard for practising physicians, medical teachers, and insurance companies.

After a careful study of the material available from many sources and after much discussion the Committees jointly recommend the following procedure as the standard method for taking and recording blood pressure readings in man. Some of these recommendations are dealt with in more detail in the explanatory notes. The British and American Committees have decided to publish over their joint signatures reports which differ slightly in wording and phraseology. In the few instances where there was any difference of opinion, the views of both Committees have been included in each report.

RECOMMENDATIONS

1. *The instrument*

The equipment to be used for measuring arterial blood pressure, whether of the mercurial or of the aneroid type, must be in good condition and requires to be calibrated at frequent intervals against a standard mercurial manometer. The British Committee think that the mercurial type is the most dependable. The proper care of these instruments and the importance of a standard armlet are dealt with in the explanatory notes that follow.

2. *Position of the patient*

The patient should be allowed time to recover from any recent exercise or excitement. He must be comfortable and may be either lying or sitting. The American Committee recommend that he should be sitting and that, if not, a special note should be made.

The arm, relaxed and comfortably supported at the patient's side, must be laid bare to the shoulder to avoid any constriction by a rolled up sleeve and to facilitate proper application of the armlet.

3. *Application of the cuff*

The cuff must be of standard size, with a rubber bag at least 12 cm. wide. The cuff, completely deflated, should be applied with the middle of the rubber bag over the inner side of the arm, and its lower edge one inch above the bend of the elbow. It should fit closely and evenly round the arm to ensure against bulging at the sides when it is inflated.

4. *Determination of the systolic pressure by palpation*

A preliminary approximate reading of the systolic pressure should be taken by palpation as a check on auscultation ; the pressure in the armlet should be raised quickly in steps of 10 mm. until the radial pulse ceases, and then allowed to fall rapidly.

5. *The application of the stethoscope*

The brachial artery should be located by palpation, and the stethoscope applied lightly and accurately over it, just below but not in contact with the cuff. The hand may be pronated or supinated according to the position yielding the stronger brachial pulse.

6. *Determination of the systolic pressure by auscultation*

After inflating the cuff quickly to a pressure about 30 mm. above the level of the systolic pressure as found by palpation, auscultation should be conducted during slow deflation.

The systolic pressure is the highest level at which successive sounds are heard.

7. *Determination of the diastolic pressure*

With the pressure continuing to fall slowly and uniformly, the sound increases to its maximum intensity and then decreases, at first gradually and later suddenly, and soon disappears. The point where the loud clear sounds change abruptly to the dull and muffled sounds should be taken as the diastolic pressure.

The American Committee recommend that if there is a difference between this point and the level at which the sounds disappear completely the latter reading should be regarded also as a measure of the diastolic pressure. This should then be recorded in the following form—Rt (or Lt) 140/80-70 or 140/40-0, or if these two levels are identical as 140/70-70. The British Committee disagree with this recommendation and think that except in aortic regurgitation it is nearly always possible to decide the point at which the change comes and that this is the only reading that should be recorded.

EXPLANATORY NOTES

The Committees feel that certain other considerations in addition to these specific recommendations should be taken into account, and for convenience they are numbered in the same way as the relevant recommendations.

1. The instrument

Frequent discussions have taken place as to relative merits of various types of blood pressure apparatus. The mercury manometer and the aneroid type of apparatus are both capable of correct readings if in good condition, and both may be inaccurate if they are not. This is sometimes neglected in reference to the mercury manometer, which should be tested at intervals in the following ways :

- (a) The level of the mercury at rest should be at the zero mark. If any mercury has leaked out it must be replaced.
- (b) If the small air vent at the top of the glass tubing becomes clogged there may be a lag which will give false readings.
- (c) The blood pressure box must be on a level surface, since tilting of the manometer will lead to mistakes ; it should also be level with the observer's eye.

The aneroid type of instrument, if used, must be calibrated frequently against a mercurial manometer. The needle should stand at zero when the rubber tubing is deflated, and move immediately when inflation begins. A stop pin at the zero mark makes it difficult to check its accuracy.

In both types of instrument the valve must be competent. The entire system, including the rubber tubing and bag, must be free from leakage.

The rubber cuff must be at least 12 cm. wide ; it must be 23 cm. long and its covering must be of inextensible material and, if not of leather or made rigid with metal ribbing, should extend as a band 15 cm. wide for a distance of 60 cm. beyond the edge of the rubber cuff and then taper gradually to an apex during a further length of 30 cm. If bulging occurs the reading may not be accurate.

For children the rubber cuff may be narrower and the covering shorter.

New types of cuffs, using a zipper mechanism or rubber hooks on a ribbed extension the same width as the cuff, may prove to be more satisfactory than the long tapering cuff end.

2. The patient

The sitting position was selected by the American Committee because for practical purposes it simplified the taking of large numbers of blood pressure readings. The British Committee did not think there was any significant difference between the readings obtained in the sitting and lying positions.

Certain physical and psychological factors should be considered. Enquiry should be made as to the patient's activity just before the examination, as strenuous exercise may produce changes in the figures recorded. Blood pressure observations taken immediately after meals differ from those taken before

meals. There are physiological variations in the level of the blood pressure, so that for research purposes observations should be made with the same relationship to meals, sleep, exercise, and allied factors.

A rest period of from 10 to 15 minutes before taking blood pressure readings would eliminate or minimize certain of these factors. Tachycardia in itself sometimes causes a raised systolic pressure. Appreciation of the stress or anxiety through which the patient is passing is important to the examiner. Any appearance of concern on his part may unduly alarm the patient, thereby increasing the pressure. Apart from this, the first reading is often much too high because of the patient's nervousness.

3. *Application of the cuff*

Venous congestion must be avoided as far as possible ; there should be no constricting bands on the patient's arm and the pressure cuff should not be kept inflated longer than is necessary to take the reading ; it must be deflated completely before any further determinations are made. In obese subjects special care in the application of the cuff is necessary to prevent bulging. Deflation should be at the rate of about 3 mm. of mercury per second.

4. *The systolic blood pressure*

If the method of palpation is used before the auscultatory method as recommended, the unusual case with a silent gap will not be missed. In these cases after the first sounds have been heard there is an auscultatory gap below which the sounds reappear. This silent gap is not very uncommon in cases of aortic disease and hypertension

8. *Cardiac arrhythmias and aortic valvular disease*

The determination of blood pressure in these conditions is more difficult and the following recommendations are made :—

- (a) Where there are extrasystoles the higher pressure of the beat that follows should be ignored.
- (b) In auricular fibrillation only approximate blood pressure readings can be obtained ; the systolic value should be taken at the point where the majority of beats appear, and the diastolic (if at all) at the point where they become dull and muffled. The American Committee suggest that the average of a series of such readings should be noted as the systolic and diastolic pressures.
- (c) Alternation in the strength of the beats (*Pulsus alternans*) must be looked for carefully. It must be distinguished from the alternating values produced by regular alternate extrasystoles (*Pulsus bigeminus*).
- (d) In aortic stenosis with a slow rising or anacrotic type of pulse, auscultation may give a false systolic reading and palpation may be more accurate ; often a satisfactory diastolic reading cannot be obtained.
- (e) In aortic regurgitation with a collapsing pulse the diastolic and point is marked by a less obvious change in the quality of the sounds, which may be difficult to appreciate.

9. General

In speaking of the changes which the sounds undergo, the term *points* is suggested for use instead of the commonly used term *phase*, since the latter implies a period of time, whereas the *points* are in fact the precise moments at which one phase changes into the next.

The use of a single figure for a pressure that varies so rapidly cannot be accurate to within from 5 to 10 mm. of mercury. For special accuracy several determinations should be made and the highest and lowest should be recorded.

If the pulse feels different on the two sides the blood pressure should be taken in both arms.

In the presence of unexplained high pressure in the arm it should be taken in the leg also, so that coarctation of the aorta may be detected.

A special cuff is necessary to record the blood pressure easily and accurately in the leg. The rubber bag should be 15 cm. wide and its covering should be 17 cm. wide and 30 cm. longer than in the case of the armlet. The patient should be in the prone position with the leg extended and the sounds should be auscultated over the popliteal artery.

In detailed researches on blood pressure the use of a basal pressure might be considered, after preparation similar to that used for basal metabolism. It should be determined 10–12 hours after the last meal of the previous night, and after resting half an hour in a warmed room. Difficulties in the use of this procedure in practice are obvious, and observations suggest that after 15 minutes the pressure has generally fallen to a basal level.

A defect of hearing in the examiner may call for the use of a stethoscope with some form of amplifier.

It is hoped that a critical attitude towards this subject on the part of physicians generally will result from the efforts of these Committees, so that every precaution will be taken to obtain conscientious and unbiased records through the use of the standard technique suggested here. These recommendations are not intended to discourage other methods of observation when indicated in special situations.