Two or more types of organisms may be present with different antibiotic susceptibilities. Thus, in one patient a faecal streptococcus was present, sensitive only to streptomycin; *Proteus*, sensitive only to chloramphenicol; and a staphylococcus which was insensitive to chloramphenicol. In these circumstances the use of a single selective antibiotic may make matters worse by removing one type of organism and so facilitating the growth of others. It may be better to reduce the whole mass of infection by the use of a quaternary ammonium compound such as cetrimide or domiphen bromide for cleaning the meatus. The alternative is to use a suitable combination of antibiotics.

In infections due to one organism or organisms with similar antibiotic susceptibilities, various antibiotics, at one time or another, have their uses. The tetracyclines, chloramphenicol, neomycin, and polymyxin-B sulphate are most favoured, the last-named being effective against *Ps. pyocyanea* (Farrar, 1954). A French antibiotic, soframycin, now under trial, which is active against staphylococci, pseudomonas, proteus, and to a less extent against streptococci, seems to have a promising future. The use of sulphonamides, streptomycin, or penicillin is inadvisable because of the tendency of these substances to sensitize the skin.

In order to prevent patients developing a sensitivity to valuable systemic antibiotics, it is inadvisable to use them for local application, and, where possible, antibiotics should be used which are not normally employed systemically. The risk is also avoided of the emergence of strains resistant to antibiotics used systemically. In this respect, neomycin and polymyxin-B are useful, and soframycin also seems most promising.

A large mass of dry wax cannot be removed from the meatus with the oil treatment. From time to time various preparations containing benzene are advocated as efficient solvents of dry cerumen. They are good solvents, but they tend to enter the ducts of the secreting glands and may damage them. As the skin glands are probably at fault in any case, it is unwise to risk damaging them further. It is often the safest course to use the syringe to remove wax when the tympanic membrane is intact. It is advisable to instil oil into the meatus daily for several days before syringing. The patient lies with his meatus filled with oil for five minutes and then mops up the excess on rising.

The patient is informed of the commoner sources of infection and is instructed in the need for adequate personal cleanliness. The nasal vestibule may also have to be treated if bacteriological investigations indicate that it is the probable source of contamination. The nasal vestibule is naturally contaminated by air-borne organisms and may also be contaminated from other parts of the body by the fingers. Any itchy, infected, or eroded skin lesions on other parts of the body should receive treatment at the same time. The hands and nails must be kept clean and the nails kept short. Investigation should be made to uncover any underlying anxiety state. Everything possible must be done to prevent scratching of the meatus and contamination by the fingers. In difficult cases 1% hydrocortisone ointment, applied twice daily, is often highly effective as an anti-pruritic application. It can also be applied in combination with the appropriate antibiotic, usually a tetracycline, neomycin, polymyxin-B, or soframycin. An evening dose of a barbiturate or of promethazine hydrochloride is often advisable while the itching persists.

Summary

Otitis externa is an inflammatory condition of the meatal and auricular skin, usually caused by pathogenic cocci, by intestinal organisms, or by both.

The reservoirs of infection include the hairy vestibule of the nose, staphylococcal folliculitis and furuncles, paronychia, areas of infective dermatitis, and the anogenital region, particularly when anal or genital pruritus exists.

Prevention depends on avoidance of digital transference of organisms from these foci of infection. A high standard of personal hygiene is essential, particularly with regard to washing the hands after defaecation.

Treatment consists in eliminating the infective state, treating any associated skin disorder elsewhere on the body, restoring the natural protective mechanism of the meatal skin, removing irritating detritus, and relieving any persistent aural pruritus with local and systemic remedies.

It is undesirable for persons with otitis externa to be employed in the preparation, manipulation, or sale of food.

We wish to thank Dr. H. B. May and Dr. John Perrin, of the Department of Clinical Pathology, and Professor Dorothy Russell, of the Bernhard Baron Institute of Pathology at the London Hospital, for their advice and help and for carrying out the bacteriological investigations.

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EFFECTS OF SQUATTING ON THE NORMAL AND FAILING CIRCULATION

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Methods of changing the effective filling pressure of the heart have been used to study baroreceptor reflexes in man and the differences in response between the normal and failing circulation (Sharpey-Schafer, 1953, 1955a, 1955b). It is a relatively simple matter to decrease filling pressure: venesection, the Valsalva manoeuvre, and tipping into the erect posture are effective methods. It is more difficult to increase filling pressure. Large rapid intravenous infusions can be given safely to normal subjects but not to cases of heart failure; and there has been no simple method available for causing an increase over a few seconds.

Work on the mechanism of certain forms of syncope (Howard *et al.*, 1951) suggested that the squatting posture might provide such a method, with the additional advantage of rapid reversal in cases with heart failure.

Material and Methods

Twenty-eight normal subjects and 16 patients with heart failure were studied. The cases with heart failure all had sinus rhythm and a raised jugular venous pressure. Eleven were hypertensive and five had rheumatic valvular disease.

Subjects squatted with weight resting on the heels and holding with one hand to a support. Some older subjects, usually men, could not squat, and cases with gross oedema of the legs were also unsuitable. Practice was sometimes needed so that the upper-limb muscles were not tensed when forearm flows were being recorded.

Intravascular pressures were measured with capacitance manometers (Hansen, 1949). It was found convenient to make use of a differential manometer system (Lee *et al.*, 1954). For arterial pressures the brachial artery at the elbow was kept at the level of the fourth rib. From the arterial needle "polythene" tubing led to a fixed manometer; a second saline-filled polythene tube open to the atmosphere was strapped to the arm beside the arterial needle and led to another fixed manometer. The hydrostatic pressure of this second tube was subtracted from the arterial pressure. Thus, when the subject changed posture the true arterial pressure at the level of the fourth rib was recorded. Intracardiac pressure minus intrathoracic pressure was measured as described previously (Lee *et al.*, 1954). Since movement occurred in a vertical direction only and changes rather than absolute values were required, it was unnecessary to site the oesophageal tube accurately. The differential system used also allowed the simultaneous recording of one of the two measurements independently, and squatting was conveniently signalled by hydrostatic pressure change in the open-ended tube.

Forearm flow was measured with the venous occlusion plethysmograph.

Results

When normal subjects squatted arterial mean pressure and pulse pressure increased. This increase was greatest after a few seconds, and thereafter mean pressure fell and eventually stabilized at a level which was higher than the standing or sitting level (Fig. 1). The immediate rise of arterial pressure was considered to have two causes: the major factor was an increase in stroke output due to an increase in cardiac filling pressure due in turn to squeezing blood out of the veins of the legs. The second factor, a minor one, was a small increase in peripheral arterial resistance due to the hydrostatic effect of posture change and kinking of the femoral arteries.

The cause of the falling off in mean arterial pressure after the first few seconds was peripheral vasodilatation, the forearm flow showing a conspicuous increase at this point (Fig. 2). Vasodilatation persisted as long as the subject squatted, and is to be regarded as a baroreceptor response to the increased pulse pressure. Many subjects showed slowing of the heart rate at the highest blood-pressure level, but the changes in mean pressure and pulse pressure were still present if no rate changes occurred, as under atropine or in cases of thyrotoxicosis.

On rising to the erect posture again, arterial mean and pulse pressures fell rapidly below the initial erect values. After five or six seconds the arterial pressure rose again and showed an overshoot similar to that seen after the Valsalva manoeuvre.

Response in Heart Failure

The results fall into two groups. In the first (Fig. 3) there was a small rise in arterial pressure, which was maintained at a constant level as long as the patient was squatting. There was no change in pulse pressure or heart rate and no increase in forearm flow. On resuming the erect posture, arterial pressure fell immediately to the control level and thereafter showed no change. These cases showed a "square wave" arterial pattern with the Valsalva manoeuvre (Sharpey-Schafer, 1955a), and it is suggested that the heart

does not change its stroke output either to a fall in effective filling pressure (Valsalva manoeuvre) or to a rise (squatting). There is therefore no change in arterial pulse pressure and no baroreceptor response. The small rise in mean pressure during squatting is due to the slight increase in peripheral arterial resistance from the posture.

The second group (five cases) were clinically the most severe. Immediately on squatting there was the same small rise in arterial pressure described above. Thereafter the pattern differed (Fig. 4): the arterial pressure rose steadily, at first without change of pulse pressure, but after about 10 seconds the pulse pressure decreased. At this point respiration became deeper and more rapid. These cases showed an increase in pulse pressure during the Valsalva manoeuvre, and it is suggested that the heart responds to

FIG. 1.—Continuous arterial record showing effect of squatting in a normal subject. In this and subsequent records squatting is signalled by a downward deflection, and regaining the erect posture by an upward deflection of the lower continuous trace. Calibration in mm. Hg and time marker in seconds.

FIG. 2.—Forearm volume record in normal subject. The rate of volume increase on applying a collecting pressure is proportional to the blood flow. Two flows are shown before squatting and three after. There is a conspicuous increase in flow on squatting.

FIG. 3.—Heart failure, showing effect of squatting on arterial blood pressure.

FIG. 4.—Severe hypertensive heart failure. There is a progressive rise of mean arterial pressure and decrease in pulse pressure on squatting.

a decrease in effective filling pressure (Valsalva manœuvre) by an increase in stroke output, and to an increase in filling pressure (squatting) by a decrease in stroke output; the output response lying on the falling limb of the Starling "venous pressure-cardiac output" curve. In the one case in which it was measured forearm flow decreased at the end of squatting. Constriction was still present when the erect posture was resumed, for mean arterial pressure remained elevated and only fell to the control level after some seconds.

Discussion

The results show that squatting is a useful method for increasing the effective filling pressure of the heart acutely. It can be used in cases of heart failure, since rapid reversal occurs on resuming the erect posture.

The effects of squatting are those to be expected from the theory of baroreceptor responses to pulse-pressure changes: an increase in pulse pressure causing vasodilatation, a decrease causing vasoconstriction, and an unchanged pulse pressure causing no peripheral response. In normal subjects the highest mean arterial pressure is reached directly after squatting, the pressure falling off as baroreceptor vasodilatation comes on very rapidly. Vasodilatation has been shown after a single cough transient (Sharpey-Schafer, 1953), and after the first beat of sinus rhythm following a fast ectopic rhythm (Howarth and Sharpey-Schafer, 1956). It is also known, however, that constriction does not follow immediately on a decrease of pulse pressure. Thus there is a delay of five or six seconds during the Valsalva manœuvre or after the onset of a fast ectopic rhythm before constriction can be demonstrated. This same delay is present when the erect posture is assumed after squatting. For some seconds the reflex vasodilatation resulting from the increased pulse pressure during squatting, combined with the acute decrease in stroke output from the hydrostatic fall in filling pressure, causes a decline of arterial pressure below control level. It is at this point, of course, that dizziness or syncope may occur.

The lack of stroke output response to an acute increase of filling pressure in many cases of heart failure corresponds to the lack of response to an acute decrease of filling pressure in the same cases. The absence of baroreceptor responses in the presence of unchanged pulse pressure but in the presence of an increased mean pressure on squatting is taken to indicate that, in man, it is the pulse pressure and not the mean pressure which governs peripheral tone, at least so far as rapid changes at this blood-pressure level are concerned.

The results in the more severe cases of heart failure are of particular interest, for this is the first occasion it has proved possible to record some of the changes which if prolonged and increased would lead to acute left ventricular failure. If it is correct that it is pulse pressure rather than mean pressure which influences baroreceptor reflexes, then, as the stroke output of a failing heart declines from a rising filling pressure, vasoconstriction might result in a rise of mean arterial pressure. It is well known that mean pressure may be conspicuously raised in an attack of acute left failure at a time when pulse pressure is decreased and intense constriction can be demonstrated in skin and muscle vessels. It is possible, however, that other reflexes are involved as well as arterial baroreceptors. In Fig. 4 the rise of mean arterial pressure precedes the decrease in pulse pressure, and this pattern was present in all severe cases studied, suggesting that some other mechanism is causing peripheral constriction before the baroreceptor mechanism is brought into play. It is suggested that this mechanism might be due to receptors in a low pressure system such as the left auricle or pulmonary veins, which are affected by the conspicuous rise of venous pressure. Constriction of forearm vessels has been shown when the venous pressure is raised acutely in normal subjects by large rapid intravenous infusions (Howarth and Sharpey-Schafer, 1947), and, although continuous records of arterial pressure were not made, cuff pressure records indicated an increase of pulse pressure

rather than a decrease. The combined effect of two such reflex systems, low and high pressure, might explain the extreme peripheral constriction which occurs in left heart failure.

In pure lesions of the right heart, such as pulmonary hypertension, the great decrease in pulse pressure (Howarth and Lowe, 1953) is probably sufficient to explain the degree of constriction present by a baroreceptor mechanism only.

Summary

Squatting increases the filling pressure of the heart, and the effects on normal subjects and patients with heart failure were studied by continuous arterial and peripheral blood-flow records.

In normal subjects the stroke output and pulse pressure increased on squatting, causing vasodilatation in the forearm and a falling off of the initially raised mean arterial pressure. On standing erect again the hydrostatic fall in stroke output took place while this vasodilatation was still present, so that arterial pressure fell below control values until restored again by constriction after a few seconds.

In cases of heart failure with a "square wave" response to the Valsalva manœuvre squatting caused no change in pulse pressure and no peripheral response. There was a small maintained mechanical increase in arterial mean pressure.

In severe cases of heart failure the arterial pressure rose progressively on squatting, and after some seconds the pulse pressure decreased and respiration increased. On standing erect constriction remained for some seconds.

The results are compatible with previous work on baroreceptor responses in man, and suggest that pulse pressure rather than mean pressure sets the level of peripheral resistance. In severe heart failure it is possible that reflexes from a low pressure system such as the left auricle may also cause constriction.

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Cuts in the "milk-in-schools" scheme, estimated to save £125,000 a year, will come into force on September 1. This was announced by the Ministry of Education on May 5. From that date free milk will be available to schoolchildren only during term time, and arrangements for its supply at week-ends and during the holidays will cease. All children in nursery schools, except "delicate children attending special schools," will have their ration cut from two-thirds of a pint (380 ml.) to one-third of a pint (190 ml.), the same amount as is now given to children in nursery classes. Local education authorities will be allowed to supply the free milk, during term time, to organized parties of pupils attending camps or other educational expeditions away from school. From September 1 also, local education authorities become responsible for the supply of school milk to pupils in non-maintained as well as maintained schools. The total cost of the milk-in-schools scheme, which amounts to about £11m. a year, is met by the Exchequer.