thus limited to the approximate determination of the relative severity of the work. Waller is, of course, aware of the source of error in the method, though he has probably underestimated the range of error.

Even in the exact method recommended by Cathcart, in which the caloric value of the oxygen varies with the R.Q., care has to be taken to ensure that the R.Q. represents tissue respiratory exchange. Analysis of expired air frequently shows a quotient that is quite fictitious. This erroneous result arises in the following way. In the body there is a large store of loosely held CO_2 which can be washed out by excessive respiratory efforts, or displaced by acid products of metabolism. On the other hand, part of the CO_2 produced in the tissues may temporarily accumulate within the body. In any sudden change, therefore, in the rate or amplitude of respiration or in the rate of metabolism, as in passing from rest to work or vice versa, there is apt to occur a washing out or retention of CO_2 which completely upsets the relationship between the CO_2 output and the rate of metabolism. The oxygen exchange is, on the other hand, much more steady. Hence, when a washing out of CO_2 occurs, there is not a balancing "washing in" of oxygen, and the R.Q. consequently rises. In the same way, on a temporary retention of CO_2 the R.Q. falls. In sudden changes of the rate of respiration, therefore, there may occur wide fluctuations in the R.Q. which are not a true reflection of tissue metabolism.

In connexion with some experiments which were being carried out we found it necessary to determine the nature of the fluctuations of the R.Q. liable to occur in sudden increases or decreases of the rate of work. Our results obtained for half-hour periods of work of moderate severity show that on passing from rest to work the R.Q. immediately drops and then rises, usually above the pre-work level, after which it slowly falls to the pre-work level. On passing from work to rest there is a sharp rise in the R.Q. followed by a fall below the pre-work level. Table II shows the nature of the fluctuations; the work consisted in marching at a uniform rate of 120 yards per minute.

TABLE II.—Nature of Fluctuations of R.Q.
Subject accustomed to apparatus.

R.Q.	Calories per Minute.	
94	1.28	Rest.
74	5.33	First minute work.
89	8.44	Third minute work.
97	8.19	Fifth minute work.
91	7.55	Seventh minute work.
94	7.55	Twenty-fifth to twenty-seventh minute work.
101	4.93	First minute rest after work.
98	1.71	Third minute rest after work.
105	2.01	Fifth minute rest after work.
90	1.55	Seventh minute rest after work.
80	1.23	Twentieth to thirtieth minute rest after work.

A rise in the R.Q. shortly after the commencement of work and a sharp rise on the cessation of work have been noted by several workers. The extent and the causes of these have recently been studied by Campbell, Douglas, and Hobson.⁴ Apart from these more or less regular fluctuations there occur occasional changes in the R.Q., such as the sudden rise in the fifth minute after work in the above table. These we believe are connected with changes in the rate of respiration. All these changes in the R.Q. are undoubtedly due to the gap that exists between tissue respiration and tracheal respiration. They merely indicate a washing out or retention of CO_2 in this undetermined zone.

From the foregoing considerations it is obvious that any sudden alteration in the R.Q. suggests that the result is vitiated by a wash out or retention of CO_2 . In determining the energy expenditure, therefore, it is necessary that the rate of muscular work should have been constant for about ten minutes before the sample of expired air is taken. If the work is very severe a longer period may be necessary. The constancy of the R.Q. at or about the level of the preceding period is the indication that equilibrium between tissue respiration and tracheal respiration has been established, and that the result may be relied on to represent tissue metabolism. It is obvious that in the method of estimating the cost of work from the CO_2 exhalation, results obtained at the beginning of work or immediately

after the work stops are of little value. In the former case CO_2 is accumulating within the body, while in the latter it is being washed out. In neither case is there any parallelism between the production of CO_2 in the tissues and the exhalation of CO_2 .

The consideration of the R.Q. is of interest apart from the accuracy of the determinations. Krogh and Lindhard⁵ have shown that the physiological cost per unit of work is less in the post-absorptive state following a high carbohydrate diet than following a high fat diet, and Orr and Kinloch⁶ have shown that following a meal the net cost of the work—that is, the rate of metabolism during work minus the rate of metabolism during the preceding rest period—is greatest on a high protein diet and least on a high carbohydrate diet. The net apparent cost of the work therefore depends to some extent on the nature of the material being consumed in the muscles which is indicated by the respiratory quotient.

Note.—The first observations on which the above note is based were made when one of us (J. B. O.) was working with Professor Cathcart, F.R.S., at the London Hospital in the winter of 1918-19. The results of Table I are taken from unpublished results of that period and included here by the kind permission of Professor Cathcart.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, May 7th, 1921, p. 669. ² R.A.M.C. Journal, November, 1918. ³ Proceedings of the Physiological Society, March, 1919. ⁴ Transactions of the Royal Society, 1920, vol. B, 210, p. 1. ⁵ Biochemical Journal, 1920, vol. 14, p. 290. ⁶ R.A.M.C. Journal, February, 1921.

THE CONTROL OF HAEMORRHAGE BY INTRAMUSCULAR INJECTION OF CALCIUM CHLORIDE.

BY

W. R. GROVE, M.D., AND H. W. C. VINES, M.B.,
ST. IVES, BEIT MEMORIAL RESEARCH
FELLOW.

THE treatment of haemorrhage by intramuscular injection of calcium chloride is gradually becoming a well recognized and useful procedure, but we know of no published results which show what has taken place in the blood, or how long the drug may be acting. Originally it was pointed out in the *Guy's Hospital Gazette* of May 18th, 1918 (W. R. G.), that the credit for the use of the drug is due to Dr. W. E. Dixon. One of us (H. W. C. V.) has now examined the blood after many of these injections, and, though his results will be published later, it seems worth while to publish separately a short statement from the practical point of view.

One grain of calcium chloride is dissolved in about 100 minims of water and injected deeply into the gluteal muscles; it must not be injected subcutaneously or sloughing of the skin will be caused. If a solution of the salt is made up to a concentration of 1 in 4 (2 drachms in an ounce is a convenient quantity), four minims then contain one grain. This solution has been kept for weeks, and in this strength apparently remains sterile indefinitely. If the solution is not quite clear, it must be shaken before use. The four minims are diluted to 100 mm. with boiled water, and in some hundred or more injections nothing abnormal has developed at the site of injection. Generally the injection is painless, though a few patients have complained of pain and stiffness running down the limb. In the blood the calcium value is found to rise slowly to a maximum in six hours, and then to remain practically constant for at least twenty-four hours. It is not at present possible to state definitely the action of calcium salts in controlling bleeding; it is probable that there is a direct constrictor effect on the blood vessels, and, further, the increased calcium content of the plasma may cause combination to occur between the calcium and the blood lipoids, with a consequent acceleration of clotting.

As a practical application of these results it has been found perfectly safe to give a second injection at the end of twenty-four hours, and, if necessary, a third twenty-four hours later; this was actually done in a case of haematemesis. In anticipating haemorrhage at or after operation, an injection not more than two hours before, or even at the time of operation, would seem indicated.

Calcium salts given by the mouth had no influence on the blood calcium; this confirms the observations of Dr. Dixon, from whom this treatment originated. It may

be noted in this connexion that cases of chilblains showed no calcium deficiency in the blood, and the treatment by calcium lactate by the mouth therefore does not seem to be indicated.

The injections are of the greatest service in ordinary hæmoptysis, and it is seldom necessary to give more than one dose, though the knowledge that another can be given in twenty-four hours is useful. They are also most helpful in uterine hæmorrhages, and the results obtained in aneurysms are hopeful.

The uses are so manifold, the solution so easy to make and keep, and the technique so simple, that when once the effect is realized we believe that the majority of practitioners will carry a solution in the emergency and obstetric bag. We have frequently injected a 1 in 20 solution in an ordinary hypodermic syringe with a long needle, and it is only that we believe that a 1 in 100 solution is more readily absorbed than this strength has become the standard.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

ACUTE RAPIDLY SPREADING PSORIASIS TREATED WITH ARSENIC.

In the second edition of *A Handbook of Skin Diseases and their Treatment*, by Professor Arthur Whitfield, King's College, London, the author says, on p. 176: "It is commonly asserted that arsenic should not be administered in acute outbreaks, but, having accepted this on the authority of others for some time, I have convinced myself that though in a few cases it may aggravate the eruption, in the majority of acute cases it is undoubtedly beneficial."

It was decided to test this statement, and the following case of acute rapidly spreading psoriasis, then in the ward, was selected:

A. B., aged 16, apprentice metal worker, was admitted to Ward 2, Edinburgh Royal Infirmary, on April 19th, 1921, suffering from acute psoriasis. According to the patient, the eruption first appeared eighteen months previously as a red spot on the right knee. Spread was slow. Three months before admittance there were "a few scattered spots" over the body and limbs. Twelve months after the commencement on the knee scaldiness

of the scalp was bad enough to demand attention. From a medical practitioner he obtained a "yellow paste," which he employed at irregular intervals, with little or no benefit. About a month before admission the eruption became much worse.

On admission there was profuse scaling of the scalp. There was a red patchy eruption affecting particularly the forehead, face, forearms, lower part of trunk, scrotal region, and lower limbs, and showing a marked preference for the extensor surfaces of the limbs. There was no pitting of the nails, and no involvement of palms and soles.

Treatment was as follows: For ten days the patient had a daily sulphur bath and an application to

Dorsal surface of right forearm, April 30th, 1921. Same surface, June 2nd, 1921.

the scalp of 2 per cent., and to the body of 1 per cent., sulphur and salicylic vaseline. This gave no apparent benefit, and there was considerable spread.

On April 30th, 1921, Fowler's solution was commenced in doses of m.v. thrice daily after food, and detailed charts were made of the eruption on the dorsum of the right forearm and on the right thigh and leg. The sulphur and salicylic treatment was continued. For three days spread went on unchecked. In seven days, however, spread had stopped. The whole eruption had somewhat faded, and thickening had become less marked. Several large patches, especially those on the arms, had lost their well defined edge, and showed small areas of healthy skin in their centres. Seeing and feeling them from day to day caused me involuntarily to make a comparison between them and the idea of islands covered with low flat-topped hills becoming submerged. In a fortnight there was considerable paling of the whole eruption. This was most marked on the forehead and face. The scalp was almost healthy in appearance. A few of the newest spots had gone.

Continuing the analogy made above, almost the entire eruption now appeared to be becoming submerged. In three weeks the face, forehead, and scalp showed hardly any evidence of disease. More spots had disappeared from the limbs, and the remaining eruption was now quite pale.

On May 18th, 1921, the sulphur bath was discontinued, and the strength of the sulphur and salicylic vaseline applied to the body was increased to that of the scalp application. On May 23rd, 1921, the arsenic was stopped because an erythematous eruption closely resembling a sunburn, which had appeared twelve days before on the front of neck and chest, was rapidly spreading. The spread stopped within forty-eight hours. The part was kept covered with a zinc paste. Ten days later there was no evidence of this eruption, save for a fine terminal scaling.

On June 8th, 1921, the psoriasis had disappeared, save for a few scattered "hilltops" in some of the larger areas that had been involved. These were in evidence near the elbows, knees, and in the scrotal region. On this day the patient was anxious to leave, for private reasons, and was discharged with the usual instructions concerning preventive treatment.

Dr. Norman Walker, to whom I am greatly indebted for permission to publish this note, considered the case to be of more than usual interest, because it appears to be so widely accepted a rule that arsenic is not to be employed, or very guardedly employed, in such acute cases.

E. FLEMING GRIFFIN, M.B., Ch.B. Edin.,
House-Physician, Skin Department,
Edinburgh Royal Infirmary.

PROCIDENTIA IN OLD WOMEN.

On reading the discussion on genital prolapse at the recent British Congress of Obstetrics and Gynaecology held at Birmingham, I was disappointed that none of the speakers made any allusion to the operation for complete prolapse of the uterus with accompanying prolapse of the anterior and posterior vaginal walls described below. For this distressing condition I used to perform vaginal hysterectomy combined with anterior and posterior colporrhaphy and perineorrhaphy. I found it was not good. Patients used to return as bad as ever, except that they had no uterus to prolapse. In this experience I see that several speakers at the congress concurred. For many years past I have performed the following operation with uniformly good results, and have seen no case of recurrence after it. I do no vaginal operation whatever. The abdomen is opened in the mid-line above the pubes. Both ovarian arteries are tied. The broad ligaments are separated from the uterus, and the uterine arteries are tied. The uterus is then cut in half antero-posteriorly as far as the internal os. The mucous membrane of the body of the uterus is next removed in one piece from each half with a separate knife, and a Paquelin's cautery thrust down the cervix from above. The two muscular flaps, consisting of each half of the uterus minus its mucous membrane, are then pared down to a suitable size, spread out over the anterior sheath of the rectus and stitched to it by a continuous catgut suture. The peritoneum is then closed round the protruding stump and the recti and skin united in the usual way. The elevation of the uterus in this fashion automatically slings up the vaginal prolapse. The operation is not a severe one and can be done in less than half an hour. It is a radical cure of the condition. No recurrence can take place. I first saw the operation described some ten years ago in an American journal at a time when my operations for this condition were causing me great dissatisfaction. I have performed it ever since, and have never had cause to regret it. I have never seen any other surgeon perform it; nor have I, on questioning our house-surgeons, who come from various parts of the British Isles, ever been informed that they knew of the operation or had seen it done. So I presume it is not a generally recognized operation in this country at all events. Nevertheless it is a good one, and I can commend it for trial by those who have to deal with this condition.

Portsmouth.

CHARLES P. CHILDE, B.A., F.R.C.S.

TRIPLETS WITH TWIN FOETUS PAPYRACEUS.

Mrs. B., who had had four previous normal confinements, was admitted to the Louise Margaret Hospital, Aldershot, at 9 p.m. on October 8th, 1920; labour pains had commenced four hours before admission. The membranes ruptured at midnight; an examination was made by the sister on duty, who reported that she was very much puzzled by the presenting part.

When I arrived dilatation was complete; the os uteri was occupied by a hard mass with some sharp spicules on