hemolysin and the hemagglutinin. The striking enhancement of the hemagglutinating capacity of mumps virus by reducing agents which may actually suppress hemolytic activity also suggests that they are distinct entities. Lowering the O/R potential apparently provides optimal conditions for the agglutination of erythrocytes by the virus.

Summary. Mumps virus hemolysin is inhibited by hydroxylamine hydrochloride and urethane without affecting the hemagglutinin. Cysteine increases both the hemagglutinating and hemolytic activity of mumps virus while glutathione, which has a marked, potentiating effect on the hemagglutinin, inhibits the hemolytic activity. Other reducing agents, such as hydroquinone and sodium sulfite, increase the hemagglutinating capacity of the virus. The different effects of these various substances on the hemolysin and the hemagglutinin suggest that they are distinct entities. The possibility that the hemolysin of mumps virus is a lecithinase is discussed.

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Saphenous Circulation Time Test with a Radioactive Tracer. (19298)

HARRY T. ZANKEL AND RICHARD CLARK.* (Introduced by R. A. Shipley.)

From the Department of Physical Medicine Rehabilitation and the Radioisotope Unit, Crile V. A. Hospital, Cleveland, O.

In January, 1947, routine post-operative stimulation of calf muscles was instituted at Crile V.A. Hospital, Cleveland, with the object of reducing the incidence of thrombosis and embolism(1). In order to find a possible explanation of the apparent good results obtained with this treatment, tests were done to ascertain the effect of sinusoidal stimulation of calf muscles upon circulation time. With the use of sodium cyanide as a test medium it was shown that sinusoidal stimulation of calf muscles reduces circulation time(2). However, the methods of study of circulation time have in the past necessitated the entry of the test medium into the systemic circulation. The test being described in this report, through the use of radioactive iodine and a scintillation counter, permits the study of circulation time in a vein or even part of a vein. The present report deals with circulation time studies in the great saphenous vein.

Test solution. Radioactive iodine (I-131) was chosen as being particularly suitable for this procedure. It is readily available, being supplied by the Oak Ridge National Laboratories and flown to the hospital at frequent intervals for use in the diagnosis of thyroid disorders. Its half-life of 8 days is long enough for an adequate stockpile to be maintained. The dose presently employed, 20 microcuries, is strong enough to permit recording by a scintillation counter, and small enough to allow as many as 5 tests at one session without exceeding the maximum total dose considered desirable in such a diag-

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nostic procedure. With a more sensitive scintillation counter which has recently been tested the dose can be reduced to as low as 5 microcuries, and thus permit as many as 20 tests on the same patient at one session. *The scintillation counter.* The measurement of saphenous vein circulation is accomplished by detection of the gamma radiation of I-131. An insignificant amount of the beta radiation from this isotope is capable of penetrating the tissues which overlie the femoral vein. With a scintillation counter, gamma activity is readily countable when relatively small individual doses are injected. The detecting mechanism constructed according to the design of MacIntyre(3) is an anthracene crystal positioned between the photo cathodes of two 1P21 photomultiplier tubes. Upon absorption of gamma radiation, the crystal produces a characteristic fluorescence which is detected by the photomultiplier tubes. The pulse resulting is amplified and fed into a scaler where counting of the pulses is accomplished. The counter itself is shielded with the equivalent of 1″ of lead on all sides, except directly over the crystal, where the total shielding is that of 3/32″ of brass, the lighttight container of the crystal. The crystal, then, is effectively exposed to the counting site, through a lead collimation 1″ in length and 2″ in diameter, giving a total field of approximately the circular area. The counter is placed in contact with the skin over the femoral vein at the groin and background counting is initiated. Following the establishment of stable background, injection is made at time zero. Counting is continued for approximately 2 minutes during which time the count is first seen to rise sharply with the arrival of the injected isotope under the counter, then decrease as the main body of the isotope passes the counter, and then, in some cases, to rise again if an appreciable amount of the unmixed isotope flows under the counter in the femoral artery. This return is not always discernible, especially in cases of increased circulation time, because of mixing of the isotope in the circulatory system. In order that continuous records of the background, injection point, and rise times may be made, scaler pulses from the counter are fed to a count rate

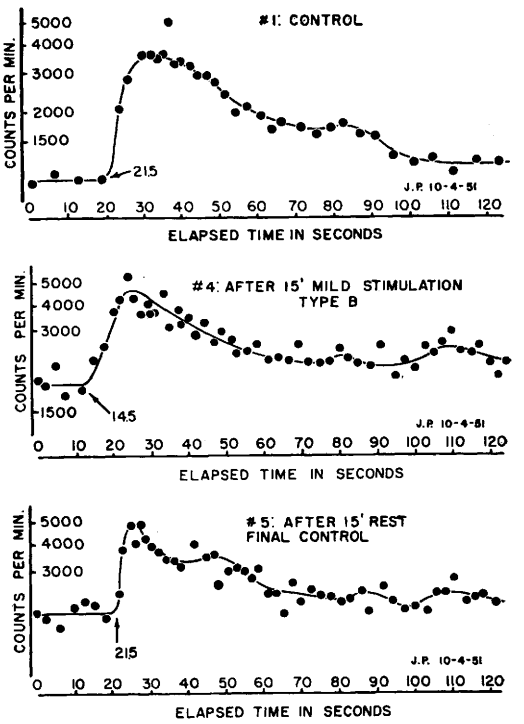

FIG. 1. Plotted curves of saphenous circulation time, before and after 15 min sinusoidal stimulation of calf muscles.

computer (Berkeley Model 1600) which is equipped with output to a continuous strip chart recorder of the Esterline-Angus 0-1 ma type. Timing is accomplished by use of the chart itself, and is sufficiently accurate for the experiment with a chart speed of 12 inches per minute. Once the chart record of a given administration is completed, the data are taken from the chart and plotted as total count vs. time, thereby giving the curves shown (Fig. 1) from which a final evaluation of circulation time is determined.

The shapes of individual curves show some variation due to more or less mixing of the isotope, *i.e.*, in cases of long circulation time when mixing is necessarily more complete, the initial rise in counting rate is of lesser slope, the peak of the curve is lower, and the effective length of time for passage of the isotope is increased, in comparison to that of shorter circulation times, when the peak is of greater slope, greater maximum and of shorter duration.

The bed. A well padded physical therapy

TABLE I. Saphenous Circulation Time.

Patient	Date	Vol. inj. (cc)	Test time in sec 1st	2nd	3rd	4th	5th	Room temp., °C
Group I: Continuous flow of i.v. saline after inj., 60-120 drops/min								
N.	8/9/51	1.00	14	12				28
T.	24	.30	29	28				22
C.	9/12	.22	25	17	15			27
M.	13	.24	16	17	17			28
B.	20	.14	34	31				29.5
W.	28	.16	85	82				25.5
P.	10/ 4	.27	21	21				31.5
G.	5	.29	10	9	7	7	8	32.5
E.	9	.23	13	18	22	21		26
E.C.	9/11	.20	20					28
	27	.26	23					27
Group II: I.V. saline stopped after inj. until a value had been recorded								
J.B.	10/15/51	.40	67.5	70				28
S.	15	.40	25	15	15			28
L.	17	.24	46	45	42			27
F.P.	18	.27	107	98	107	112	107	27
G.	22	.38	20	20	20	20		25

Five successive tests were performed at a single session at intervals of 5 to 20 min. Patients W., J.B., L., and F.P. had known disorders of venous or arterial circulation which would be expected to interfere with blood flow. Remaining patients were normal. First readings on C. and S. were made prior to usual 15 min period allowed for stabilization of flow after insertion of needle.

treatment table has been found suitable for the purpose of the studies. It is comfortable and allows freedom of motion on all sides. The room should preferably be of constant temperature and humidity. Lacking such, we have been using a partitioned off corner of a large room in the Radioisotope department. The temperature of this room has varied from day to day, but for the duration of each experiment, which has taken as long as 2½ hours, the temperature has not varied more than ½°C. *Needle and saline solution.* A 20-gauge needle is used. It is kept open by a continuous flow of normal saline solution at the rate of 60 drops per minute. A 3-way stopcock allows the introduction of saline or test solution as required.

Preliminary preparation of patient. In order to avoid absorption by the thyroid of appreciable quantities of radioactive iodine, Lugols solution is administered by mouth prior to the test. A dose of 10 drops is given at 6 and 10 p.m. the day before and again at 10 a.m. the day of the test. The patient is brought to the department at 12:30 p.m. The mean value of thyroid uptake after 24 hours for 21 patients tested was 2% of the total dose, with a range from 0% to 16% and with only 3 cases being in excess of 10%. The maximum value of 16% uptake occurred in only one case. On comparison of this maximum with that of 35% for normal uptake with 50 microcurie tracer doses, it is evident that the dose delivered to the thyroid in these experiments is equal to or much less than the dose delivered in routine diagnostic studies of thyroid function. Similarly, applying the method and values of Marinelli(4) and assuming a 70 kg man, with a 24-hour urinary excretion of I-131 of 65% of the total dose, it can be shown that the integrated total body radiation delivered in these experiments is only in the order of 10% of the daily tolerance of 0.05 e.r. (equivalent roentgens).

Procedure of test. A tourniquet is applied to the calf. The needle, held in a small empty sterile syringe, is inserted into the dorsal vein of the foot, which is the beginning of the great saphenous vein. The appearance of blood in the syringe indicates entry into the vein. The tourniquet is released, the syringe withdrawn, and the stopcock leading to the intravenous saline is connected with the needle. By the use of an adjustable clamp, the rate of saline flow is regulated to 60 drops per minute. At least 15 minutes are allowed

for stabilization before the first test dose is given. A point is selected under Poupart's ligament ¼" medial to the femoral artery, the pulsations of which can be felt. This point corresponds to the femoral vein just proximal to the junction of its great saphenous vein tributary. The point is marked with ink. Over this point is placed the sensitive chamber of the scintillation counter in such a manner that it is as close to the skin as possible without pressing upon it. The strip chart record is set in motion. When the background reading has been stabilized the flow of saline is discontinued and radioactive iodine is injected during an interval of less than 1 second. The time of injection is marked by hand on the moving paper of the recorder with an error in timing estimated to be less than ½ second. Since the time of flow is never less than 7 seconds a mechanical signal device is not essential. In one series of patients (Table I, Group I) the saline was allowed to resume its flow immediately after the test injection. In another group (Table I, Group II) no saline was allowed to flow until after the reading was recorded. The latter procedure would appear to be preferable in that a possible accelerating effect due to the flow of saline is avoided.

The circulation time having been obtained and permanently recorded, various modalities can then be applied to the calf or any other part of the body, and their possible effects upon this circulation time can be ascertained. Table I shows the control circulation times as obtained in patients before the administration of any physical modalities intended to promote venous flow.

Discussion. The saphenous circulation time appears to be reasonably constant for the same individual tested at intervals of 5 to 20 min. One patient (E.C.) showed no change in time when retested after 16 days. Preliminary tests already made, as indicated by one example (Fig. 1), show that saphenous circulation time is affected by various modalities or even by the same modality differently administered. It is hoped in the course of time to study a sufficient number of patients to permit an evaluation of such modalities upon the saphenous circulation time as measured by the present technic.

Conclusion. A saphenous circulation time test using radioiodine which is detected by a scintillation counter has been described, and its possible uses have been indicated.

We wish to thank Dr. R. A. Shipley, Director of the Radioisotope Unit of Crile V. A. Hospital for his constant cooperation and guidance in the development of this test.

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Acute Arterial Plethora. (19299)

D. G. JOHNSTON AND R. D. MOORE. (Introduced by A. R. Moritz.)

From the Institute of Pathology, Western Reserve University, School of Medicine and University Hospitals of Cleveland, Ohio.

Byrom and Dodson(1) reported the production of acute necrotizing renal arteritis in 10 of 23 young rats within 3 days after an acute transient episode of hypertension, which had been induced by a series of rapidly administered intra-arterial injections of Ringer's solution. The vascular lesion was described as an acute necrotizing arteritis and was usually limited to one or 2 vessels in each kidney section. The authors concluded from their experiments that a sudden brief rise in intra-arterial tension can cause fibrinoid arterial necrosis in a normal animal and that the smaller arteries of the kidney are selectively