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Methods for Studying Lymphatic Function in Intact Man Utilizing Au^{198} . (23914)

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Methods have been devised for studying functional patterns, dynamics and quantitative particle pickup by intact lymphatics and lymph nodes under various conditions. Previous methods using intracutaneous injection of particulate dyes, as that of Hudack and McMaster(1), have demonstrated the pattern of fine superficial cutaneous lymphatics in various experimental and clinical states. Demonstration of deeper lymphatic channels and lymph nodes by pickup of stained particles or radioactive gold has required operative exposure of lymph-bearing tissues and lymph nodes(2,3). The methods to be described require no operation and provide graphic records of lymph node pickup, and quantitative measurements of such pickup. Thus, serial physiologic and diagnostic studies can be performed.

Method. Pictorial pattern of lymph node pickup is obtained by local injection of radioactive gold and the use of a scintiscanner. Similar Lymphatic Scintigrams were first obtained in dogs(4). Injection of Au^{198} into various sites in head and neck precedes continuous or interval scintiscanner recording of the pickup by deep lymphatics and lymph nodes. Since the half-life of radioactive gold is 2.69 days, speed of disappearance from site of injection and later distribution in the lymphatic system can be recorded. Lymphatic scintigrams have now been obtained in both upper and lower extremities in intact humans. Fifty to 100 microcuries of radioactive gold are injected into subcutaneous tissues of calf

of leg. Deposition in femoral and inguinal nodes within 10 minutes to an hour can be detected under normal conditions. The first node (Fig. 1, part a.) to be outlined is usually in the femoral triangle about one to two inches below the inguinal ligament. The pictorial pattern obtained can be varied by altering the sensitivity and kinetics of the scintiscanner. This counter moves automatically across and up and down the field at varied speeds which increase or decrease the concentration of recorded dots. Thirty to 60 minutes may be required to scan the area

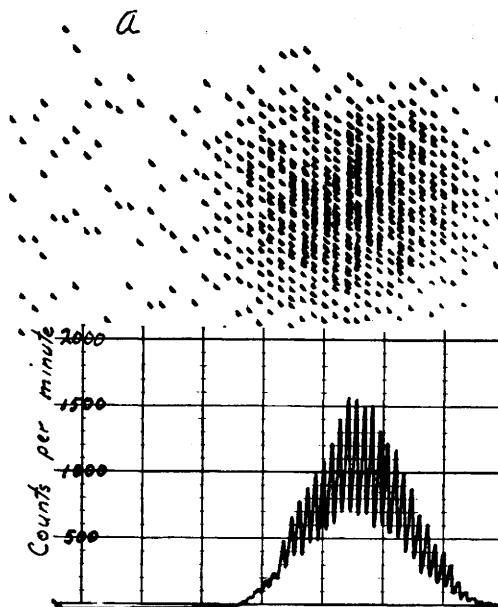


FIG. 1. a. (top) Lymphatic scintigram of femoral region 24 hr after inj. of 100 microcuries of Au^{198} inj. into subcut. tissues of calf. b. (bottom) Count rate meter graph run simultaneously and coordinately with 1-a.

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completely. Spacing can also be varied to delineate lymph node pickup. Concentration of recorded counts can be varied by the scintillation crystal used and size of collimator opening. Anatomic delineation of individual lymph nodes in the pattern is aided by a pulse height analyzer which records the peak energy of gamma rays. The distance of crystal from lymph nodes influences the pickup. Finer delineation of individual lymph nodes may be obtained by introduction of a photographic circuit. Some background effect can be eliminated by this means.

Two methods have been used for recording pickup in individual lymph nodes quantitatively. Numerical counts can be made with the scintillation counter and recorded as a grid directly from the field to be investigated, at spacings of one centimeter or more. A count rate meter and automatic recording graph will provide a continuous time-record of

pickup by individual lymph nodes (Fig. 2). This is an effective method of obtaining information concerning the dynamics as well as quantity of lymph node pickup. Counts/minute may be recorded continuously over many hours, or at intervals for days.

The count rate meter, recording graph, and scintiscanner records can be run simultaneously. In this way a quantitative estimate of lymph node pickup and a pictorial representation is obtained. Timing of the devices can be arranged so that records can be interpreted coordinately when attached to each other (Fig. 1, b).

Various anatomic, physiologic and pathologic factors alter the lymphatic pattern obtained, the dynamics and quantity of lymph node pickup. Choice of isotope, dosage and particle size, and volume and pressure of injected material, are important in establishing baseline conditions. Baseline conditions used were 1/10th cc of injected material containing 50 to 100 microcuries of Au^{198} of .003 average particle size. A photograph of particle size of material can be obtained with an electron microscope. Rate and amount of pickup depend on size, dosage, volume and pressure. Rate of pickup also depends on site of injection, since skin, subcutaneous and deeper lymphatic systems vary in their size, capacity and function. Some physiologic and pathologic states are being studied.

Summary. Methods have been devised, using Au^{198} , for studying functional patterns, dynamics and quantitative pickup of lymphatics and lymph nodes. These can be applied to intact man, as well as animals, under varied conditions.

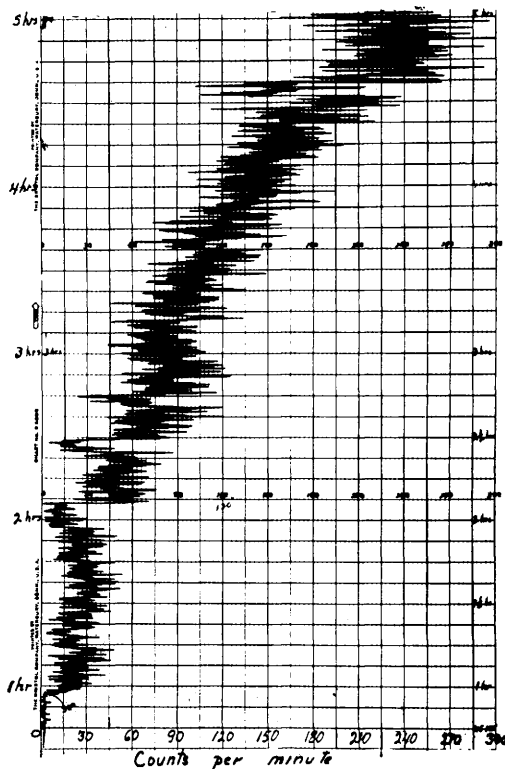


FIG. 2.

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