

INTRAARTICULAR LYMPHOSCINTIGRAPHY OF THE HUMAN KNEE JOINT: A PRELIMINARY STUDY

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ABSTRACT

Intraarticular (knee) lymphoscintigraphy using ^{99m}Tc -nanocoll was performed in five patients with chronic synovitis. Scintigrams from the anterior and lateral view of the knee and of the iliac region were taken 1, 2, 4, and 22 hours after injection. The inguinal and iliac lymph nodes uniformly visualized in about 2 hours. Based on radioactivity in regional lymph nodes measured at prescribed time intervals, we were able to quantify lymph drainage from the knee joint.

Lymphoscintigraphy is without complication and discomfort and is potentially useful to study synovial fluid reabsorption in joint diseases.

Although synovial fluid is probably removed from joint spaces by the lymphatic system (1), attempts to demonstrate lymphatic pathways from human joints are meager, and they usually involve contrast lymphography, a technique limited to depicting large lymphatics (2). Contrast lymphography moreover is technically difficult, uncomfortable for the patient, and associated with complications such as local infection, lymphangitis, anaphylaxis, and pulmonary "oil" embolism (3).

Because drainage of lymph from joints is theoretically important for understanding joint diseases such as chronic synovitis and osteoarthritis (4), we examined the use of lymphoscintigraphy (LSG) using ^{99m}Tc -labeled microcolloidal particles to visualize

lymphatic absorption. Until now, LSG has been used to investigate lymph drainage from malignant melanoma and breast carcinoma (3), lymphedema from filariasis, recurrent subcutaneous infection and following trauma (5), malignant lymphoma, gynecologic cancer, and other miscellaneous disorders (6). In these studies intradermal or subcutaneous injection was used. The present study is the first attempt to visualize lymphatic flow patterns from human joints using LSG.

MATERIALS AND METHODS

Five patients (2 females and 3 males; age 24 to 61 years) with chronic synovitis were examined. Each patient had obvious swelling of the knee joint with increased intraarticular fluid. Infection was absent.

The knee joint was punctured aseptically through a lateral-proximal route with a thin needle to minimize extraarticular loss of radioactive colloid. The intraarticular position of the needle tip was confirmed by aspiration. One ml saline containing 60 MBq ^{99m}Tc -nanocoll (Solco Nuclear) with albumin-colloid particles (size <80nm) was then injected. Labeling efficiency was >95%. Immediately thereafter and for the following 1, 2, 4, and eventually 22 hours scintigraphy was performed on a Siemens gamma camera (ZLC 370S) coupled to a Siemens Scintiview II microdatamat. The patients were allowed to walk between

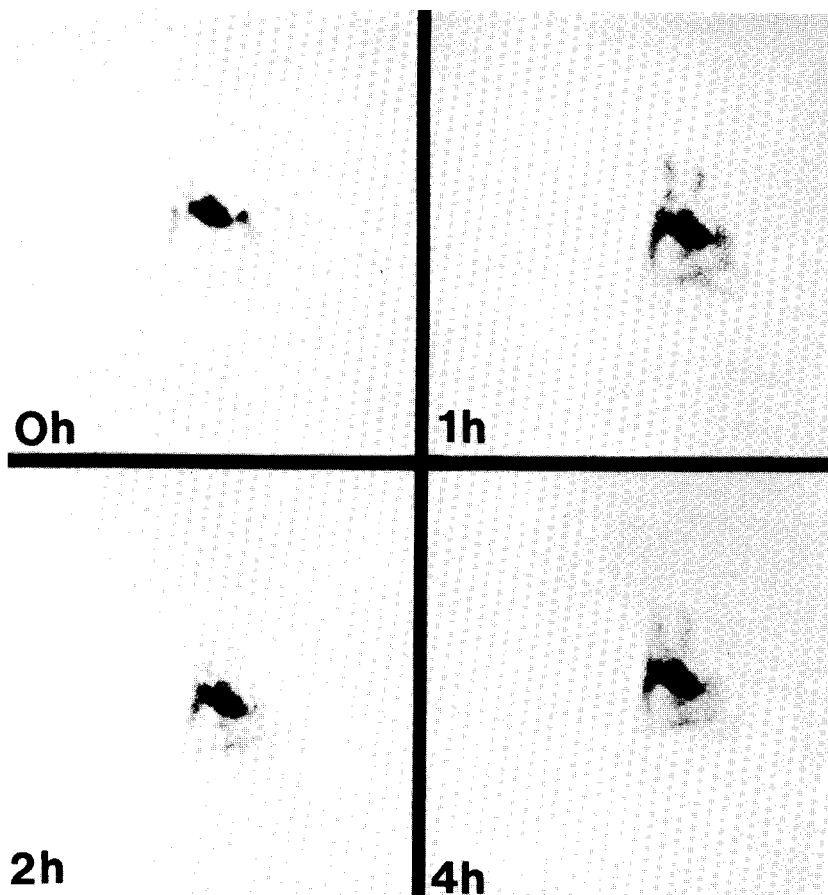


Fig. 1. Scintigrams obtained at hourly intervals (h) over the knee after intraarticular injection of 60 MBq nanocoll (Patient 3 in Table 1). Note the redistribution of activity in the knee. Time after injection shown in the left lower corner of each frame.

imaging. Data were stored on floppy diskettes. Scintigrams were taken of the injected site (knee) from the anterior and lateral view and of the iliac region. It was necessary to take 2 pictures; one avoiding pixel overflow to count properly the total amount of radioactivity at the different time periods, and the other with pixel overflow to investigate finer details in the tissue surrounding the knee. The total amount of radioactivity in the knee and inguinal lymph nodes was determined from a pen-drawn region of interest. Thus values were obtained from radioactivity (counts per minute) from a defined region of interest, corrected for background and decay, and given in $\% \times 10^{-2}$ of injected dose into the

anterior aspect of the knee.

RESULTS

Each study was similar and accordingly an illustrative example is shown of lymphoscintigraphy after intraarticular injection (Fig. 1). Radioactivity initially remained in the knee joint distributing over the joint surface. Some of the isotope was absorbed and excreted in the urine within 1-2 hours. This excretion likely represents unstable binding of technetium despite labeling efficiency *in vitro* $>95\%$. Inguinal and iliac lymph nodes were visualized after 2 hours indicating some lymphatic absorption of the injected colloid (Fig. 2).

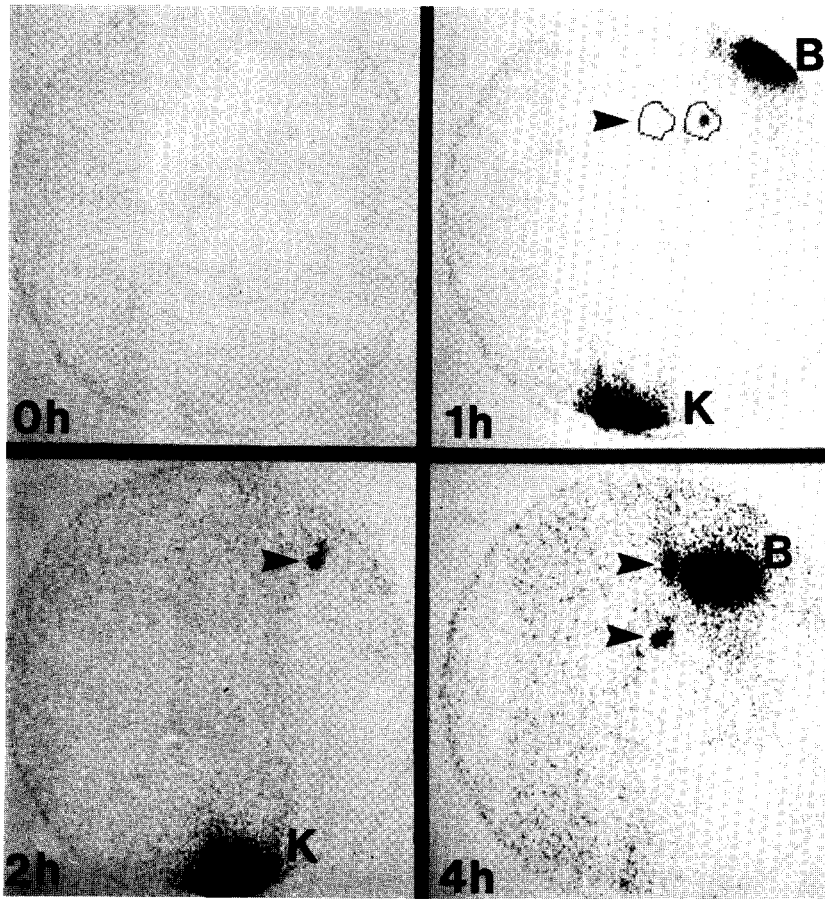


Fig. 2. Scintigrams obtained at hourly intervals (h) over the thigh and inguinal region after intraarticular injection of the knee as shown in Fig. 1. Position of knee (K) and bladder (B) are marked because positioning under the gamma camera was not exactly reproduced. In the upper right frame a lymph node (arrowhead) is "surrounded" as an area of interest for quantitative calculation of radioactivity (see Table 1). Note faint accumulation in the lymphatics of the groin and greater concentrations of isotope in the nodes (arrowheads) with time (2 and 4 hrs).

Assuming that isotope drainage was collected entirely in the regional nodes, and that radioactivity can be counted with near 100% efficiency, a rough estimate of the absorbed isotope amount can be calculated (Table 1).

DISCUSSION

This preliminary study confirms that some synovial fluid from the knee joint is absorbed via the lymphatic system and that it follows known anatomical pathways. The

radiopharmaceutical chosen is a colloid made from albumin having a well-defined particle size (40-80nm). There are other colloids with even smaller particle size but these agents are combined with sulfur-or antimony-sulfur colloid and therefore are foreign substances to the knee joint. Non-freeze dried albumin also has a much smaller size and has been used to follow lymph drainage in muscle and subcutaneous tissue (7). However, its absorption is not detectable in regional lymph nodes and the route of absorption is probably directly via the

Table 1
Radioactivity in Regional Inguinal Lymph Nodes

Patient #	Hours after knee injection			
	1	2	4	22
1	0	0	4.1*	6.3
2	0	1.5	7.9	24.7
3	0.7	1.8	5.3	—
4	1.6	4.8	41.3	—
5	0.5	1.8	1.5	3.0
X	0.6	2.0	12.0	—
Range	0-1.6	0-4.8	1.5-41.3	3.0-34.7

*% $\times 10^{-2}$ of injected dose

blood capillaries. Accordingly, use of this agent to trace lymphatic drainage of joints having a variable synovial hyperemia and surface is not likely to be of value.

Although our experience is limited, visualization of regional lymph nodes by LSG after intraarticular isotopic instillation suggests this technique may be useful to explore drainage pathways in a variety of local and generalized joint diseases.

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