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Velocity of Lymph Flow in the Head and Neck Lymphatics During Food Stimulation. Preliminary Communication

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Summary

In 12 healthy volunteers the velocity of food stimulated lymph flow in the head and neck lymphatics was studied. The velocity of lymph flow between subsequent lymph nodes had a mean of 0,6 mm/sec with a range of 0,4–1,4 mm/sec thus reaching the range of the velocity of blood in the capillaries.

In a previous study we have demonstrated (3) a very constant food stimulatory effect on the flow in the head and neck lymphatics.

Accordingly this study is an attempt to evaluate separately the velocity of lymph flow during food stimulation between subsequent lymph nodes in the head and neck lymphatics.

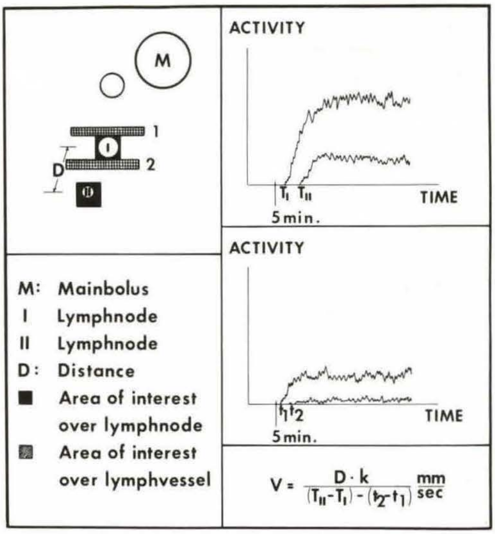

Fig. 1 To the right the time function curves from subsequent lymph nodes and time function curves immediately proximal and distal from lymph node no. I (below) are illustrated.
As it can be seen from the formular calculation of velocity is not influenced by the quantitative accumulation of radioactivity in the head and neck lymlymphatics.

Material and Method

12 healthy subjects gave their informed consent to participate in the study (5 females and 7 males, age: mean 36,6, range: 32–48 years). After four hours of fasting 500 μCi ^{99m}Tc-Lymphoscint-Solco and 75 I.U. hyaruronidase in a volume of 0,2–0,3 ml was injected in the submucous tissue on the right side of the tongue base (M–fig. 1).

The person was then placed in supine position and with the head in the right oblique position under the gamma camera covering the head and neck region.

The registration of radioactivity was started immediately using a 15 000 holes parallel collimator with an interfaced mini-computer (Medstor – General Electric).

A scintigram was registered every five seconds. Five minutes in the basal state and ten minutes during food intake (the person was given a 300 g solid test meal consisting of beef, butter and potatoes (31 g protein, 30 g carbohydrate and 30 g fat)) and postprandial up to thirty minutes.

Finally two Co^{57} point sources were placed on the skin in the neck region with a distance of 10 cm, and a gamma camera image was taken, thus the distance between subsequent lymph nodes could be measured.

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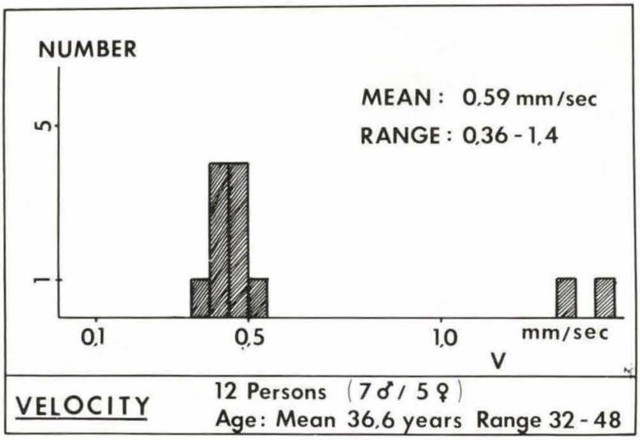

Fig. 2 The individual values of V are illustrated.

The sequence of scintigrams was summarized, and from these summations regions of interest over and immediately proximal and distal to visualized lymph nodes were defined via a display oscilloscope (see fig. 1).

From the sequence of registered scintigrams time function curves were generated.

The delay in radioactivity accumulation ($T_{II}-T_I$) includes the filtration time in lymph node no. I and the transport time by the lymph vessel to lymph node no. II. The filtration time was the delay between activity accumulation immediately proximal and distal for the lymph node no. I. (t_2-t_1). The distance between the subsequent lymph nodes I and II (D) could be measured by means of the Co^{57} point sources, and the velocity of lymph flow (V) could then be calculated by means of the formular $V = \frac{D \cdot k}{(T_{II}-T_I)-(t_2-t_1)}$ mm/sec.

$K = \frac{100}{d}$ (d = the distance between the two Co^{57} point sources measured on the gamma camera image).

Results

The mean transport time between subsequent lymph nodes ($T_{II}-T_I$) was 177 sec and with a range of 120–300 sec. The filtration time through the individual lymph node (t_2-t_1) had a mean of 113 sec with a range of 50–255 sec.

The mean velocity of lymph between subsequent lymph nodes (V) was 0,6 mm/sec., range: 0,4–1,4 mm/sec (fig. 2).

Discussion

In this study the velocity of lymph flow has been calculated by means of a formula where the numerator is well defined and easily measured. In the denominator the transport time between subsequent lymph nodes is also well defined, but estimation of filtration time is more delicate. It assumes, that the increase in activity in the areas of interest immediately proximal and distal to the lymph nodes represent activity in afferent and efferent lymph vessels, and not merely in bypassing lymph or concomitant blood vessels. The last mentioned is, however, contradicted by previous observations where radioactivity could be registered in blood samples from the cubital vein already in the basal state after submucous injection of ^{99m}Tc colloide in the tongue base (unpublished), and no increase in radioactivity was registered until after food stimulation in this study.

Bypassing lymph vessels can probably also be excluded since the range of filtration time (t_2-t_1) was 65–255 sec and with a mean velocity of 0,6 mm/sec one should have expected filtration times far below 65 sec.

Finally it must also be stressed that by calculating the velocity of lymph it is also necessary to assume, that the particles are transported by the lymph vessels and that the course of these vessels between nodes is straight.

Taking this into consideration the mean velocity of lymph flow in the vessels was 0,6 mm/sec during food stimulation, thus reaching the range of the velocity of the blood in the capillaries (o,7 mm/sec) (1) and thereby suggesting active transmission of lymph. This is supported by *Olszewski* and *Engeset* (2), who demonstrated waves of lymphatic pulse generating intralymphatic pressure of 50 mmHg in the leg lymphatics.

However, a pronounced variation in velocity cannot be denied. In Fig. 2 velocity for illustrative purpose has been plotted with two decimals, and it appears that most values are clustering around 0,45 mm/sec, and the mean (0,59 mm/sec) is significantly influenced by two extreme high values. This is also in accordance with the results by *Olszewski* and *Engeset* (2), where the lymph flow rate in the leg lymphatics ranged from 0,06 ml/hour–0,8 ml/hour.

References

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