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Editorial

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In this issue we present 7 papers on personal experience in clinical and experimental lymphatic microsurgery. Four papers contain practical hints concerning surgical treatment of lymphedema by anastomosing lymph vessels with veins, according to the present state of knowledge. One paper of significant importance, is dealing with the prolonged drainage of the thoracic duct in man. Two experimental papers describe microsurgical techniques used contemporarily in research on the lymphatic system. The authors are aware of the fact that they have presented only a part of the many types of surgical procedures used throughout the world for treatment of lymph stasis. The number of potential contributors to this issue could have been much larger, since almost every vascular surgeon has experience in treatment of lymphedema. However, the editor of the issue invited primarily those who specialize themselves in microsurgical procedures and their experience is already large enough to be made wider known.

The results of surgical treatment of lymph stasis are still far from being satisfactory. How can we explain this rather pessimistic statement. Two basic conditions should be fulfilled before we can talk about the possibility of making progress in treatment of lymph stasis. One is increasing our knowledge of the physiology of the lymphatic system, the other developing of new microsurgical techniques. There is a large number of physiological questions which should be answered before the diagnosis of lymph stasis and its treatment could be based on reasonable grounds. For example, while operating on lymph vessels, the surgeon uses his knowledge of the physiology of the blood vessel system. Some of the analogies might be correct, but most are not. The hydraulic laws applicable to blood flow in small arteries and veins do not hold for the lymph. The lymph vessel system is not a closed one. Lymph is propelled primarily by pressures generated by spontaneous intrinsic contractions of segments of lymph vessels. There is no hydrostatic component. Muscular contractions do not produce any significant pressures propelling lymph, whereas, they increase the venous outflow and lower venous hydrostatic pressure. The vascular resistance and its regulation in the lymph nodes is not much known. What is the main force driving lymph through the nodes?

There are other questions to be answered for understanding the process of development of lymph stasis and of the subsequent tissue changes. What is the molecular structure of the ground substance maintaining adequate hydration of the tissue? Are there any volume receptors in the interstitial space? What is the mechanism of entry of free tissue fluid into the initial lymphatics? Do the lymph vessels and nodes possess the concentrating ability of lymph proteins? Is the lymphatic transport away from the tissues necessary only for maintaining the proper volume of the interstitial space or is it also the way of transmitting the metabolic and growth signals from the cells to the regulating centers?

For a long time the lymph vessel system and lymphoid tissue were considered functionally to be two different systems. This does not hold true any longer. The knowledge of physiology of the lymphatic system should in-

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clude problems of physiological recirculation of cells through the lymphoid and non-lymphoid tissues, function of these cells in the lymph, transfer of signals about invasion of antigenically foreign substances into the tissues by the lymph cells and the flowing stream of lymph to the lymphoid organs. More research is also needed on the mechanism of adluminal and abluminal transport of particulate materials through the lymphatic endothelial cells.

The aim of surgical treatment of lymph stasis is the decompression of the stagnant lymph and creation of new pathways for free lymph flow away from the tissues. What type of changes and at which level develop in the tissues in lymph stasis? May there be a block for tissue fluid flow at the level of initial lymphatics? Are there any pathological conditions affecting the spontaneous contractile force of lymph vessels? Is there any reabsorption of tissue fluid proteins by the blood capillaries in lymph stasis, protecting against excessive accumulation in the interstitial space and impairing the capillary transport? Do the natural lympho-venous communications open spontaneously below the level of lymphatic obstruction in man? These are the questions we ask ourselves when we see a patient with lymphedema, a candidate for surgical treatment.

The second requirement for successful developing of lymphatic surgery is elaborating of procedures based on new developments in suture materials and operating microscopes. Introducing on the market the fine absorbable Dexon sutures seems to be very promising, so do the newly designed microsurgical instruments. However, these new developments can not solve problems as long as we do not know more about the healing process of the lympho-venous anastomosis and specifically about the union of lymphatic and venous endothelium. The blood supply to the lymph vessels and the influence of its interruption on spontaneous contractility of the wall should be investigated. The pressure and flow conditions in the lymph vessels and veins to be anastomosed should be known before the operation is performed. More information about coagulation and fibrinolysis processes in lymph vessels is necessary.

All the above listed questions should be stepwise answered if we are to expect any real progress in the microsurgical treatment of lymph stasis.

At present, the diagnosis of lymph stasis is based on the clinical investigation and lymphangiography. None of these methods give us enough knowledge about lymph formation and flow dynamics in a particular patient and also how do the lymphatics look like below the level of cannula introduced for performing lymphangiography. We establish the diagnosis and decide upon the type of operation basing to a large extent on the clinical impression.

In this issue we try to answer partly some questions concerning the physiology of the lymphatic system important for the surgeon operating on a patient with lymphedema of lower limbs. In the first paper the results of studies on lymph flow rate and intralymphatic pressure in lower limbs of normal men in various positions and activities are described. They give an idea about the volumes which have to pass through a newly created anastomosis to alleviate the stasis as well as about the pressure conditions in the obstructed and patent lymph vessels. Also data on lymph flow with an increase in ambient temperature and on immune humoral and cellular constituents of lymph taking part in the defense reaction are presented. The latter data throw some light on the possible mechanism of development and persistence of lymphangitis, so often complicating lymphedema. In the same article one can find a list of lymphangiographic criteria for selecting patients with lymphedema of lower limbs for lympho-venous shunts and the typical examples of contraindications. Functional lymphangiography and measuring of lymph pressures and flow, highly recommended by the author, seem to be the two best contemporary methods allowing selection of patients for microsurgery of lymphatics. The technical details of various types of lympho-venous anastomoses, also using new type

absorbable microsutures, are presented, based on experience of over 150 operations. One can also find a description of the technique of prolonged cannulation of human peripheral lymphatics for diagnostic and research purposes.

In his technical paper, *Degni* presents details of the very simple but meticulous operation of implanting single lymphatics into the vein. It seems to be a good operation if several lymphatics can be implanted and they are not deprived of their vasa vasorum. The latter might affect the contractile function of the lymphatic wall.

Jamal describes briefly his experience in treatment of filarial lymphedema with direct lymphatico-venous anastomoses. Although the number of operated cases is still small the method seems to be very promising in this type of disease and the experience should certainly be expanded.

The paper of *Clodius* is full of personal considerations on all the pros and cons for microsurgical treatment of lymph stasis. Despite of many doubts considering the results of treatment he is still in favor of continuing clinical research on lymphedema.

External drainage of the thoracic duct in man is not a new procedure. It has been used mostly by transplantologists for prolongation of kidney and liver allograft survival, with changeable results. Today we observe the revival of this method in transplantology and autoimmune diseases. The main technical problem is maintaining the drainage for weeks without iatrogenic complications. *Machleder* describes in his paper a technique which seems to meet these requirements. He has been able to drain the thoracic duct in man for mean periods of 70 days.

The two last papers on microsurgery of lymphatics deal with animal research models. One by *Perloff* and *Barker* deals with the alymphatic flap, a model widely used for studies on the role of afferent lymphatics in the afferent arc of immunization. The other presents in a concise form the commonly accepted techniques of transplantation of lymphoid tissue for immunological studies in vivo.

The editor of the issue certainly hopes the set of presented papers will serve its purpose of stimulating lymphologists and vascular surgeons to introduce the microsurgical methods to their armamentarium and promote the clinical physiological studies on lymph circulation, what is a prerequisite for improving our methods of treatment of lymph stasis and for basing them on more objective principles than clinical impressions.

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