

CHANGES IN LOWER EXTREMITIES VENOUS SYSTEM ANATOMY STRUCTURE AND PECULIARITIES OF DIFFERENT TYPE COMPRESSION CARRIED OUT FOR CURATIVE PURPOSES

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Abstract: knowing the individual peculiarities of venous system structure plays important role in evaluation of instrumental examinations data for determining a right choice of treatment methods.

The frequency of different clinical forms of chronic venous insufficiency reaches 80%. Chronic venous insufficiency is a socioeconomic problem for many developed countries.

Intermittent pneumatic compression is a quite effective method during chronic venous insufficiency, and it gained widespread for treatment of posttraumatic edema, postmastectomy edema, for prevention of post-surgical thrombosis, phlebothrombosis and lymphostasis among neurological patients. Undulating motions generated due to air pressure, promote lymph- and blood circulation improvement by extremity massage.

Compression therapy, which means resilient garments use during chronic venous insufficiency of lower extremities, plays a crucial role in combination therapy of diseases and is indicated during any degree of venous insufficiency disregarding the inducing cause. As far as chronic venous insufficiency touches on many functional systems of the body, its treatment has to be combined with other procedures and has to be focused on different pathogenic areas.

Keywords: lower extremities, venous system, compression, chronic venous insufficiency

ИЗМЕНЕНИЯ АНАТОМИЧЕСКОГО СТРОЕНИЯ ВЕНОЗНОЙ СИСТЕМЫ НИЖНИХ КОНЕЧНОСТЕЙ И ОСОБЕННОСТИ ПРОВЕДЕНИЯ РАЗЛИЧНОГО РОДА КОМПРЕССИИ С ЦЕЛЬЮ ЛЕЧЕНИЯ

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Аннотация: знание индивидуальных особенностей строения венозной системы играет большую роль в оценке данных инструментальных исследований в целях правильного выбора методов лечения.

Частота различных клинических форм венозной недостаточности достигает 80%. Хроническая венозная недостаточность во многих развитых странах представляет социально-экономическую проблему.

При венозной недостаточности достаточно эффективно прерывистая пневматическая компрессия, которая получила распространение при лечении посттравматического и постмастэктомического отека, при профилактике постоперационного тромбоза, флеботромбоза и лимфостаза у неврологических больных. Волнообразные движения, создаваемые давлением воздуха, способствуют улучшению лимфо- и кровообращения путем массажа конечности.

Компрессионная терапия, подразумевающая применение эластического трикотажа при хронической венозной недостаточности нижних конечностей, играет ключевую роль в комплексном лечении заболевания и показана при любой степени венозной недостаточности, вне зависимости от побудительных причин. Поскольку хроническая венозная недостаточность имеет отношение ко многим функциональным системам, ее лечение должно быть комплексным и должно быть направлено на различные звенья патогенеза.

Ключевые слова: венозная система, нижние конечности, компрессия, хроническая венозная недостаточность.

Physical environmental factors, participating in the life creation on the Earth and facilitating evolutionary development of animal world and human turned into intrinsic components of the world ecological system. They provide normal course of vitally important processes and secure high level of human body functioning.

Environmental action deficit causes disruption of the normal course of vital processes, reduction of functional capacities of the body and development of diseases.

Advance of science and technology provided a basis for development of physiotherapy – an area of medicine studying physiological and therapeutic action of physical factors created by nature and human, which develops methods for preventive and therapeutic application of their physical factors and provides their practical implementation, as well.

Physical factors, including laser irradiation, ultraviolet irradiation, compression etc., are widely used in the treatment of various illnesses [1-15].

Individual approach to each patient is of great importance. Let us consider the forms of chronic venous insufficiency and peculiarities of application of different kinds of compression during chronic venous insufficiency.

Physiotherapeutic procedures on human's lower extremities have to be carried out taking venous system anatomic features into account [12].

Anatomy structure of lower extremity venous system is distinguished by large variability. Knowledge of individual features of venous system structure plays major role in instrumental study data evaluation when selecting proper treatment.

In healthy humans, blood return from legs (regurgitation) usually occurs under influence of three systems interacting to each other. Among them are deep veins (they provide 85-98% of total blood circulation), superficially located veins (10-15% of total blood flow volume fall to them) and perforator veins, which connect first two systems to each other (superficial veins take a blood from tissues, while perforator veins transfer blood to deep veins).

Disorders of blood transportation from subcutaneous veins to deep veins and ensuing blood return towards heart are the cause of all venous diseases.

Chronic venous insufficiency of lower extremities is a syndrome characterized by venous outflow (return) disorders and causes disorganization of regional microcirculation system.

Chronic venous insufficiency is a wide-spread disease, which is registered among 10-15% of adult population. This syndrome is developed during polyetiologic disease – varicose vein disease of lower extremities.

The following interpretation was formulated by leading Russian phlebologists:

“Varicose vein disease of lower extremities is a polyetiologic disease, genesis of which is predetermined by heredity, obesity, hormonal status disorder, lifestyle features and pregnancy. This disease is manifested in varicose transformation of subcutaneous veins, and development of chronic venous insufficiency syndrome”.

The disease is featured by high prevalence. For instance, approximately 25% of population in USA and Western Europe has different forms of varicose diseases. In some other countries, especially in those with highly developed economics, a chronic insufficiency prevalence rate comprises 35-60%. Among roughly 1/6 of them trophic disorders, including trophic ulcers of high level of hazard are of frequent occurrence.

The course and treatment of venous insufficiency depend on the form of disease observed in the patient.

Acute venous insufficiency emerges in deeply located blood vessels in case of acute blood flow disorder, for instance as a result of venous congestion by a thrombus (venous thrombosis). It can be also caused by features of blood coagulation, different diseases, intoxication when administering some drugs.

The method of intermittent pneumatic compression is interesting and effective, as well, due to the fact that massage has a positive impact on blood-vascular and lymph systems (especially during chronic venous insufficiency) that is

manifested in acceleration of venous blood and lymph return, muscle tone enhancement and also taking into account that due to increased demand for this procedure special devices have been developed [13-15].

The use of intermittent pneumatic compression as the method of post-surgery phlebothrombosis prevention measures was reported for the first time in 1938. The development of the intermittent pneumatic compression method was based on the fact that variable external compression may cause substantial reduction in blood flow speed during the surgery and may be used afterwards with the purpose of deep vein thrombosis prophylaxis. Treatment of posttraumatic edema, postmastectomy edema, as well as prophylaxis of post-surgery thrombosis, lymphostasis and phlebothrombosis (in neurological patients) were given.

Therapeutic action procedure is conducted by means of special (single- or multi-sectional) pneumatic cuffs, which are fasten to the damaged extremities of the patient, and necessary external gradient compression is created in them by a pressure adjusted through boost air charging. Operation of this device imitates muscular contraction.

Undulating motions generated by air pressure facilitate lymph and blood circulation improvement by extremity massage.

The sequence of cuff sections pressurization may vary. Complex devices can program it in a wide range. During one regime of "traveling wave" sections are sequentially filled one after one. Compression wave motion may be directed both from up to down and from bottom to top. There is another one possible mode – "traveling wave with pressure memorizing", when section blown out in the direction of compression wave, keep their filled state up to cycle termination. As soon as compression in the last (upper) chamber is established, simultaneous pressure drop takes place in all chambers and pneumomassage cycle iterates. Such algorithm of pneumocompression operation is the most physiological one, since it imitates valvular apparatus of muscles and veins.

It is possible to inflate (fill with air) all cuff sections and keep pressure throughout a cycle as well. As the evidence from practice shows, even single-step compression of lower extremities at their entire surface is effective and facilitates blood and lymph upward motion. Air pressure in the cuff is selected depending on patient disease and individual tolerability, and it has to be sufficient for stimulation of muscular-venous pump action, however must not exceed diastolic pressure of a patient. The procedure should not evoke disagreeable sensations in patient.

Compression cycle duration varies from 15 sec to 5 min. The shorter is a cycle, the better is patient's tolerability to high pressure. Wave traveling speed must correspond to extremity edema manifestation and pneumocompression session time. The more evident is extremity edema, the more manifested is resistance to blood and lymph flow and the less should be compression rate. Proper speed can be established even during long-term (several hours long) massage session. Effect of pneumocompression may not be reached right after short session, so the treatment efficiency sometimes can be evaluated after prolonged and recurrent procedures only.

Intermittent pneumatic compression is used for treatment of varicose vein dilation without trophic disorders and also at the different stages of trophic disorder, during postphlebitic syndrome with or without trophic disorders, during restless legs syndrome, and during lymphatic edemas of congenital and acquired genesis (past surgeries, after radiotherapy or chemotherapy).

Contraindications to prescription of intermittent pneumatic compression:

- acute venous thrombosis (up to 6 months);
- acute thrombophlebitis;
- infections (sacred fire (rose), lymphangitis);
- hemophilia;
- angiaesthesia;
- evident eczema or dermatitis;
- decompensated blood circulation failure.

Among the devices for intermittent pneumatic compression the most common are: LIMFA, LIMFA-E (Russia), Limpha-MAT (Germany), FLOWPAC, FLOWTRON (England), PHIZIOPRESS I and II (Italy), GREEN-PRESS (of Iskra-MED company, Slovenia-Italy), WRIGHT LINEAR PUMP, HEMAFLO-2 (USA), LYMPHA-PRESS (Israel) etc.

The optimum technique is as follows:

During first 10 min a wave has to be down-directed from inguinal folds to foets under low pressure conditions – 30-40 mm Hg (it is optimal to do a manual massage of inguinal nodes for lymph return improvement), afterwards a wave goes in opposite direction from foets to inguinal folds. It is preferable to use "traveling waves with pressure memorization". Cuff pressure is 60-90 mm Hg, cycle duration – 20-30 min, total exposure time – up to 60 min.

Compression therapy improves action of shin muscular-venous pump, reduces edemas and reverses feeling of heaviness and severe bloating, relieves a pain.

The best way is to use special healing knitted garments, which promotes optimum physiological distribution of pressure [14-15].

Use of compression garments (golf hoses, compression stockings, compression hoses) provides constant uniform pressure on legs, that improves blood circulation and allow us to elude blood return (regurgitation) resulted in reduction of swelling. Compression garments also allow us to get rid of venous ulcers and assist healing of already existing ulcers. Compression garments provide necessary effect in case of their everyday use.

Elastic bandages have gained widespread use, as well.

Elastic bandages are usually 2,5-3 m in length, and 8-10 cm in width. They have a characteristic feature of expanding in length only, with unchanged width of bandage. High-quality elastic bandages must contain no less than 50% of natural fibers (cotton, flax, crepe).

You need to be consulted by a doctor how to properly bandage a leg. This procedure has to be performed every day (a leg must be bandaged in the morning and removed in the evening). Prior to bandaging a leg has to be elevated by 15-20 degrees and you must lay down for 10-15 min in this position. Afterwards a first turn of a bandage is put on the base of toe, then the next turn must overlap a previous one by 2/3 etc. It important to reliably bandage a heel by the type of "hammock". Bandage roll must be unfolded in the close proximity of skin cover.

Bandage must be wrapped following the extremity shape. For this purpose, a bandage should be put on alternatively on ascending and descending direction.

One must be taken into account that the lower, medium and upper thigh thirds substantially differ according their diameter, so bandage must be put on in the form of "figure eight".

If compression band is correctly applied, toe tips slightly turn blue in state of rest, and restore the initial color as soon as motion begins. Elastic bandage should be washed everyday in warm water by baby soap and dried between two dense textures.

In case of delicate handling a bandage may withstand 15 washings, thereafter it loses its healing properties and turns into ordinary cloth.

Medical compression garments may be divided into two large, prophylactic and therapeutic groups. In contradistinction from ordinary decoration articles a prophylactic knitted garment is characterized by a denser material and so-called distributed pressure. That means that this stocking builds higher pressure on the foot, compared to shin and thigh. The difference in pressure facilitates venous blood return. It is highly recommended for humans with high risk of venous insufficiency development (high stature, heavy load on legs, hormone preparations intake, excessive weight, bad inheritance etc.) to wear preventive knitted garments.

At that it should be taken into account that a preventive knitted garments have no therapeutic action and are unable to **make those changes** in veins, which have been already developed during a disease.

Preventive knitted garments have a distinguishing mark – special marking in Dens (Den is a technical characteristic reflecting the tissue density).

Therapeutic compression knitted garments are made according to special technology. It also provides the distributed pressure schedule, but creates more pressure than preventive **goods**. Main pressure in therapeutic garments falls on ankle zone and lower third of shin, i.e. on those zones, where skin trophic ulcers are the most frequent and where perforated ulcers exist. In cases of different venous diseases, it is necessary to observe a definite compression degree. Therefore, the whole range of therapeutic garments has to be divided into four classes depending on pressure value at the ankle level.

I – low-degree compression (20-30 mm Hg);

II – medium degree compression (30-40 mm Hg);

III – severe degree compression (40-50 mm Hg);

IV – very high degree compression (50 mm Hg and more).

Compression class and healing pressure level (in mm Hg) must be indicated at the wrapping of the mentioned good.

Knitted garments are distinguished by individual sizes, which vary from three to nine. As of today, only six companies manufacture such medical compression garments, which comply with current requirements. Among them such recognized manufacturers of therapeutic garments stand out, as firm Sigvaris in Switzerland, and firm Medi in German.

Advices for reduction of venous insufficiency manifestation:

- don't cross your legs when sitting;
- place your legs on a small chair (stool) when sitting for a long time, e.g. at the table;
- at night or when taking a rest in the daytime put a pillow under your legs in such a way so that to position foets and shins a little higher than heart level;
- when forced to stand on your feet try to alternate legs, while in case of forced prolonged sitting (in a train, plane or car) try to fix heels on a floor and move foets up and down;
- don't take a hot shower, exclude visits to bathhouses and saunas;
- get rid of leg overheating and sun burns;
- don't wear tight shoes and close-bodied dress.

Thus, we have discussed the features of different kinds of compression methods and their action mechanisms during chronic venous insufficiency. At the same time, it should be noted that chronic venous insufficiency is closely associated with many functional systems of organism, including macro- and microdynamics of hemostasis system, mineral metabolism, reduction-oxidation processes, enzymatic and hormone action of the body. That is why its treatment must be of integrated nature and has to be oriented on different pathogenetic areas.

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