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Compression therapy “Double focal compression bandaging” in patient with cardiac failure. Can we use compression therapy in these patients?

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Introduction:

Cardiac failure is usually listed as a contraindication for compression therapy, due to the improvement in preload caused by the displacement of volume of blood to the heart. A potential impact of compression therapy on the cardiac or heart function has rarely been studied. Can we use it, in patients with NYAH class I, II, or III heart failure?

Of course, compression in legs is contraindicated in patients with NYAH class IV: “Patients with heart disease resulting in the inability to move on any physical activity without discomfort. Symptoms of Cardiac failure or the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is improved” (NYAH classification) (1).

We used compression therapy for years, as only treatment in patients with vascular ulcers (legs). Some of them with Cardiac disease, and one of my fears was that the compression could worsen their symptoms. They were subject to special follow-up to detect signs and symptoms of cardiac decompensation, in which case, we would remove the bandaging. However, what we observed was that they improved regard to cardiac function (there was not cardiac decompensation) and their quality of life. There are some papers about this clinical fact (2).

We needed find an explanation for this improvement, and this one could be in physiological secretion natriuretic peptides (Fig 1).

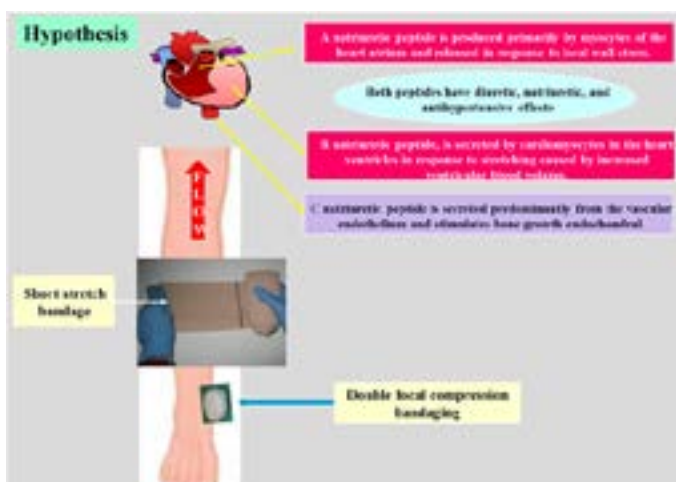


Fig. 1: Compression bandaging leads to increased cardiac preload, with a physiological secretion antidiuretic peptides.

Compression in lower limbs increases cardiac preload, by an excess blood volume towards the cardiac chambers. This is a negative effect in patients with failure cardiac (NYAH IV class) but, can have a positive effect in the other classes (I, II, III)?

This increase in cardiac preload leads to an increasing of pressure in the walls of heart chambers, which secrete natriuretic peptides as a compensatory physiological mechanism. Natriuretic peptides (NPs) are hormones which are mainly secreted from heart and have important natriuretic and kaliuretic properties. Apart from blood pressure lowering properties, natriuretic, diuretic, and/or kaliuretic properties of the NP originating from the ANP prohormone (3) and from BNP, inhibition of the renin-angiotensin system, sympathetic outflow, and vascular smooth muscle and endothelial cell proliferation have been attributed to NP (4). C-type natriuretic peptide (CNP), are potent stimulators of endochondral bone growth (5). We present our experience in patients with cardiac failure (NYHA II-III) with vascular leg ulcers, who were treated by this compression technique (images and radiographic comments are showing). This therapeutic measure looks be contraindicated in these patients by increasing cardiac preload (6), for this reason, we made a daily follow to detect any sign/symptom of cardiac discompensation, but this did not happen. These are clinical cases in patients with vascular leg ulcers and cardiac failure, treated by this technique:

Case report 1 (Fig 2, 3): A 86-years-old female with the following background diseases: Arterial hypertension, type 2 diabetes mellitus, dyslipidemia and severe obesity.

She takes oral anticoagulants because of suffering a chronic atrial fibrillation. On July 2012, she had a hospital admission because of rectal bleeding and severe anaemia. She is diagnosed of Colonic diverticulosis.

On November 2013 the patient suffers a new rectal haemorrhage, she had again a hospital admission. The cardiologists decided to terminate anticoagulation for the haemorrhage risk. The patient was released from hospital, one week later.

One month later, the patient suffered from trauma on her leg. The ankle brachial index was 1.1. We started treating her with “Double focal compression bandaging”, making a daily follow up of ulcer’s clinical course.



12- 04- 2012 12-12-2012 12-19-2012 01-01-2013 03-12-2013

Fig. 2: Clinical course of ulcer until its healing, three months later.

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We taught her relatives to bandage the leg. Since this date (4-12-2012) her relatives bandaged her leg every day, removing it at bedtime, to put again in the morning, at get up. In primary care, we only can make a chest X- ray test (Fig 3).



Fig. 3: The size of heart chambers has decreased.

The patient in July 2016 goes to cardiology office and this is the cardiac report: Hypertensive heart disease with left ventricular ejection fraction preserved. Chronic atrial fibrillation (anticoagulant drugs contraindicated). Moderate-severe mitral regurgitation. Moderate tricuspid regurgitation. Pulmonary hypertension. Cardiac heart failure secondary to these pathologies. The patient did not have any hospital admission for acute decompensated heart failure, in these 6 years and your quality of life improved. We did not modify her treatment, and only added a compression bandaging. She died in 2018 after falling down the stairs. She was 91 years old.

Case report 2 (Fig 4, 5, 6, 7, 8): A 88-years-old female with the following background diseases: Arterial hypertension, hyperthyroidism, moderate aortic and mitral stenosis.

On September 2011, she required hospitalization for a cardiovascular syncope and heart failure due to rapid atrial fibrillation (Fig 4).

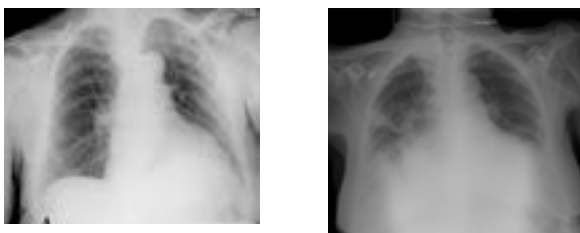


Fig. 4: A/ X-ray (5-20-2009) B/ X-ray: Heart failure (9-09-2011)

The patient was diagnosed of pre-tibial vascular ulcer in her right leg, with a torpid evolution. The ankle brachial index was 0.95. We treated the patient with “Double focal compression bandaging technique”, making a daily follow up, at the first weeks, due to disease the patient. We had to be cautious concerning to any sign and symptom of decompensated heart failure.

One month later, a second ulcer appears close to the first one, and three months later, others appear in the same leg (Fig 5). Right leg ulcer is healed, eight months later. Eight months later of starting compression therapy, a new ulcer appears in left leg (06-08-2012), (Fig 6).

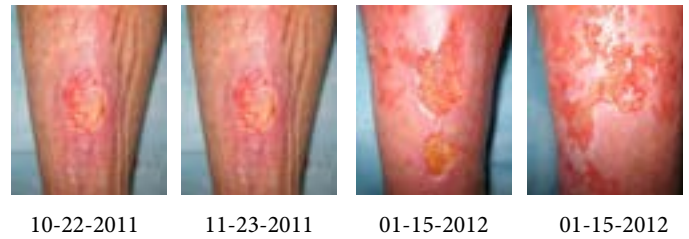


Fig. 5: Clinical course of ulcer



Fig. 6: Ulcer in left leg and ulcers healed in right leg, after compression therapy



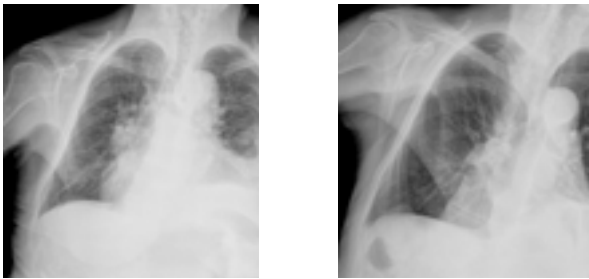
Fig. 7: We note that these new ulcers in left leg have very similar form and localization (pre tibial) to the right leg healed.

We applied the same treatment, and getting the same result: “Ulcer healing”. The ulcers needed several years to heal, and we made a continuous follow up of the patient, achieving reduce oedema in her legs (Fig 7). She had not any hospital admission in these years. There was no modification of treatment for cardiopathy, we only added “Double focal compression bandaging”. Finally, she died by age when she was 97 years, not due to heart failure.

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10-25-2012 12-02-2016
 Fig. 8: A/ X-ray (10-25-2012). B/ X-ray (12-02-2016)

These cases in elderly patients with heart disease and vascular leg ulcers, they were healed with compression therapy, a therapy measure that would be contraindicated in patient with cardiomegaly, by increasing cardiac preload, the compression bandaging in legs (Fig 3-4-8). We continuously monitored the clinical course of the ulcers until their healing, to detect early sign/symptom of cardiac decompensation and removing the bandaging, but this did not happen. Both patients continued taking their medications for heart failure, we only added compression therapy. There was no hospital admission for decompensated heart failure. They did not die from complications of heart failure and improved their quality of life.

There is a fear for appealing compression in patients diagnosed of Cardiac failure. This is due to compression in legs increases cardiac preload by displacement of blood from legs towards to the heart. This is a truth fact, for this reason, we can not apply compression in patients with heart failure grade IV, but according to this clinical experience, it is possible to do it in patients with a lower grade of heart failure (I/II/III). It is necessary to make a continuous follow up of the patient, to detect decompensated heart failure, and if this happens, removing the bandaging. In my opinion, the improvement of their quality of life in both patients could be explained so: the natriuretic peptides have diuretic, natriuretic and antihypertensive effects (7, 8). Compression therapy in the legs leads to an increase in cardiac preload and a stress at the cardiac chambers walls, which stimulate a physiological secretion of natriuretic peptides. More studies are necessary for establishing a investigation line in this sense.

Case report 3 (Fig 9, 10, 11, 12, 13, 14): A 90-years-old male with the following background diseases: Arterial hypertension, chronic obstructive pulmonary disease, left hip replacement, cholecystectomy, chronic venous insufficiency, chronic renal failure (stage 3B), type 2 diabetes mellitus and chronic atrial fibrillation (Fig 9). He takes oral anticoagulant.

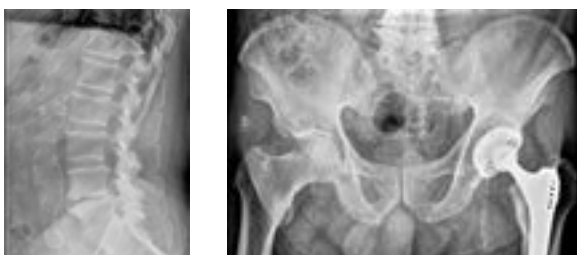


Fig. 9: X-ray showing atherosclerotic disease of the abdominal aorta and left hip replacement surgery

On March (03-05-2018), the patient had a hospital admission for acute decompensated heart failure from pneumonia (Fig 10 B).

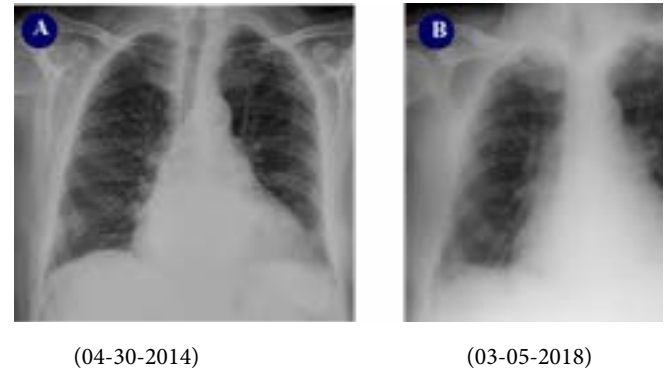


Fig.10: Chest X-ray (A/ Cardiac failure;B/ Pneumonia and cardiac failure)

The patient was diagnosed from cardiac failure NYHA III/IV (Fig 10 A). This patient was surgically intervened from varicose veins in 2005. On July (07-22-2019), he came to our office because of an ulcer of torpid evolution in his right leg. The ankle brachial index was 0.9, and we started treating him, applying only “Double focal compression bandaging”, and the ulcer healed 3 months later (Fig 11). The patient bandages both legs, removing the bandage at bed time. This technique seems to be contraindicated in this patient, nevertheless, he tolerated all day the bandage and his quality of life improved.



Fig.11: Venous ulcer healed, three months later, applying double focal compression bandaging

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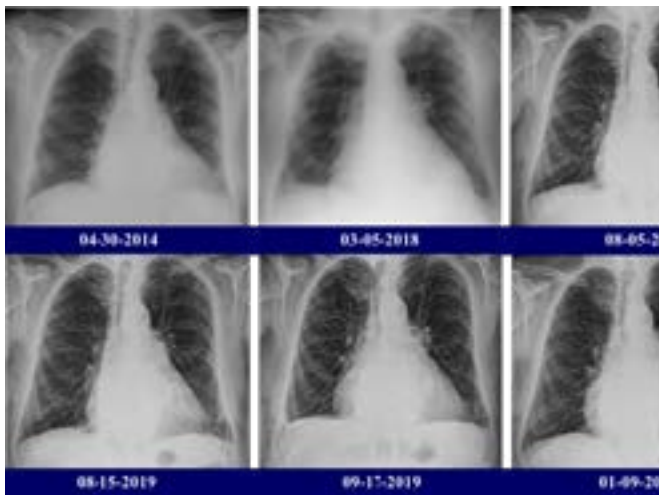


Fig.13: Chest X-ray. Clinical course



Fig. 14: Venous ulcer healed 5 months later applying “Double focal compression bandaging”.

Case report 4 (Fig 15, 16, 17): An 85-year-old female with the following background diseases: Arterial hypertension, obesity, dyslipidaemia, arthrosis. She was diagnosed with ischaemic cardiomyopathy, left bundle branch block and moderate aortic stenosis with heart failure II/III (Fig 15).

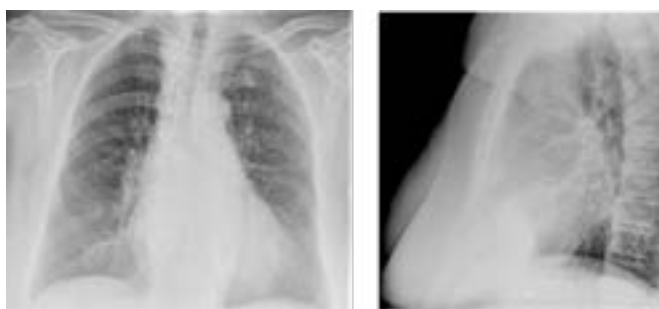


Fig.15: Chest X-ray, before aortic valve replacement surgery

She had a hospital admission for acute decompensated heart failure (10-02-2015), being diagnosed from severe aortic stenosis and undergone aortic valve replacement surgery (Fig 16).

On May (05-06-2019) he came to our office because of suffering a trauma in her left leg, with a wound did not heal despite treatment. We made a daily follow-up in the first weeks, to detect any sign/symptom of cardiac decompensation, but this did not happen.



Fig. 16: Chest X-ray after applying compression to the legs

The ankle brachial index was 0.96. We started treating her, with double focal compression bandaging, and the ulcer healed five months later (Fig 17). She tolerated the compression bandage well and said feeling better. Currently, she wears compression stockings.



Fig. 17: Clinical course of the ulcer

Case report 5 (Fig 18, 19, 20, 21): An 84-years-old female with the following background diseases: Valvular heart disease, ischaemic heart disease, ischaemic stroke, arterial hypertension, chronic venous insufficiency, megaloblastic anaemia and type 2 diabetes (insulin-dependent). On October 2009, she presents a cardiac failure decompensated (Fig 16 A).

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Fig. 18: Chest X-ray. A/ Cardiac failure decompensated, B/ Stable heart failure

The patient suffered trauma to her left leg (05-18-2019), with a small ulcer that we treated with double focal compression bandaging, achieving the ulcer healing forty-five days later (Fig 19).

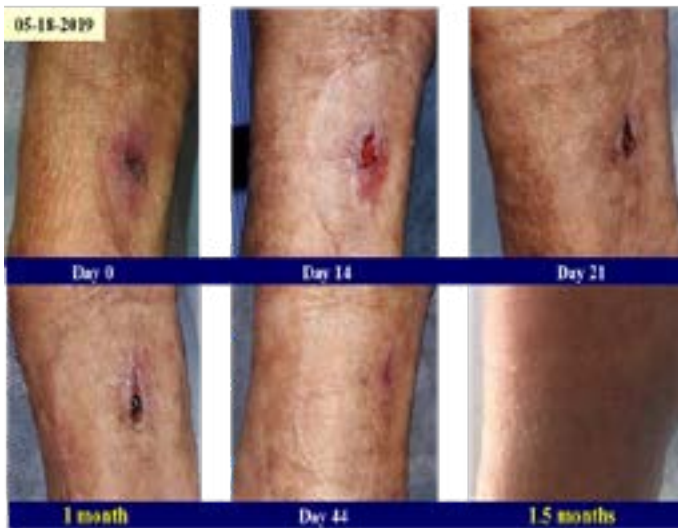


Fig. 19: Healing venous leg ulcer (forty-five days later) applying double focal compression bandaging

Applying this technique, we achieved to heal the ulcer improving her symptomology and quality of life. Chest X-ray control shows a favourable clinical course (Fig 20).



Fig 20. Chest X-ray since was applied double focal compression bandaging

We can observe the effect of compression in the legs. Right leg treated with compression and left leg without it (Fig 20).



Case report 6 (Fig 21, 22, 22): A 57-years-old man with the following background diseases: Dyslipidaemia. He suffered a right ankle fracture on February 2016, being undergone surgical with osteosynthesis material, that it is removed due to infection (osteomyelitis).

The patient is referred to another higher hospital for complications in the ankle (September 2016). The safest therapeutic option was the amputation, due to antibiotic resistance to bacteria and the osteomyelitis, that the patient refused it assuming the risk (October 2016).

He was treated with antibiotic at high dose (intravenous ertapenem), for 1 month, without positive result. He is released, with hyperbaric oxygen therapy at other hospital (November 2016). He received 58 sessions in hyperbaric chamber, without positive result.

He came in a wheelchair to our office, in April 2017. Ankle brachial index was 1. We started treating him, using only "Double focal compression bandaging". No antibiotic was prescribed. We did not achieve to close the wound, but achieved the patient to walk again (Fig 21).



Fig.21: Clinical course of the ulcer. Exposed bone

This is no patient with cardiomyopathy (Fig22)

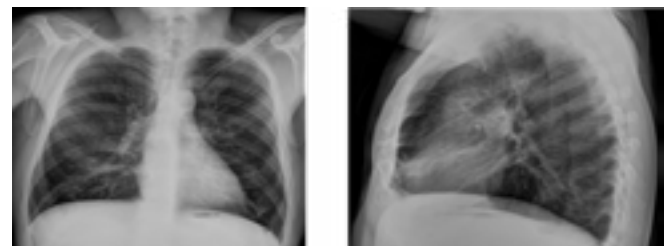


Fig.22: Chest X-ray

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This case seems to be unrelated to the others, but we achieve a bone growth that allowed him to walk again (Fig 23). He came to our office in wheelchair. After treatment by double focal compression bandaging, we got the patient to walk again. Why do I show you this case? The question is: Is there a relationship between endochondral bone growth and natriuretic peptide C secretion?

According to the following hypothesis: Compression therapy in the legs leads to an increase in cardiac preload and a stress to the cardiac chambers by increasing the volume of blood to the heart, which stimulates a physiological secretion of natriuretic peptides (Fig 1).



Fig.22: Fibula fracture and bone growth

These clinical cases show that leg compression therapy in patients with cardiac failure, excluding those that are in NYAH class IV, it is possible and convenient. More studies are necessary for establishing an investigation line in this sense.

References:

1. The Criteria Committee of the New York Heart Association. Nomenclature and Criteria for Diagnosis of Diseases of the Heart and Great Vessels. 9th ed. Boston, Mass: Little, Brown & Co; 1994:253-256.
2. Exercise-based cardiac rehabilitation for adults with heart failure. Long L, Mordi IR, Bridges C, Sagar VA, Davies EJ, Coats AJ, Dala H, Rees K, Singh SJ, Taylor RS.
3. Vesely DL, Douglass MA, Dietz JR, Gower WR, Jr, McDormick MT, Rodriguez-Paz G, et al. Three peptides form the atrial natriuretic factor prohormone amino terminus lower blood pressure and produce a diuresis, natriuresis, and/or kaliuresis in humans. *Circulation*. 1994; 90:1129-40.
4. Nakao K, Ogawa Y, Suga S, Imura H. Molecular biology and biochemistry of the natriuretic system. I. Natriuretic peptides. *J Hypertens*. 1992;10:907-12.
5. Kanai Y1, Yasoda A, Mori KP, Watanabe-Takano H, Nagai-Okatani C, Yamashita Y, Hirota K, Ueda Y, Yamauchi I, Kondo E, Yamanaka S, Sakane Y, Nakao K, Fujii T, Yokoi H, Minamino N, Mukoyama M, Mochizuki N, Inagaki N. Circulating osteocrin stimulates bone growth by limiting C-type natriuretic peptide clearance. *J Clin Invest*. 2017 Nov 1;127(11):4136-4147. doi: 10.1172/JCI94912. Epub 2017 Oct 9.
6. Andriessen A, Apelqvist J, Mosti G, Partsch H, Gonska C, Abel M.J *Eur Acad Dermatol Venereol*. 2017 Sep;31(9):1562-1568. doi: 10.1111/jdv.14390. Epub 2017 Jul 31. Review. Compression therapy for venous leg ulcers: risk factors for adverse events and complications, contraindications - a review of present guidelines
7. Nishikimi T, Kuwahara K, Nakao K. Current biochemistry, molecular biology, and clinical relevance of natriuretic peptides. *Journal of Cardiology* 2011; 57: 131-140.
8. Pandey KN. Emerging Roles of Natriuretic Peptides and their Receptors in Pathophysiology of Hypertension and Cardiovascular Regulation. *J Am Soc Hypertens* 2008; 2(4): 210-226.