

## Compression therapy for non-venous leg ulcers: Current viewpoint

Dear Editors,

Compression therapy is utilised to enhance venous return and reduce lower extremity edema to promote wound healing.<sup>1</sup> Following Laplace's law, the resulting sub-bandage pressure is directly proportional to the tension of the applied fabric and indirectly proportional to the radius of the limb. This principle is the basis for the application of compression therapy to improve calf muscle function, restore valve competence, and reduce venous reflux. The compression therapy is the evidence-based standard care for management of venous leg ulcers.<sup>1</sup> However, the compression therapy is only rarely used in leg ulcers of non-venous aetiology. Although 75% of chronic leg ulcers are purely venous or mixed arteriovenous, acute wounds of the legs and atypical leg ulcers are an important group of ulcers for the clinicians. Most of these ulcers are painful and significantly affect patients' daily activities. Treating the cause is the mainstay of the treatment, but proper wound care is critical to shorten the time to healing. Majority of these ulcers have a secondary venous insufficiency and limitation in calf muscle function. Integrating the compression therapy in non-venous ulcers is lacking the evidence. What is the role of compression therapy for leg ulcers due to non-venous aetiologies? The truth is that we cannot answer this simple question in certain.

We have conducted a literature review to assess this issue. A PubMed search included articles in the English language, published between 2000 and 2018, with keywords "compression therapy of lower limbs/extremities." Our search was using keywords plus compression therapy: "chronic leg ulcers" and compression therapy, "pyoderma gangrenosum" and compression therapy, "cutaneous leukocytoclastic vasculitis," or "vasculitis" and compression therapy, "sickle cell anemia" and compression therapy, and "necrobiosis lipoidica" and compression therapy. A total of 1926 publications have been found out of which 304 were review articles, but most of them are related to neurological compression injuries. After limiting the search only to publications that include compression, therapy, and/or lower limbs/extremities, the list was narrowed to 69 articles that dealt with lower limb management and finalised to 33 after further appraisal of their content, as strictly pertaining to our

subject of interest and contained only the keywords within the title of the publication and discussed clinical aspects of the subjects. The results indicate that 76% (25/33), 21% (7/33 combined with venous), 21% (7/33), and 12% (4/33) of these reports address the application of compression therapy for venous disease, lymphedema, deep venous thrombosis prophylaxis, and other causes, respectively. For which, not surprisingly, sufficient data exist to support their well-accepted and established consensus on the compression treatment (Table 1).

As provided in Table 1, only limited evidence supports the use of compression for non-venous ulcers; however, experimental data suggest a potential benefit for patients with well vascularized leg ulcers of non-venous aetiology. For atypical wounds such as traumatic ulcers, wounds due to pyoderma gangrenosum (PG), necrobiosis lipoidica (NL), vasculitis, and any other chronic wounds, they may potentially present to wound healing clinics. However, this was not the real subject of our interest; we wanted to inquire how about applying this therapy for non-venous or related diseases. We have become attended to this issue, since, based on our clinical experience, applying compression is apparently obvious to be provided for any given lower extremities' wounds, but is that really?

Compression stockings were recommended in the literature for the management of non-venous leg ulcers including cutaneous vasculitis in lower extremities to reduce purpura. The authors of this article have argued that although no studies exist to support their statement, it is pathophysiologically appropriate and not with major adverse effects.<sup>2</sup> Compression therapy has a crucial role on wound healing particularly when edema is present regardless of aetiology. A case series of three reported patients with chronic leg ulcers and anaemia have failed to respond to the haematological therapy but healed with an appropriate compression therapy.<sup>3,9</sup> PG is a chronic painful inflammatory ulcer that commonly involves lower extremities. One report signifies the importance of combined multimodal therapy, including immunosuppressive, wound care that includes compression therapy, the latter as negligible. While another report indicates complete healing of PG, only with conservative therapy of wound healing including compression therapy, although this raises

**TABLE 1** Lists of previous reports on compression therapy<sup>2-38</sup>

Author	Journal/year	PubMed ID	Indication for compression therapy	Sample study	Outcome
Ginocchio et al <sup>5</sup>	Adv Skin Wound Care, 2017	28914682	NL	1	PR
Hague et al <sup>6</sup>	Surgeon, 2017	27658664	CVI	NA	CR
Gould et al <sup>7</sup>	Plast Reconstr Surg, 2016	27556762	CVI	NA	CR
Raju et al <sup>8</sup>	J Vasc Surg Venous Lymphat Disord, 2016	27318058	CVI	NA	CR
de Carvalho et al <sup>9</sup>	J Vasc Nurs, 2016	27210451	CVI VLU	NA	CR
Williams <sup>10</sup>	J Wound Care, 2016	27169339	CVI Lymphedema Lipedema	NA	CR
Berntsen et al <sup>11</sup>	Am J Med, 2016	26747198	Post-thrombotic syndrome	5 RCTs (n = 1418) a single large RCT at low risk of bias provided moderate-quality evidence of no effect on post-thrombotic syndrome (HR 1.00; 95% CI, 0.81-1.24). Moderate-quality evidence including all 5 studies suggests no effect of elastic compression stockings on recurrent venous thromboembolism (RR 0.88; 95% CI, 0.63-1.24) or mortality (RR 1.00; 95% CI, 0.73-1.37, 5 studies)	CR
Cooper et al <sup>12</sup>	Semin Vasc Surg, 2015	27113282	CVI	NA	CR
Todd <sup>13</sup>	Br J Community Nurs, 2015	26418585	CVI Lymphedema	3 case studies	CR
Pascarella and Shortell <sup>14</sup>	Semin Vasc Surg, 2015	26358306	CVI	NA	CR
Todd <sup>15</sup>	Br J Community Nurs, 2015	26140315	Lymphedema	NA	CR
Partsch and Mortimer <sup>16</sup>	Br J Dermatol, 2015	26094638	CVI	NA	CR
Linitt <sup>17</sup>	Br J Community Nurs, 2015	26043014	CVI	NA	CR
de Carvalho <sup>18</sup>	J Wound Ostomy Continence Nurs, 2015	25549308	CVI	4 studies met criteria	3/4 studies reported no differences in HR for patients managed with compression plus surgery in comparison to patients managed with compression alone. 1 study reported higher HR in the surgical group

(Continues)

**TABLE 1** (Continued)

Author	Journal/year	PubMed ID	Indication for compression therapy	Sample study	Outcome
Mauck et al <sup>19</sup>	J Vasc Surg, 2014	24877851	CVI	36 studies and 2 Cochrane systematic reviews	Moderate-quality evidence supports compression over no compression, multicomponent systems over single component systems, and systems with an elastic component over those without. We did not find significant differences with respect to ulcer healing outcomes for other comparisons
Smeenk et al <sup>20</sup>	Neth J Med, 2014	24659590	Orthostatic hypotension	11 publications were selected	Full length compression (lower limbs and abdomen) and compression of solely the abdomen were found to be superior to knee-length and thigh-length compression. Both significantly reduced the fall in systolic blood pressure after postural change
Chia and Tang <sup>4</sup>	Int Wound J, 2014	23237056	PG	17	CR
Carpentier et al <sup>21</sup>	Womens Health (Lond), 2013	23614519	CVI	NA	CR
Fioramonti et al <sup>3</sup>	In Vivo, 2012	22210732	PG	1	CR
Stout et al <sup>22</sup>	Int Angiol, 2012	22801397	CVI	NA	CR
Simms and Ennen <sup>23</sup>	J Clin Nurs, 2011	21083786	Lower limb ulcerations	Twenty-nine articles were identified for use in the evaluation of best practice of lower limb ulcerations	Use of dressings and compression therapy to relieve venous congestion identified as important factors in the treatment of venous lower limb ulcerations
Kouri <sup>24</sup>	Am J Med, 2009	19486710	lower extremity varicose veins	NA	PR-CR
Hettrick <sup>25</sup>	J Am Col Certif Wound Spec, 2009	24527104	CVI	NA	CR
Kerchner et al <sup>26</sup>	J Am Acad Dermatol, 2008	18513827	Lower extremity lymphedema	NA	PR
Flour <sup>27</sup>	Int J Low Extrem Wounds, 2008	18492674	Lower extremity lymphedema CVI Trauma induced edema	NA	PR

(Continues)

TABLE 1 (Continued)

Author	Journal/year	PubMed ID	Indication for compression therapy	Sample study	Outcome
Nicolaidis et al <sup>28</sup>	Int Angiol, 2008	18277340	CVI	NA	CR
Sajid et al <sup>29</sup>	Eur J Vasc Endovasc Surg, 2006	16931066	Evaluate stocking length and efficacy of thromboprophylaxis	14 RCT's	Knee length graduated stockings can be as effective as Thigh length stockings for the prevention of DVT
Angirasa et al <sup>30</sup>	Ostomy Wound Manage, 2006	16687770	CVI DFU	1	CR (application of bioengineered human dermal implant to the wound)
Sunderkötter et al <sup>2</sup>	J Dermatolog Treat, 2005	16249140	LCV	NA	CR
Felty and Rooke <sup>31</sup>	Semin Vasc Surg, 2005	15791552	CVI	NA	CR
Dawn et al <sup>32</sup>	Br J Dermatol, 2003	12653740	CVI	1	No healing
Kantor and Margolis <sup>33</sup>	Semin Cutan Med Surg, 2003	14649588	CVI	NA	CR
Hampton <sup>34</sup>	Br J Nurs, 2003	12937370	Lymphedema	NA	PR
Johnson <sup>35</sup>	J Tissue Viability, 2002	12001328	CVI	NA	PR-CR
Ramelet <sup>36</sup>	Dermatol Surg, 2002	11991273	CVI Lymphedema Leg ulcers	NA	CR Compression Rx is cost effective
Byrne <sup>37</sup>	Heart Lung, 2001	11449214	DVT prophylaxis Thigh-length stockings vs below knee stockings for DVT prophylaxis	10 articles selected 4 RCT's	Below-knee graduated compression stockings appear to be equally effective to the thigh-length stockings in DVT prophylaxis
Rudolph <sup>38</sup>	J Vasc Nurs, 2001	11251936	CVI ulcers	NA	CR

Abbreviations: CI, confidence interval; CR, complete healing; CVI, chronic venous insufficiency; DFU, diabetic foot ulcer; DVT, deep venous thrombosis; HR, healing rates; LCV, leukocytoclastic vasculitis; NA, not applicable; NL, necrobiosis lipoidica; PG, pyoderma gangrenosum; PR, partial healing; RCT's, randomised control trials; RR, relative risk; VLU, venous leg ulcers.

some questions regarding the stability of such long-term regimen in an inflammatory disorder such as PG, it emphasises the importance of utilising compression to such wounds.<sup>3</sup> Nevertheless, in another study investigating chronic leg ulcers in patients, more than 100 adult patients with rheumatological diseases, of whom 17 have suffered from PG, were treated with the compression therapy alone and exhibited successful results.<sup>4</sup> In contrast to this, another study of 103 PG patients treated with multiple treatment modalities include tissue debridement but did not include any compression therapy.<sup>40</sup>

NL is another chronic granulomatous cutaneous disorder that mostly present in the lower shins is commonly associated, but not restricted to diabetic patients. The compression

therapy is part of management plan for all NLs located on lower extremities. We have found only one report that combined compression therapy to the regimen; although it was a successful therapy with almost complete healing, success was not attributed to the compression at all.<sup>5</sup> It is essential to remember that compression therapy should be managed with caution in cases of significant arterial disease or symptomatic congestive heart failure. Adherence to treatment is another challenge for the application of compression therapy to extremely painful ulcers such as PG that can be addressed with proper counselling.

Compression therapy is mostly known to be used for chronic venous ulcers and lymphedema, with obvious rationale and with robust evidence-based data. Compression therapy is the evidence-based standard care for management of

venous leg ulcers. However, compression therapy is only rarely used in leg ulcers of non-venous aetiology.

\*\*\*\*\*How about application of compression therapy for other indications?


Even though the evidence is limited, most experts are applying compression therapy to lower extremity ulcers to improve the healing. It is possible that many patients with lower extremity ulcers have a functional venous insufficiency. Application of compression therapy improves the calf muscle function and reduce the edema. We have experienced good results in our practice. We assume that unless contraindicated to do so, compression therapy may be beneficial for almost any given lower leg ulcer.

Therefore, based on our experience, and much less due to the lack of robust evidence, at this point, we conclude to the question whether to use compression or not to use compression? we choose to use compression, well, at least until proven otherwise.

We strongly recommend that further future studies will address this issue to make our assumption more solid.

## CONFLICT OF INTEREST

A.A. has consulted for AbbVie, Janssen, LEO, Galderma, Novartis, and Valeant, and is also an investigator for AbbVie, Novartis, Regeneron, Pfizer, Boehringer-Ingelheim, Glenmark, Merck Serono, Roche, Xoma, and Xenon. A.A. received an unrestricted educational grant from AbbVie. E.S. has no conflicts of interest.

Eran Shavit   
Afsaneh Alavi

Division of Dermatology, Department of Medicine, Women's College Hospital, University of Toronto, Toronto, Canada

## Correspondence

Eran Shavit, MD, Division of Dermatology, Department of Medicine, Women's College Hospital, University of Toronto, Toronto, Ontario, Canada.  
Email: erans29@gmail.com

## ORCID

Eran Shavit  <https://orcid.org/0000-0003-2397-6316>

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