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**Literature search results**

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<td>Search completed by:</td>
<td>Richard Bridgen</td>
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**Search details**

Is there a connection between heel ulcers and arterial disease?

**Resources searched**

NHS Evidence; TRIP Database; Cochrane Library; AMED; BNI; CINAHL; EMBASE; HMIC MEDLINE; PsychINFO; Google Scholar

**Database search terms:** “pressure ulcer*”; “decubitus ulcer*”; bedsore*; “bed sore*”; “pressure necros*”; “pressure sore*”; PRESSURE ULCER; HEEL ULCER; heel*; calcaneus; exp CALCANAUS; HEEL SPUR; “arterial disease*”; disease* adj2 arter*; exp INTRACRANIAL ARTERIAL DISEASES; exp CEREBRAL ARTERIAL DISEASES; exp ARTERIAL OCCULUSIVE DISEASES; exp CAROTID ARTERY DISEASES; “arteriosclerotic heart disease*”; exp ARTERY DISEASE; exp CORONARY ARTERY DISEASE; PERIPHERAL ARTERY DISEASE; CAD; PAD; “arterial insufficient*”; FOOT ULCER;

**Evidence search string(s):** (heel or calcaneus) ("pressure ulcer*" OR "decubitus ulcer*" OR bedsore* OR "pressure sore*" OR "pressure necros") ("arterial disease*" OR "arterial insufficient*" OR PAD OR CAD)

**Google search string(s):** (heel or calcaneus) (~"pressure ulcer" OR "decubitus ulcer" OR bedsore OR "pressure sore" OR "pressure necrosis") (~"arterial disease" OR "arterial insufficient" OR PAD OR CAD)

**Summary**

There is some information on heel ulcers and their connection to arterial diseases or insufficiency. I had problems with the databases, so some of the later database results will not link to available full-text articles. Please contact the library if you need any of these articles.
### Guidelines

None found.

### Evidence-based reviews

None found.

### Published research

1. **A critical review on the use of lipid apheresis and rheopheresis for treatment of peripheral arterial disease and the diabetic foot syndrome.**

   **Author(s)** Weiss N

   **Citation:** Seminars in Dialysis, March 2012, vol./is. 25/2(220-7), 0894-0959;1525-139X (2012 Mar-Apr)

   **Publication Date:** March 2012

   **Source:** Medline

   Available in print at [ULHT journal article requests. Complete the online form to obtain articles.](#)

2. **Checklist for improved wound outcomes: part 1.**

   **Author(s)** Hess CT

   **Citation:** Advances in Skin & Wound Care, March 2012, vol./is. 25/3(144), 1527-7941;1538-8654 (2012 Mar)

   **Publication Date:** March 2012

   **Source:** Medline

   Available in print at [ULHT journal article requests. Complete the online form to obtain articles.](#)

3. **Specific guidelines for the diagnosis and treatment of peripheral arterial disease in a patient with diabetes and ulceration of the foot 2011.**


   **Citation:** Diabetes/Metabolism Research Reviews, February 2012, vol./is. 28 Suppl 1/(236-7), 1520-7552;1520-7560 (2012 Feb)

   **Publication Date:** February 2012

   **Source:** Medline

   Available in print at [ULHT journal article requests. Complete the online form to obtain articles.](#)

4. **Diagnosis and treatment of peripheral arterial disease in diabetic patients with a foot ulcer. A progress report of the International Working Group on the Diabetic Foot.**


   **Citation:** Diabetes/Metabolism Research Reviews, February 2012, vol./is. 28 Suppl 1/(218-
5. A systematic review of the effectiveness of revascularization of the ulcerated foot in patients with diabetes and peripheral arterial disease.


**Citation:** Diabetes/Metabolism Research Reviews, February 2012, vol./is. 28 Suppl 1/(179-217), 1520-7552;1520-7560 (2012 Feb)

**Publication Date:** February 2012

**Source:** Medline

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**Author(s)** Bakker K, Schaper NC, International Working Group on Diabetic Foot Editorial Board

**Citation:** Diabetes/Metabolism Research Reviews, February 2012, vol./is. 28 Suppl 1/(116-8), 1520-7552;1520-7560 (2012 Feb)

**Publication Date:** February 2012

**Source:** Medline

Available in print at ULHT journal article requests. Complete the online form to obtain articles.

7. Diabetic foot and PAD: the endovascular approach.

**Author(s)** Reekers JA, Lammer J

**Citation:** Diabetes/Metabolism Research Reviews, February 2012, vol./is. 28 Suppl 1/(36-9), 1520-7552;1520-7560 (2012 Feb)

**Publication Date:** February 2012

**Source:** Medline

Available in print at ULHT journal article requests. Complete the online form to obtain articles.

8. Why critical limb ischemia criteria are not applicable to diabetic foot and what the consequences are.

**Author(s)** Jorneskog G

**Citation:** Scandinavian Journal of Surgery: SJS, 2012, vol./is. 101/2(114-8), 1457-4969;1457-4969 (2012)

**Publication Date:** 2012

**Source:** Medline

Available in print at ULHT journal article requests. Complete the online form to obtain articles.

**Author(s)** Cardaioli P, Rigatelli G, Dell’avvocata F, Giordan M, Lisato G, Mollo F, Vassilev D, Nanjundappa A

**Citation:** Journal of Interventional Cardiology, December 2011, vol./is. 24/6(562-8), 0896-4327; 1540-8183 (2011 Dec)

**Publication Date:** December 2011

**Source:** Medline

Available in print at ULHT journal article requests. Complete the online form to obtain articles.

10. Chapter V: Diabetic foot.


**Citation:** European Journal of Vascular & Endovascular Surgery, December 2011, vol./is. 42 Suppl 2/(S60-74), 1078-5884; 1532-2165 (2011 Dec)

**Publication Date:** December 2011

**Source:** Medline

Available in print at ULHT journal article requests. Complete the online form to obtain articles.

11. The heel: Anatomy, blood supply, and the pathophysiology of pressure ulcers

**Author(s)** Cichowitz A., Pan W.R., Ashton M.

**Citation:** Annals of Plastic Surgery, April 2009, vol./is. 62/4(423-429), 0148-7043 (April 2009)

**Publication Date:** April 2009

**Source:** EMBASE

Available in print at ULHT journal article requests. Complete the online form to obtain articles.

12. Heel pressure ulcers on the increase? Epidemiological change or ineffective prevention strategies?

**Author(s)** Meaume, S, Faucher, N

**Citation:** Journal of Tissue Viability, Feb 2008, vol. 17, no. 1, p. 30-33, 0965-206X (February 2008)

**Publication Date:** February 2008

**Source:** BNI

Available in print at ULHT journal article requests. Complete the online form to obtain articles.

13. Improvements in artery occlusion by low-density lipoprotein apheresis in a patient with peripheral arterial disease

**Author(s)** Kamimura M., Matsuo M., Miyahara T., Kimura K., Matsumoto K., Nakaya T., Abe T., Akizawa T.
OBJECTIVES: The aim of the study is to determine factors affecting ischaemic wound healing and role of the angiosome concept in bypass surgery.

DESIGN: Single-centre, retrospective clinical study.

MATERIALS AND METHODS: A total of 249 consecutive critical ischaemic limbs with tissue loss in 228 patients who underwent distal bypasses from 2003 to 2009 were reviewed. A total of 81% of patients were diabetic, and 49% of patients had dialysis-dependent renal disease (end-stage renal disease, ESRD). Distal targets of bypasses were the crural artery (57%) and the pedal artery (43%).

RESULTS: The complete healing of ischaemic wounds was achieved in 211 limbs (84.7%). ESRD (odds ratio (OR) 0.127, p<0.001), diabetes (OR 0.216, p=0.030), Rutherford category 6 (R6) with heel ulcer/gangrene (OR 0.134, p=0.001), R6 except heel (OR 0.336, p=0.025) and low albuminaemia (OR 0.387, p=0.049) were negative predictors of wound healing. Regarding the angiosome, the healing rate in the indirect revascularisation (IR) group was slower than in the direct revascularisation (DR) group, especially in patients with ESRD (p<0.001). However, the healing rates of the DR and IR groups were similar after minimising background differences with propensity score methods (p=0.185).

CONCLUSIONS: In the field of bypass surgery, the angiosome concept seems unimportant, at least in non-ESRD cases. The location and extent of ischaemic wounds as well as co-morbidities may be more relevant than the angiosome in terms of wound healing. Copyright Copyright 2011 European Society for Vascular Surgery. Published by Elsevier Ltd. All rights reserved.

Clegg A. Kring D. Plemmons J. Richbourg L.
[Comparative Study. Journal Article. Multicenter Study]

PURPOSE: Heels are the second most common location for pressure ulcers, and their prevalence is increasing. The purpose of this multisite research project was to describe physical characteristics and medical history of patients experiencing heel pressure ulcers (PUs).

SUBJECTS AND SETTING: The settings for this study were different healthcare settings (acute care, long-term care, and homecare) in North Carolina and Virginia, where member WOC nurses perform consultative services for patients with heel ulcers. Patients older than 18 years with a heel PU were included in the study.

METHODS: A data collection tool was developed by the authors. Participating members of the NC WOC Nurses Group identified 84 participants. Descriptive statistics were used to summarize the data by using proportions, means, standard deviations, and ranges.

RESULTS: Over half of the population had a palpable pedal pulse. Full-thickness PUs were found in 45% of the sample while 19% had suspected deep tissue loss. Subjects tended to be elderly and have low nutritional markers, high body mass index, multiple comorbid conditions such as diabetes mellitus, systemic infection, end-stage renal disease and peripheral arterial disease, as well as low Braden Scale scores.

CONCLUSION: The study revealed important factors specific to heel PUs including advanced age, malnutrition, high body mass index, and multiple comorbid conditions. Further research is needed to further refine our knowledge of our factors associated with an increase likelihood of heel PUs. Our findings also point out the need for a tool specific for the evaluation of heel PU risk.

5. The heel: anatomy, blood supply, and the pathophysiology of pressure ulcers.

Cichowitz A. Pan WR. Ashton M.
There remains much confusion regarding the pathophysiology of pressure ulcers. Data indicate that the prevalence of pressure ulcers is increasing. The heel is unique in structure and well adapted to the task of shock absorption. However, it is often subject to prolonged pressure, which predisposes it to tissue breakdown, with attempts at reconstruction prone to failure. Four dissections were carried out of the heel region, which included removing each heel pad en bloc for histology. Seventeen arterial injection studies, 12 venous studies, and a combined arterial and venous study of the foot were performed. The results were correlated with clinical cases and previous research. The heel was found to be richly vascularized by a subdermal plexus and periosteal plexus with vessels traveling between the 2 within fibrous septa that connect the reticular dermis and periosteum of the calcaneus. These septa effectively create isolated compartments containing relatively avascular fat. A layer of panniculus carnosus muscle was observed in the subcutaneous tissue. It is likely that the metabolically active panniculus carnosus muscle is involved early in the course of pressure ulcers. Extensive pressure damage can be concealed by intact skin. Friction and shear are additional factors important in skin breakdown.

Status
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Jack Brockhoff Reconstructive Plastic Surgery Research Unit, The Royal Melbourne Hospital, Melbourne, Australia. agcich@hotmail.com
Comments
Date Created
20090327
Year of Publication
2009
Link to the Ovid Full Text or citation:
Click here for full text options

10. Heel pressure ulcers and ankle brachial pressure index. [Review] [21 refs]
Graham J.
[Journal Article. Review]
UI: 15719792
There is a substantial body of literature that emphasises the importance of measuring ankle brachial pressure index (ABPI) as part of an holistic assessment for leg ulcers (Scottish Intercollegiate Guideline Network, 1998). However, there is a paucity of research-based evidence to indicate the importance of measuring ABPI as part of an holistic assessment for patients who develop pressure ulcers on their heels. (ABPI is a simple, non-invasive method of identifying arterial insufficiency within a limb.) The importance of identifying the presence of peripheral vascular disease (PVD) in patients who develop pressure ulcers on their heels is discussed, as is the argument for measuring ABPI as part of an holistic assessment for heel ulceration before planning the wound management. [References: 21]
Status
13. The complexities of heel ulcers. [Review] [50 refs]
Hampton S.
[Journal Article. Review]
UI: 12739295
This article examines the complexities of heel ulcers. Treatments now considered outdated and potentially hazardous are discussed as are modern treatments that may reduce the development of heel ulcers. [References: 50]

17. Management of ischemic heel ulceration and gangrene: An evaluation of factors associated with successful healing.
Treiman GS. Oderich GS. Ashrafi A. Schneider PA.
[Journal Article. Multicenter Study]
UI: 10842147
OBJECTIVE: The objective of this study was to determine the effectiveness of treatment of nonhealing heel ulcers and gangrene and to define those variables that are associated with success.
METHODS: A multi-institutional review was undertaken at four university or university-affiliated hospitals of all patients with wounds of the heel and arterial insufficiency, which
was defined as absent pedal pulses and a decreased ankle/brachial index (ABI). Risk factors, hemodynamic parameters, and arteriographic findings were statistically analyzed to determine their effect on wound healing. Life-table analysis was used to assess graft patency and wound healing.

RESULTS: Ninety-one patients (57 men, 34 women) were treated for heel wounds that did not heal for 1 to 12 months (62% of nonhealing wounds, 3 months or longer). The mean preoperative ABI was 0.51, and 31% of wounds were infected. Of the patients, 55% had impaired renal function (Cr > 1.5), with 24% undergoing dialysis, 70% had diabetes, and 64% smoked cigarettes. Treatment was topical wound care for all patients and operative wound debridement in 50%. Infrainguinal bypass was performed for 81 patients, 4 had inflow procedures, 3 had superficial femoral artery percutaneous transluminal angioplasty, and 3 had primary below-knee amputation. Postoperatively, 85% of patients had in-line flow to the foot with at least a single patent vessel, 66% had a pedal pulse, and the mean ABI improved by 0.40, to 0.91. Follow-up ranged from 1 to 60 months (mean, 21 months), and 77 patients (85%) are currently alive. In 66 patients (73%), the wounds healed—all within 6 months (mean, 3 months). For 14 (16%) the wounds had not healed, and 11 patients (11%) underwent below-knee amputation. By life-table analysis, limb salvage was 86% at 3 years. During follow-up, 75 infrainguinal bypasses (91%) remained patent (3 secondarily) and 6 occluded, with primary assisted patency of 87% at 3 years. All wounds in patients with occluded grafts failed to heal. Variables found to be statistically significant in predicting healing included normal renal function (95% healed vs 55% nonhealed, P <.002), a palpable pedal pulse (85% healed vs 42%, P <.0015), a patent posterior tibial artery past the ankle (86% healed vs 57%, P <.02), and the number of patent tibial arteries after bypass to the ankle (P <.0001). Neither the ABI nor the presence of infection (defined as positive tissue cultures or the presence of osteomyelitis), diabetes, or other cardiovascular risk factors influenced the outcome.

CONCLUSIONS: Complete wound healing of ischemic heel ulcers or gangrene may require up to 6 months, and short-term graft patency is of minimal benefit. Successful arterial reconstruction, especially a patent posterior tibial artery after bypass, is effective in treating most heel ulcers or gangrene. Patients with impaired renal function are at increased risk for failure of treatment, but their wounds may successfully heal and they should not be denied revascularization procedures.
Prospective and retrospective analyses of 1,182 consecutive patients undergoing primary total knee arthroplasty (TKA) were performed to determine (1) the incidence of chronic lower extremity ischemia (CLEI); (2) the effect of tourniquet occlusion; and (3) guidelines that will allow TKA to be performed safely. Despite the appropriately advanced age of our patients, the incidence of CLEI was only 2%. All ischemic complications occurred in six patients with CLEI (25%), but none resulted in death or amputation. The ischemic complications consisted of pressure-induced necrosis of toes, heel, or foot, atheroembolism, femoral-popliteal graft occlusion, and asymptomatic popliteal occlusion. Tourniquet compression in the 1,158 patients without CLEI produced no untoward effects. Patients with mild CLEI can have a TKA performed safely with a tourniquet if there is no femoropopliteal calcification. When the ischemia is severe or there is a femoropopliteal aneurysm, arterial reconstruction should precede the TKA. In patients with patent femoropopliteal bypasses or calcification without ischemia, TKA should be performed without a tourniquet. Ischemic pressure necrosis is an additional mechanism of injury.

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Country of Publication

United States

Emtree Heading

adult; aged; artery compression/et [Etiology]; *artery occlusion/et [Etiology]; conference paper; female; human; incidence; *leg ischemia/et [Etiology]; major clinical study; male; necrosis/et [Etiology]; postoperative complication; priority journal; *total knee replacement; tourniquet.

Embase Section Headings

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Year of Publication

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Link to the Ovid Full Text or citation:
35. Healing of ulcers on the feet correlated with distal blood pressure measurements in occlusive arterial disease.

Holstein P., Lassen N.A.


The frequency of healing in subchronic ulcers in 66 feet in 62 patients with arterial occlusive disease was correlated with the systolic digital blood pressure (SDBP) and the systolic ankle blood pressure (SABP), both measured with a strain gauge, and with the skin perfusion pressure on the heel (SPPH) as measured with a photocell. Thirty-two patients (35 feet with ulcerations) had diabetes mellitus. The treatment was conservative. In 42 feet the ulcers healed after an average period of 5.8 months; in 24 feet major amputation became necessary after an average of 4.3 months. The frequency of healing correlated significantly with the three distal blood pressure parameters investigated, the closest correlation being with the SDBP measured at the final examination, i.e. just after healing of the ulcer or just before an inevitable major amputation. Of the 22 cases with SDBP below 20 mmHg only 2 cases (9%) healed. Of the 11 cases with SDBP of 20 to 29 mmHg 7 cases (64%) healed and of the 33 cases with SDBP of 30 mmHg or above all cases (100%) healed. There was no significant difference between the 35 diabetic feet and the 31 non-diabetic feet as regards the healing rates, although infection and peripheral neuropathy were frequent in the diabetic group. The data show that the systolic digital blood pressure is a particularly valuable prognostic parameter.

Institution
Correspondence Address
Country of Publication
Denmark
Emtree Heading
blood pressure; cardiovascular system; diagnosis; *foot ulcer; methodology; *peripheral occlusive artery disease; peripheral vascular system; therapy; *wound healing.
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19810609
Year of Publication
1980
Anatomy and Physiology. The calcaneus, the largest bone of the foot, is relatively wide for its skin surface area, yet has a pointed shape to the bony prominence, with little subcutaneous fat. The heel pad has an average thickness of 18 mm with a mean skin thickness of ... the cup ligament, which is attached to the periosteal membrane of the calcaneus by the ... The heel and malleoli may be ...
Deep Tissue Injury (sDTI) because the skin is intact and there is a blister with underlying discoloration from ...

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MM Baharestani, CR Ratliff - Advances in skin & wound care, 2007 - journals.lww.com

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E McGinnis - 2011 - etheses.whiterose.ac.uk

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**Heel Pressure Ulcers: A to Z**
world.o-wm.com/files/docs/DM-transcription.pdf
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**heel**-lift boot comes with an extra **pad** that can be placed on either side to ... And I would also say the National Pressure Ulcer Advisory Panel has a website NPUAP.org. ... circulation is a round localized purple/black area over the **calcaneus** ...

**Pressure Ulcers: Merck Manual Professional**
world.merckmanuals.com/.../pressure_ulcers/pressure_ulcers.html

**Pressure sore** risk increases as the score decreases: 15–16 = mild risk; 12–14 ... and **heels**, but they can develop elsewhere, including behind the ears when nasal ... Protective **padding** includes pillows or foam wedges placed between knees, ...

**What are pressure ulcers and why do they matter? Federal law**
world.nationalhealing.com/.../Q1-WHP-PressureUlcers-... - United States
File Format: PDF/Adobe Acrobat

Appearance of **heel** pressure .... 2007 NATIONAL PRESSURE ULCER ADVISORY PANEL. Staging .... foam, gel and gel **pads**, .... **calcaneus** is relatively wide ... 

**The complexities of **heel** ulcers - Nursing Standard**
nursingstandard.rcnpublishing.co.uk/.../article-the-complexities-of-he...
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the condition of the patient's **heel pressure ulcer** is either worsening or ... particularly as the **calcaneum** has a small surface area and is a large weight-bearing bony ... **Arterial disease** when the blood supply to the **heels** is poor. Anti-embolic ...

**Diabetic **Heel** Ulcers: A Major Risk Factor for Lower Extremity**
world.o-wm.com/.../diabetic-heel-ulcers-a-major-risk-factor-lower-ext...

3 Sep 2008 – The second highest risk factor, peripheral arterial disease (PAD), is four times more prevalent .... Fourth national pressure ulcer prevalence survey. .... for the treatment of large ulcerations the **heel** and **calcaneal** osteomyelitis.

**Pressure ulcer prevention and management practices : integration of**
world.publications.health.sa.gov.au/cgi/viewcontent.cgi?article...
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**Causes of Pressure Ulcer** Development. 11-12. Sites of Pressure .... For patients undergoing surgery – gel **pad**/high ..... **calcaneus** (**heel** bone) exerting pressure ...