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Venous leg ulcers – Risk factors and assessment tools

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Introduction



- ❖ Serious health problem for thousands of years
- ❖ St. Peregrinus special saint for chronic leg ulcers

Introduction



- ❖ Chronic leg ulcers affect 1-3% of the population^{1,2}
- ❖ Prevalence of leg ulcers increases with age^{1,3,4,5}
- ❖ Many of these ulcers remain unhealed for months or years
- ❖ May result in serious complications
- ❖ Health service resource intensive^{3,6}
- ❖ 3% of total health expenditure⁷
- ❖ 70% of chronic leg ulcers are predominantly venous⁸
- ❖ Many leg ulcers remain unhealed for years or decades; and after healing 30% recur within one year and 78% after two years⁹

Significance

- ❖ No screening tools currently being utilised to assist clinicians to detect leg ulcers at-risk of delayed healing in order to guide appropriate wound management
- ❖ Decisions in relation to alternative interventions when standard care may be insufficient to achieve healing
- ❖ Contribute to the current high level of health service use for leg ulcers and poor healing rates of wound healing¹
- ❖ Would offer an opportunity for clinicians to be able to determine realistic outcomes for their patients
- ❖ Modification of risk factors by appropriate intervention and thus influence healing

Literature Review of risk factors associated with delayed healing

Physiological

❖ Strong Risk Factors

- Lack of high compression
- Larger wound area
- Longer ulcer duration
- Venous abnormalities

❖ Moderate Risk Factors

- Mobility
- Recurrence
- Previous limb surgery
- Age

IJCP THE INTERNATIONAL JOURNAL OF
CLINICAL PRACTICE

Review Article | [Full Access](#)

Risk factors for delayed healing in venous leg ulcers: a review of the literature

C. N. Parker ✉, K. J. Finlayson, P. Shuter, H. E. Edwards

First published: 01 April 2015 | <https://doi.org/10.1111/ijcp.12635> | Cited by: 12

Economic

- ❖ Low socio-economic status

Social

- ❖ Social Support



Psychological

- ❖ Anxiety / Stress
- ❖ Depression

Research Study on risk factors associated with delayed healing and recurrence

- ❖ Delayed Healing - Analysed a large database of information collected from patients with venous leg ulcers to identify significant relationships between physiological or psychosocial factors and delayed healing after 24 weeks of treatment
- ❖ Recurrence - Analysed a large database of information collected from patients with healed venous leg ulcers to identify significant relationships between physiological or psychosocial factors and recurrence up to 12 months

Methods



- ❖ Delayed healing - Secondary analysis was conducted on data from a sample of 366 patients from outpatient clinics and community nursing services

Recurrence - Secondary analysis was conducted on data from a sample of 250 patients from outpatient clinics and community nursing services

- ❖ Medical, clinical, venous, ulcer, healing, health and psychosocial data collected from this sample prospectively in previous studies

Methods

Delayed Healing

❖ Inclusion Criteria

- Ulcers of primarily venous aetiology
- ABPI ≥ 0.8 and < 1.3

❖ Exclusion Criteria

- Patients without a minimum of 4 weeks of data
- Cognitive impairment



Methods

Recurrence

❖ Inclusion Criteria

- Healed leg ulcer of primarily venous aetiology (defined by full epithelialisation maintained for at least 2 weeks)
- ABPI ≥ 0.8 and < 1.3

❖ Exclusion Criteria

- Cognitive impairment

❖ QUT Human Ethics Approval Number 11000001368

Results – Independent predictors for delayed healing

After adjustment for all variables in the model

- ❖ Lives alone (RR 1.91)
- ❖ ↑ PUSH (>10) (RR 3.13)
- ❖ Compression (<30mmHg) (RR 2.81)
- ❖ Area reduction <25% at two weeks (RR 4.22)

Remained significantly associated with non-healing of a venous leg ulcer at 24 weeks.

Results – Independent predictors for recurrence

After adjustment for all variables in the model

- ❖ Age
- ❖ Previous DVT
- ❖ Duration of previous ulcer
- ❖ History of previous leg ulcers (more than 1)
- ❖ Elevating legs for 30min/day
- ❖ Walking for at least 3 hours/day
- ❖ General Self-efficacy scale

Remained significantly associated with recurrence of a venous leg ulcer within 12 months.

Development and retrospective validation of new venous leg ulcer risk assessment tools

- ❖ Develop risk assessment tools for venous leg ulcers based on the study results, the evidence from the literature and advice from an expert wound advisory group
- ❖ Validate retrospectively the risk assessment tool for delayed healing and recurrence of venous leg ulcers





Methods

- ❖ Development of Risk Assessment Tool for delayed healing and recurrence of venous leg ulcers
 - Wound Expert Advisory Group (national & international experts)
 - Evidence from the literature
 - Regression co-efficients

- ❖ Validation of the tool on the developmental database
 - Receiver Operating Characteristic (ROC)
 - Area under the ROC curve (AUC)

Results – Development of risk assessment tools

Predicting the Likelihood of Delayed Venous Leg Ulcer Healing and Recurrence: Development and Reliability Testing of Risk Assessment Tools

October 2017 · Ostomy/wound management 63(10):16-33

DOI: 10.25270/owm.2017.1633

| Risk Assessment Tool Venous Leg Ulcers | | Participant Code No. Date: | |
|---|--------------|-------------------------------|---------|
| At First Visit or Assessment | | | |
| Health, medical & social history | | | Score |
| 1. Age (years) | <70 = 0 | 70 -79 = 1 | ≥80 = 2 |
| 2. Ulcer Duration (weeks) | <24 = 0 | 24 – 51 = 1 | ≥52 = 2 |
| 3. History of previous Deep Vein Thrombosis in study ulcer leg | No = 0 | Unknown = 0 | Yes = 1 |
| 4. Client lives alone? | No = 0 | Yes = 2 | |
| Sub TOTAL | | | |
| On clinical examination | | | |
| 5. Uses an aid to mobilise? | No = 0 | Yes = 1 | |
| 6. Wound bed mainly slough and/or necrotic tissue? | No = 0 | Yes = 1 | |
| 7. Ulcer area ≥5cm ² ? | No = 0 | Yes = 3 | |
| 8. Treatment at present time with no, low or moderate level compression systems (<30mmHg) | No = 0 | Yes = 3 | |
| Sub TOTAL | | | |
| TOTAL SCORE O/A = | | | |
| ≥10 = High Risk of Non-Healing; 4 – 9 = Moderate Risk; < 4 = Low Risk | | | |
| 2 weeks after admission or first assessment | | | |
| 9. 25% ulcer area reduction in 2 weeks | Achieved = 0 | Not achieved = 6 | |
| 10. 2cm or more decrease in calf circumference in 2 weeks | Achieved = 0 | Not achieved = 4 | |
| TOTAL SCORE at 2 weeks after initial assessment = | | | |
| ≥17 = High Risk of Non-Healing; 10 - 16 = Moderate Risk; ≤9 = Low Risk | | | |

| Risk Assessment Tool Venous Leg Ulcer Recurrence | | Date: | |
|--|---------|-------------|---------|
| At First Visit or Assessment (soon after healing) | | | |
| Health, medical & social history | | | Score |
| 1. History of previous leg ulcers in this leg? | No = 0 | Unknown = 0 | Yes = 4 |
| 2. History of Deep Vein Thrombosis (DVT) in this leg? | No = 0 | Unknown = 0 | Yes = 1 |
| 3. Previous Ulcer Duration (weeks) | <52 = 0 | ≥52 = 1 | |
| 4. BMI <22? | No = 0 | Yes = 2 | |
| 5. Client lives alone? | No = 0 | Yes = 1 | |
| Sub TOTAL | | | |
| Preventive activities | | | |
| 6. Is moving around on feet for at least 3 hours/day? (e.g. walking, doing housework, shopping) | No = 2 | Yes = 0 | |
| 7. Elevating legs for 30 minutes/day or more? (above level of heart) | No = 3 | Yes = 0 | |
| 8. Wearing compression hosiery Class 2 or above for at least 5 days/week? | No = 2 | Yes = 0 | |
| Sub TOTAL | | | |
| TOTAL SCORE = | | | |

Results – Retrospective Validation

Delayed Healing

Baseline Score

- AUC 0.74 (95% CI, 0.68-0.80)
p<0.001

❖ Two week score

- AUC 0.84 (95% CI, 0.73-0.93)
p<0.001

❖ Total Risk Assessment Score

- AUC 0.80 (95% CI, 0.68-0.93) p<0.001



IWJ International Wound Journal

ORIGINAL ARTICLE | [Full Access](#)

Predicting delayed healing: The diagnostic accuracy of a venous leg ulcer risk assessment tool

Helen E Edwards, Christina N Parker ✉, Charne Miller, Michelle Gibb, Suzanne Kapp, Rajna Ogrin, Jacinta Anderson, Kerrie Coleman, Dianne Smith, Kathleen J Finlayson

Results – Prospective Validation

Delayed Healing

Baseline Score

- AUC 0.69 (95% CI, 0.60-0.77)
p<0.001

❖ Two week score

- AUC 0.74 (95% CI, 0.59-0.79)
p=0.001

❖ Total Risk Assessment Score

- AUC 0.75 (95% CI, 0.68-0.82) p<0.001



Results – Prospective Validation

| | N, % not healed | N, % healed |
|----------------------|------------------------|--------------------|
| <9 (low risk) | 3 (5.7%) | 50 (94.3%) |
| 9-16 (moderate risk) | 30 (29.4%) | 72 (70.6%) |
| >=17 (high risk) | 24 (63.2%) | 14 (36.8%) |

Results – Retrospective Validation

Recurrence

- ❖ Total Risk Assessment Score
 - AUC 0.83 (95% CI, 0.76-0.90) $p < 0.001$



IWJ International Wound Journal

ORIGINAL ARTICLE

Predicting the likelihood of venous leg ulcer recurrence: The diagnostic accuracy of a newly developed risk assessment tool

Kathleen J. Finlayson✉, Christina N. Parker, Charne Miller, Michelle Gibb, Suzanne Kapp, Rajna Ogrin, Jacinta Anderson, Kerrie Coleman, Dianne Smith, Helen E. Edwards

Results – Prospective Validation

- ❖ Total Risk Assessment Score
 - AUC 0.73 (95% CI, 0.64-0.82) $p < 0.001$

Results – Prospective Validation

| | N, % not recurred | N, % recurred |
|----------------------|--------------------------|----------------------|
| <6 (low risk) | 28 (84.8%) | 5 (15.2%) |
| 6-10 (moderate risk) | 27 (39.1%) | 42 (60.9%) |
| >=11 (high risk) | 5 (33.3%) | 10 (66.7%) |

Inter-rater reliability testing Methods

❖ Inter-rater reliability

- 30 venous leg ulcer patients and three nurses (calculated using a minimum of .80 correlation, 85% power)
- Intraclass correlation (ICC)

Results

| Items | ICC | CI | p | Strength of agreement |
|--|-------|-------------|--------|-----------------------|
| Age (years) | 0.993 | 0.986-0.997 | <0.001 | Very good |
| Ulcer duration (weeks) | 0.860 | 0.705-0.957 | <0.001 | Very good |
| History of previous deep vein thrombosis in study ulcer leg | 0.887 | 0.763-0.952 | <0.001 | Very good |
| Poor social support – lives alone? | 0.896 | 0.781-0.956 | <0.001 | Very good |
| Clinical examination | | | | |
| Uses an aid to mobilise? | 0.897 | 0.784-0.956 | <0.001 | Very good |
| Wound bed mainly slough and/or necrotic tissue? | 0.932 | 0.856-0.971 | <0.001 | Very good |
| Ulcer area $\geq 5\text{cm}^2$? | 0.940 | 0.874-0.974 | <0.001 | Very good |
| Treatment at present time with no, low or moderate level compression systems (<30mmHg) | 0.611 | 0.180-0.834 | 0.007 | Good |
| Baseline Score | 0.944 | 0.883-0.976 | <0.001 | Very good |
| Two weeks after first assessment | | | | |
| 25% ulcer area reduction in 2 weeks | 0.802 | 0.476-0.938 | 0.001 | Good |
| 2cm or more decrease in calf circumference in 2 weeks | 0.733 | 0.293-0.916 | 0.004 | Good |
| Two Week Score | 0.554 | -1.82-0.860 | 0.052 | Fair |
| Total risk assessment score (Baseline Score + Two Week Score) | 0.873 | 0.663-0.960 | <0.001 | Very good |

Results

| Items | ICC | CI | p | Strength of agreement |
|--|------|------------|--------|-----------------------|
| Health, medical, social history | | | | |
| History of previous leg ulcers in this leg | 0.87 | 0.74-0.94 | <0.001 | Very good |
| History of previous deep vein thrombosis in study leg | 0.89 | 0.78-0.95 | <0.001 | Very good |
| Previous ulcer duration | 0.87 | 0.73-0.94 | <0.001 | Very good |
| BMI<22 | 0.32 | -0.39-0.70 | 0.142 | Poor |
| Lives alone | 0.81 | 0.62-0.92 | <0.001 | Very good |
| Subtotal | 0.86 | 0.72-0.94 | <0.001 | Very good |
| Prevention | | | | |
| Patient moving around on feet for at least 3 hours/day | 0.79 | 0.58-0.91 | <0.001 | Good |
| Patient elevating legs for 30mins/day or more | 0.91 | 0.81-0.96 | <0.001 | Very good |
| Patient wearing compression hosiery class 2 or above for at least 5 days/week | 0.73 | 0.45-0.88 | <0.001 | Good |
| Subtotal | 0.85 | 0.70-0.93 | <0.001 | Very Good |
| Total risk assessment score | 0.88 | 0.75-0.94 | <0.001 | Very Good |

Health Professional Feedback

74% found no difficulty in answering the questions

55% took 1-3 minutes to complete the tool



Where to from here

- ❖ Further testing has reduced the number of items in the risk assessment tool
- ❖ The risk assessment tool has been developed into an IT application

<http://www.vlur-risk-tools.org.au/>



International Validation

- Patients who had consented to prospective validation study in two international populations

1. Mid York NHS Trust, UK

2. Center for Wound Management,
Hospital Melk, Austria



Results - Patient characteristics

- 57 patients
- Age Mean 73 (SD 11.14)
- Ulcer Duration Median 36 weeks (Range 3-1560)
- Ulcer Area Median 15cm² (Range 0.5 – 270)
- Wound not healed at 24 weeks n=29 (53.7%)

International Validation Results

The model's discrimination and goodness-of-fit in predicting delayed healing of venous leg ulcers at 24 weeks:

Baseline score: ROC 0.66 (95% CI, 0.51-0.80) $p=0.05$

Total risk assessment score: ROC 0.61 (95% CI, 0.46-0.76)

$p=0.16$

| | |
|-----------------------|-----------------------|
| Low risk (29.8%) | 52.9% remain unhealed |
| Moderate risk (49.1%) | 46.2% remain unhealed |
| High risk (21.1%) | 72.7% remain unhealed |



wound clinics based in Southland in the towns of
Invercargill and Gore



New Zealand sites coming



Emil Schmidt for Otago (WCNS Otago)

Implications for practice



- ❖ The identification of risk factors for delayed healing would offer an opportunity for clinicians to:
 - Be able to determine realistic outcomes for their patients
 - Prompt and guide early referrals and tailored interventions for those identified at high risk in the first 2 weeks of treatment
- ❖ Improved healing rates for patients with venous leg ulcers, leading to cost savings for the consumers and health care system

Thank You



Princess Alexandra Hospital
Health Service District



Royal Brisbane & Women's Hospital
Health Service District

- ❖ To all the patients and staff of the Spiritus (Anglicare) nursing service, Royal Brisbane and Women's Hospital, Princess Alexandra Hospital, Wound Healing Community Outreach Service at QUT, Bluecare (Sunshine Coast) community service and Royal District and Nursing service in Victoria

