

Schiller Saal

14.00–15.30

## V 3

***Growth Factors: From Bench to Bedside I*****Wachstumsfaktoren: Von der Theorie zur Praxis I**

## V 3-1

***Activin: a crucial regulator of skin-morphogenesis and wound repair****S. Werner*

Prof. Dr. Sabine Werner, ETA Hoenggerberg, HPM D42, Institut für Zellbiologie, 8093 Zürich, E-Mail: [sabine.werner@cell.biol.ethz.ch](mailto:sabine.werner@cell.biol.ethz.ch)

The transforming growth factor  $\beta$  family member activin is a potent regulator of skin morphogenesis and wound repair. Thus, transgenic mice overexpressing activin in the epidermis displayed epidermal hyperthickening and dermal fibrosis in non-wounded skin and enhanced granulation tissue formation after wounding. However, they also showed enhanced scarring. By contrast, mice overexpressing the soluble activin antagonist follistatin in the epidermis suffered from delayed wound healing, but the quality of the healed wound was improved. These results demonstrate that the levels of bioactive activin in a skin wound determine both the speed and the quality of healing. To determine if activin exerts these effects via keratinocytes or stromal cells or both, we generated and characterized transgenic mice, which express a dominant-negative activin receptor in the epidermis. These studies revealed that activin affects both stromal cells and keratinocytes in normal and wounded skin, and that the effect on keratinocytes is dose-dependent *in vivo*. To gain insight into the mechanisms of activin action in keratinocytes, we searched for activin target genes in this cell type. One of the identified targets encodes the Id1 protein, and our studies demonstrate a novel role of this transcriptional regulator in epidermal homeostasis in normal and wounded skin.

## V 3-2

***PDGF in tissue repair and homeostasis****K. Rubin*

Prof. Kristofer Rubin, Department of Medical Biochemistry and Microbiology, Uppsala University, BMC, Box 582, SE-751 23 Uppsala, Sweden, Email: [Kristofer.Rubin@imbim.uu.se](mailto:Kristofer.Rubin@imbim.uu.se)

Connective tissue cells exert control of interstitial fluid volume by a process related to fibroblast-mediated compaction of three-dimensional collagen lattices *in vitro*. It has become evident that connective tissue cells actively control the interstitial fluid pressure (IFP) and thereby fluid flux over the blood vessel wall. A rapid lowering of IFP plays a fundamental role in the development of edema in burns and during inflammatory reactions. Integrin-mediated contacts provide a common pathway by which cells can control IFP and the activity of integrins. Inflammatory swelling can be modulated by PDGF thereby suggesting that connective tissue cells can serve as targets for pharmacological intervention aimed to control edema. Furthermore, these new concepts in interstitial physiology and means to regulate IFP may be of importance for drug delivery into carcinoma, where a pathologically elevated IFP seems to limit the uptake of therapeutic drugs.

## V 3-3

**The case of TGF***M. W. J. Ferguson*

Professor Mark W J Ferguson, Faculty of Life Sciences, University of Manchester, 3.239 Stopford Building, Oxford Road, Manchester, M13 9PT, UK

The Transforming Growth Factor Beta family of molecules are important in the wound healing response. Exogenous addition of TGF $\beta$ 1 and TGF $\beta$ 2 markedly accelerates healing. Neutralisation of TGF $\beta$ 1 and TGF $\beta$ 2 markedly improves scarring. Modulation of the Smad pathway involved in TGF $\beta$  signalling also either accelerates healing and or reduces scarring. TGF $\beta$ 3 is in clinical trial as a scar improving / reducing pharmaceutical agent.

Hegel Saal

14.00–15.30

## V 4

# *Bridging the Gap: Infection* Brücken bauen: Infektion

### V 4-1

#### *Clinical research – what's the evidence?*

*D. Leaper*

David Leaper MD ChM FRCS FACS, Emeritus Professor of Surgery,  
Wound Healing Research Unit, Cardiff Medicentre, Cardiff CF14 4UJ, UK

The definition of infection is, perhaps surprisingly, sometimes difficult. This is particularly the case in chronic open wounds healing by secondary intention, although the classical Celsian signs of calor, rubor, dolor et tumor (with function laesa) are easier to define in sutured wounds healing by first intention. Reliable, reproducible and consistent definition of infection is critical in clinical research which aims to bridge the gap between the precision of the laboratory report and clinical decision making in care of problem wounds. Equally, despite all the progress around the recognition that infection is probably the largest single factor which delays healing in wounds, there is still no consensus about which antimicrobial clinical intervention is indicated, at which time, and for how long, in these wounds.

Infection of wounds has become a prominent feature reported in the media. Patients and politicians have responded to the inexorable rise in resistant organisms, particularly Methicillin Resistant *Staphylococcus aureus* (MRSA), in problem wounds which are not confined to secondary care but also found in the community. Current clinical research is failing to halt the progress of resistance and the outcomes of improved hospital hygiene and the clean your hands campaign are awaited with interest. In problem wounds there is often an underlying disease process, which needs to be addressed, that allows organisms to become opportunistic or virulent pathogens. This may be the immunosuppression of diabetes, drug therapy or cancer; or ischaemia, related to poor systemic perfusion or localised progressive atherosclerosis. With this has come a bewildering, controversial new set of definitions, including bacterial burden and critical colonisation, which are considered to precede frank infection and delayed healing. Evaluation of novel ideas of antimicrobial use becomes more difficult but increasingly needed to avoid the difficulties of bacterial resistance and emergence, allergy, and local and systemic toxicity.

The control of infection is not all doom and gloom. The use of antibiotic prophylaxis in surgery is supported by good evidence but not in clean wound surgery. There is increasing high quality clinical evidence that close attention to oxygenation, perfusion (and nutrition), avoidance of hypothermia, and strict control of

hyperglycaemia can also achieve infection control without the need for antibiotics. The introduction of new topical antimicrobials and methods to reduce wound surface contamination is exciting but marred by poor quality Randomised Controlled Trials (RCTs), inadequately powered because of cost and the time required for completion.

### V 4-2

#### *Putting evidence into practice*

*E. Pina*

Elaine Pina, Clinical Microbiologist, Grupo Associativo de Investigação em Feridas, Lisboa, Portugal

In the last decade substantive basic science and clinical research have been directed to clarification of the mechanisms of wound healing, microbiological diagnosis of infection, signs and symptoms relevant to clinical diagnosis and efficacy of local and systemic interventions to treat wound infections. It is however difficult for health care professionals to appraise, synthesise and integrate the evidence into day-to-day practice. There is an evident lack of standardization in the definition of problems, interventions and outcomes. For the microbiological diagnosis some studies highlight quantitative aspects whereas others give relevance to particular species or groups of organisms. Studies are difficult to compare due to the use of different methods of specimen collection, exhaustivity of analysis in the laboratory, type of patients and type of wounds. Very often laboratories do not have the capabilities to process specimens according to the methodologies proposed. It is increasingly evident that the significance of microbial burden varies according to the type of wound. In addition, definitions of infection and different criteria have been proposed but most clinical studies have a limited scope making it difficult to generalize the evidence obtained. Finally, therapeutic indications for local management are sometimes controversial or difficult to put into practice. It is therefore necessary that professionals involved in wound management have the skills and resources to obtain, interpret and integrate the evidence with patient and clinical observations in their practice. Interdisciplinary communication is essential as is the need to devise interventions that make the evidence available and accessible to all professionals and to link problems with interventions and outcomes.

## V 4-3

***From the laboratory to the patient:  
the role of the microbiology laboratory*****P. Bowler****Phil Bowler, Director, Anti-Infectives & Microbiology, Wound Therapeutics  
Global Development Centre, ConvaTec, Flintshire, UK.**

The microbiology of a wound is often complex, involving a variety of aerobic and anaerobic micro-organisms. Since these organisms often interact via communication strategies within a wound environment, it is often difficult to determine the causative organism(s) in infected, polymicrobial wounds. Consequently, debate continues regarding the need to sample a wound, when to sample a wound and how to sample a wound.

When a wound sample is sent to the microbiology laboratory (e. g. superficial swab, devitalised debris or biopsy), analysis is likely to reveal a number of organisms that may include skin staphylococci, coliforms and anaerobes (of oral and gastrointestinal origin), and other potential pathogens such as MRSA and *Pseudomonas aeruginosa*. The laboratory can then perform further tests on selected organisms to determine their antimicrobi-

al susceptibility and this may help the wound care practitioner in selecting appropriate treatment. However, the quality and relevance of the output provided by the microbiologist is largely dependent on the quality of the clinical information received from the wound care practitioner that accompanies the wound sample. A wound sample that is sent to the laboratory must be accompanied by information on the clinical presentation of the wound (site, type, clinical signs of infection, colour, exudate, odour, existing antimicrobial therapy etc) as this will provide guidance on the types of tests to perform and the types of organisms that are likely to be present and involved with infection.

Microorganisms present a major challenge to wound healing, primarily due to their ability to interact with each other and subsequently increase their net pathogenic effect. Similarly, continual dialogue and exchange of information between the microbiologist and the wound care practitioner is essential to maintaining a competitive advantage over wound micro-organisms and providing the best opportunity for a wound to heal.

**References**

1. **Bowler PG, Duerden BI, Armstrong DG.** Wound Microbiology and Associated Approaches to Wound Management. *Clin. Micro. Rev.* 2001, 14:244–269.

## V 25

***Clinical Novelties***  
**Klinische Neuheiten**

## V 25-1

***The development of a reproducible in vitro  
model of a chronic wound biofilm*****K. Hill<sup>1</sup>, S. Malic<sup>1</sup>, R. Edwards<sup>2</sup>, T. Rennison<sup>3</sup>,  
P. Price<sup>4</sup>, K. Harding<sup>4</sup>, D. Thomas<sup>1</sup>**<sup>1</sup>Wound Biology Group, Dental School, Cardiff University, Cardiff, United Kingdom,<sup>2</sup>Department of Surgery, Wales College of Medicine, Cardiff, United Kingdom,<sup>3</sup>Ethicon Wound Care, Gargrave, Yorkshire, United Kingdom,<sup>4</sup>Wound Healing Research Unit, Wales College of Medicine, Cardiff University, Cardiff, United Kingdom

**Aim:** Bacteria play a pivotal role in impaired wound healing and remodelling in chronic wounds. Recently much attention has

been focused on the ability of bacteria within the chronic wounds to form and exist within a potential biofilm. Such biofilms may play an important role in the ability of wounds to resist antimicrobial and antibiotic treatments. In this study we sought to develop a reliable in vitro model of the chronic wound biofilm using the most commonly encountered bacterial species (n = 6) derived from chronic wounds in a constant-depth film fermentor (CDFF). This system enables multiple discrete, reproducible biofilms of uniform depth to be generated at any one time.

**Methods:** Bacterial species were selected from a prospective study of 70 patients with chronic venous leg ulcers and included those most frequently encountered: *Pseudomonas*, *Staphylococcus*, *Micrococcus* and *Streptococcus* spp. as well as a range of strict anaerobes. To demonstrate the ability of bacteria from wounds to take the first step in biofilm formation, ten isolates of each group were tested for their ability to coaggregate

both intra- and intergenerically. Although not coaggregating at such high levels as specific members of the oral microbiota, all wound isolates were capable of coaggregation with at least one other wound isolate. Isolates with the best coaggregating ability were subsequently used to produce a six member mixed culture biofilm in the CDFF.

**Results:** *Staphylococcus aureus* and *Pseudomonas aeruginosa* predominated in this wound model in the same way as in chronic leg wounds in vivo. Bacterial counts of *Streptococcus oralis* and *Bacteroides fragilis* hovered around the levels of detection, whilst those of *Peptostreptococcus anaerobius* and *Micrococcus luteus* consistently remained below the levels of detection. Establishment of the chronic wound biofilm was confirmed by scanning electron microscopy and characterised by confocal laser-scanning microscopy.

**Conclusions:** Using the CDFF we have been able to produce reproducible biofilms which may be maintained over a period of up to 4 weeks in vitro. This model of the chronic wound biofilm is being used to test the effectiveness of the antibiotic, antimicrobial and biocide agents currently employed in the treatment of chronic leg wounds.

## V 25-2

### ***Ischemia and prolonged reperfusion prior to anastomotic construction do not reduce wound strength in the rat intestine***

**A. E. Posma, R. P. Bleichrodt, H. van Goor, T. Hendriks**

Radboud University Nijmegen Medical Center, Department of Surgery, Nijmegen, Netherlands

**Introduction:** Anastomotic dehiscence is a most serious complication in bowel surgery, causing substantial morbidity and mortality. Under certain conditions, transient intestinal ischemia can reduce anastomotic strength. Preliminary findings suggest that prolonged reperfusion time, prior to anastomotic construction, may result in massively reduced wound strength. If true, such a phenomenon could have significant clinical implications. The objective of this study is to establish if wound strength indeed decreases with increasing length of the time interval between an ischemic period and construction of an anastomosis.

**Methods:** In male Wistar rats, ischemia was induced by clamping the superior mesenteric artery (SMA) immediately distal to its origin for 40 min. In control groups, the SMA was exposed but not clamped. Resection and anastomosis in both ileum and colon (the latter not having been ischemic) were performed immediately after releasing the clamps, or after a reperfusion interval of 90 min or 24 h. Both the anastomotic bursting pressure and breaking strength were measured on the 3rd or 5th day after anastomotic construction, together with wound hydroxyproline levels. All groups consisted of 10 rats each.

**Results:** Overall mortality was 9% and equally divided between all groups. Neither bursting pressure nor breaking strength, either in ileum or in colon, as measured on the 5th day after anastomotic construction, did change significantly if the

time between the end of ischemia and anastomotic construction was increased. Similar values were obtained in all experimental and corresponding control groups. In the group where anastomoses were constructed after 24 h reperfusion, mechanical strength increased significantly from day 3 to day 5 and at the same rate as in the control group. No significant differences in anastomotic hydroxyproline levels were found between experimental and control groups analyzed at day 5.

**Conclusions:** A prolonged interval between intestinal ischemia and anastomotic construction does not affect the development of early wound strength. Therefore, delayed anastomosis after transient intestinal ischemia is not likely to increase the risk of anastomotic dehiscence. This is important for the timing of elective bowel surgery after mesenteric ischemia.

## V 25-3

### ***A comparison of warming with antibiotics or both on the rate of surgical site infection after breast surgery***

**A. Melling, S. Kumar, D. Whetter, L. Baker, D. Leaper**

University Hospital of North Tees, Professorial Unit of Surgery, Stockton-on-Tees, United Kingdom

**Background:** The rate of surgical site infection following breast surgery can be high and the benefits of prophylactic antibiotics remain unclear. In a previous randomised controlled trial it was found that warming the potential incision site prior to breast surgery could significantly reduce the rate of infection when compared to standard treatment (antibiotics not standardised). In this study the impact of warming is compared directly with antibiotics and their effect on the rate of surgical site infection is studied.

**Methods:** 300 patients having non-implant breast surgery are being recruited and randomised to one of three treatment groups. The first group receive a standardised antibiotic at the time of induction. The second group receive a minimum of thirty minutes preoperative warming to the potential incision site and two hours of warming to the wound after surgery. Warmth is provided by an exothermic warming pad. The third group receive both warming and antibiotics. Blinded wound reviews by a trained observer are performed at two and four weeks.

**Results:** An interim analysis of the first 152 patients has been performed. No patients have been lost to follow up. The mean age of the sample was 59 years old and mean body mass index was 28. Surgery lasted on average 65 minutes and 55 % of the sample had a mastectomy. 55 patients received antibiotics alone, 50 received warming alone and 47 patients received both warming and antibiotics. Nine infections have been diagnosed in the standard group (16.4 %), six in the warmed group (12 %) and four in the combined group (8.5 %).

**Conclusions:** The rate of infection after breast surgery in this study is high but reflects the intense patient follow up. Infection rates are highest in the antibiotic alone group and lowest in the group that received both treatments which may suggest that warming enhances the effect of antibiotic prophylaxis in breast surgery.

## V 25-4

**High-fat diet delays rat cutaneous wound healing**

A. P. Nascimento, A. Costa

State University of Rio de Janeiro, Histology and Embryology, Rio de Janeiro, Brazil.

The aim of this study was to examine the effects of high-fat diet on excisional cutaneous wound healing in rat. Male Wistar rat were fed high-fat diet (30 %) (diet group, n = 10) or standard rat chow (6 % of fat) (control group, n = 5) during 18 weeks ad libitum. At the 15th week of diet, a full-thickness excisional wound was done in the back of each rat. The animals were euthanized 21 days after wounding. Wound tracings were made to assess wound contraction and reepithelialization. During the experimental period animals were weighted, and nasoanal length, blood pressure and glucose were measured. After euthanasia, the retroperitoneal fat mass was removed and weighted, the lesion and adjacent normal skin were formol-fixed and paraffin-embedded. Sections were stained with hematoxylin-eosin or Sirius red, or immunostained for  $\alpha$ -smooth muscle actin. At the 15th week, the body mass and obesity index of Lee were higher in the diet group ( $p < 0.001$ ). There was no difference in blood pressure or glucose between diet and control groups. The retroperitoneal fat mass in diet group was heavier than control group ( $p < 0.0001$ ). The diet group presented delayed contraction and re-epithelialization 14 ( $p = 0.02$  and  $p < 0.0001$ , respectively) and 21 days after wounding ( $p = 0.002$  and  $p = 0.03$ , respectively). In diet group presented decrease in collagen fibers density, morphological changes in fibroblasts and delay in myofibroblastic differentiation. Our study demonstrated that high-fat diet affects cutaneous wound repair by decreasing wound contraction and re-epithelialization and by delaying granulation tissue formation.

## V 25-5

**Does warming effect wound healing profiles following breast surgery?**

E. Baker, S. Kumar, D. Whetter, A. Melling, D. Leaper

Professorial Unit of Surgery, University Hospital of North Tees, Stockton on Tees, United Kingdom

**Introduction:** Breast surgery following the diagnosis of cancer is a devastating life event for any patient and the high risk of wound healing complications can only increase trauma and suffering. Tissue repair is multi-factorial, but adequate blood flow and oxygenation are required for successful healing and avoidance of infection. The application of warmth can improve wound blood flow and healing and increase resistance to infection. The study aims to compare the effects of patient warming directly with the use of antibiotics on the rate of wound infection after breast surgery and to investigate the effects of warming on the wound healing properties of acute wound fluid.

**Methods:** Patients undergoing breast surgery were randomised into one of three groups; i) prophylactic antibiotics, ii) pre- and post-operative warming or iii) antibiotics and warming. Daily drain fluid samples were collected from 23 patients from post-operative day (POD) 1 until drain removal. Samples were analysed by ELISA for profiles of biological factors (IL-6, bFGF, EGF, VEGF, PDGF and TGF $\beta$ 1; (pg/ml); MMP-3, TIMP-1 (ng/ml)).

**Results:** Differential levels of biological factors were observed on each POD; e.g. POD-1, EGF 100, median (18-301pg/ml, range); PDGF, 963(17-4,702) and IL-6 35,210(4,675-102,470). Significant positive (MMP-3, TIMP-1) and negative (EGF, bFGF, PDGF, IL-6) correlations were observed with POD: e.g. TIMP-1; POD-1, 1,023(99-3,270ng/ml); POD-2, 2,387(1,023-5,066); POD-3, 3,813(3,471-4,996); bFGF; POD-1, 503(228-1,575); POD-2, 135(22-526); POD-3, 57(39-123). Similar profiles were observed in all three groups for these factors. However, differential daily profiles were observed for TGF $\beta$ 1 and VEGF between groups. Correlations (positive and negative) also existed between biological factors e.g. EGF and PDGF levels on each POD. Differences were observed between levels of certain factors with length of operation, and the level of axillary clearance. Three patients developed post-operative wound infections (one in each group).

**Conclusions:** Differential levels of each biological factor were observed on each POD and this may reflect their individual involvement at each stage of wound healing. With an increased sample number significant trends may also emerge with the study group and clinical outcome.

## V 25-6

**Definition of efficiency in vacuum therapy – redon vs. VAC<sup>®</sup>-therapy****Effizienzbestimmung Vakuumtherapie – Redon vs. VAC<sup>®</sup>-Therapie**S. Stremitzer<sup>1</sup>, A. Budzanowski<sup>1</sup>, T. Hölzenbein<sup>1</sup>, C. Ludwig<sup>2</sup>, T. Wild<sup>1</sup><sup>1</sup>Medizinische Universität Wien, Wien, Austria, <sup>2</sup>Haus der Barmherzigkeit, Wien, Austria

**Introduction:** Vacuum sealing in wound treatment was already introduced in the 1940s. Since then, various systems were commercially available for this purpose. Redon-drains for suction of wound exudate are still used in some wards for vacuum sealing. In doing so, pressure levels of up to 900 mm Hg are obtained. VAC<sup>®</sup>-therapy on the other hand is controlled by computer and works at 125 mm Hg. The aim of this study was to investigate the efficiency of these 2 methods in wound healing.

**Methods:** 2 groups with 10 patients each were created with patients either treated with Redon-drains or a VAC<sup>®</sup>-system in this controlled randomized trial. Progression of wound healing was analyzed and documented with the WHAT-software (Wound Healing Analyzing Tool). Patients with decubitus ulcers grade III-IV were included in this study. Primary parameters of investigation were the absolute and relative fraction of granulation tissue, fibrin and

necrotic tissue. Secondary parameters were the wound area, the circumference and the vertical and horizontal diameter of the ulcer. Additional parameters of investigation were the numbers of wound dressing changes and the expenditure of time for the 2 systems. A time period of 10 days was defined for the investigation.

*Results:* Already after 5 patients in the Redon-group and 6 patients in the VAC<sup>®</sup>-group the study was canceled, due to the huge differences between the groups and in regard to the enormous care effort in the Redon-group. The wound analyses showed a progression of the granulation tissue of 52 % in the VAC<sup>®</sup>-group, while granulation tissue completely disappeared in the Redon-group. The wound field showed almost 100 % of fibrin and colliquation necrosis. While the VAC<sup>®</sup>-system alarmed in case of leakage of the vacuum sealing, the Redon-system had to be controlled every 2 hours. A new system had to be applied when it was untight. Redon-flask changes had to be performed up to 10 times a day. The VAC<sup>®</sup>-group was superior to the Redon-group concerning the reduction of care effort (VAC<sup>®</sup>: 0.5 dressing changes/d, Redon: 3 changes/d ( $p < 0.05$ )).

*Discussion:* The results show that VAC<sup>®</sup>-therapy is superior to the Redon-therapy, regarding the progression of wound healing and the care effort. Leakage of the Redon-system, suction of stool without alarm, tissue pressure higher than the perfusion pressure, pain under Redon-therapy and an enormous and unacceptable care effort led to the abort of the study.

*Einleitung:* Die Vakuumversiegelung wurde bereits in den 40er Jahren erstmals zur Wundversorgung eingesetzt. Seit dem haben sich mehrere Systeme am Markt entwickelt. Das Redon-Drain zur Wundexsudat-Absaugung wird in einigen Abteilungen ebenfalls zur Vakuumversiegelung genutzt. Hier entstehen Spitzendrücke von 900 mmHg. Bei der VAC<sup>®</sup>-Therapie wird eine computergestützte Druckkontrolle von 125 mmHg aufgebaut. Ziel dieser Studie war es, die Effizienz auf die Wundheilung zu untersuchen.

*Methoden:* Es wurden 2 Gruppen mit jeweils 10 Patienten

gebildet, wobei entsprechend einem Randomisierungsschema entweder der Patient mit einem Redon-Drain oder mit einem VAC<sup>®</sup>-System versorgt wurde. Die Progression der Wundheilung wurde mit dem Computerprogramm „Wound Healing Analysing Tool“ analysiert und dokumentiert. Inkludiert wurden Patienten mit einem Dekubitusgrad III-IV. Zielparameter waren der absolute und relative Anteil von Granulationsgewebe, Fibrin und Nekrose. Nebenzielparameter waren die Wundfläche, der Umfang und der maximale vertikale und horizontale Durchmesser. Weitere Parameter die erfasst wurden, waren die Anzahl der Verbandwechsel und der Zeitaufwand der einzelnen Systeme. Der Beobachtungszeitraum erstreckte sich über 10 Tage.

*Ergebnisse:* Bereits nach 5 Patienten in der Redongruppe und 6 Patienten in der VAC-Gruppe zeigten sich so große Unterschiede, dass die Studie vor allem auf Rücksicht des Pflegeaufwandes abgebrochen wurde. In der Wundanalyse zeigte sich eine Progression des Granulationsgewebes in der VAC-Gruppe um 52 %, in der Redongruppe nahm das Granulationsgewebe gänzlich ab. Der Wundgrund bestand zu 100 % aus Fibrin bzw. Kolliquationsnekrose. Während die VAC<sup>®</sup>-Therapie bei Undichtheit alarmierte, musste bei der Redontherapie alle 2 Stunden auf Dichtheit kontrolliert werden. Bei Undichtheit musste das System neu angelegt werden. Der Flaschenwechsel erfolgte bis zu 10 mal täglich. Die VAC-Gruppen waren in Bezug auf die Reduktion des Pflegeaufwandes (Mediane Zahl der Verbandwechsel: 3 (Redon), 0.5 (VAC-Gruppe) ( $p < 0.05$ )) dem Redon überlegen.

*Schlussfolgerungen:* Aufgrund der vorliegenden Ergebnisse scheint die VAC<sup>®</sup>-Therapie der Redontherapie hinsichtlich der Progression in der Wundheilung und dem personellen Aufwand überlegen. Undichtheit, Ansaugen von Stuhl ohne Alarmierung, Gewebsdrücke weit über dem Perfusionsdruck des Gewebes, Schmerzen der Patienten unter der Redontherapie und Überschreitung des zumutbaren Arbeitsaufwandes haben zum Abbruch der Studie geführt.

Silcher Saal

14.00–15.30

## V 26

## Basic Research

## Grundlagenforschung

## V 26-1

**How long should biosurgical maggots be kept in the wound for maggot debridement therapy (MDT)?****An experimental investigation of the age dependent enzymatic secretion in larvae of *Lucilia sericata*****Wie lange sollte man Maden zum biochirurgischen Debridement in der Wunde belassen?****Eine experimentelle Untersuchung der altersabhängigen Enzyausscheidung bei Fliegenlarven von *Lucilia sericata*****C. Marquardt<sup>1</sup>, J. von Seydlitz-Kurzbach<sup>2</sup>, D. Hoefler<sup>2</sup>**<sup>1</sup>General and Visceral Surgery, Klinikum Ludwigsburg, Ludwigsburg, Germany,<sup>2</sup>Institute for Hygiene und Biotechnology, Hohenstein Research Institutes, Boennigheim, Germany

**Introduction:** The convincing success of *Lucilia sericata* larvae in the treatment of chronic wounds made maggot debridement therapy (MDT) become a standard therapy regimen. This is due to their outstanding necrolytic effects of the maggot products (excretory and secretory, ES). Until now the recommended treatment time was based on clinical observations and maggots were left for 2–5 days in the wound.

**Materials and Methods:** To examine this clinical recommendation, we investigated the enzymatic activity of the excretory – secretory (ES) products from unsterile *Lucilia sericata* larvae over 4.5 days in vitro. During every day the maggot products were measured every 2 hours, while the larvae were kept without food source. By enzymatic catalization of N-benzoyl-DL-arginyl-p-nitroanilid (BAPNA) we determined the tryptic activity.

**Results:** The enzymatic activity decreased continuously on every day, when the maggots were kept without food source. In contrast, the tryptic activity increased during the first days in the life of the maggots and reached its maximum on the 3rd day. After this day it decreased again to a level of 46 % of the maximum on day 4 and after 4.5 days it was lying below the initial activity of day 1 (8,7 % of the maximum).

**Conclusion:** According to this results maggots for biosurgical debridement should be kept in the wound for 2–3 days. Larvae are

applied in the wound on the 2nd day of their life and should then stay in the wound for a minimum duration of 2 days, to unfold their full enzymatic activity. They should be replaced by fresh maggots every 3 days to provide a constant enzymatic level in the wound. After the 3rd day of application the expected enzymatic activity is less than 10 % of the maximum.

**Zielsetzung:** Die durchschlagenden Erfolge bei der Behandlung chronischer Wunden mit Fliegenlarven der Gattung *Lucilia sericata*, führten zu einem festen Platz dieser Therapieform im Rahmen der standardisierten Wundbehandlung. Dies ist insbesondere auf die herausragende nekrolytische Wirkung der Larvenprodukte (Sekrete und Exkrete) zurückzuführen. Empfohlen wurde bisher die 2–5 tägige Anwendung der Maden in der Wunde.

**Methoden:** Zur in vitro Überprüfung dieser Therapieempfehlung wurde die Enzymaktivität der Ausscheidungs- und Sekretprodukte unsteriler Larven untersucht. Larvenprodukte wurden über 4,5 Tage in 2 stündlichen Intervallen gesammelt. Durch Umsatz des Trypsinsubstrates N-Benzoyl-DL-Arginyl-p-Nitroanilid (BAPNA) konnte die tryptische Enzymaktivität bestimmt werden.

**Ergebnisse:** Die tryptische Enzymaktivität nahm an jedem Meßtag kontinuierlich mit der Zeit ab, wenn die Larven ohne Nahrung blieben. Im Gegensatz dazu nahm die tryptische Enzymaktivität in Abhängigkeit vom Larvenalter bis zu einem Maximum am 3. Lebenstag zu und reduzierte sich am 4. Lebenstag wieder bis auf 46 % ihres Maximalwerts. Nach 4,5 Tagen lag die Aktivität unter dem Anfangsniveau vom 1. Lebenstag.

**Schlussfolgerung:** Die Ergebnisse legen damit eine Anwendungszeit zum biochirurgischen Wunddebridement von 2–3 Tagen nahe. Da die Larven erst am 2. Lebenstag im Stadium 2 in die Wunde gelangen, sollten sie mindestens 2 Tage belassen werden, um ihre volle enzymatische Wirkung am 3. Lebenstag zu entfalten. Nach dem 4. Lebenstag sinkt die enzymatische Aktivität wieder unter 10 % des Maximalwertes.

## V 26-2

**Erste Erfahrungen mit autologem Thrombozytengeltransfer****T. Aigner, F. Weyer**

Landeskrankenhaus St. Pölten, Abt. f. Plastische Chirurgie, St. Pölten, Austria

**Grundlagen:** Mit einem Autologous Platelet Separator lässt sich aus 30–50 ml Vollblut ca. 3–10 ml Thrombozytenkonzentrat (Pla-

telet Rich Plasma, PRP) gewinnen. Durch die Aufbringung dieses Gels auf stagnierende chronische Wunden kommt es zu einer konzentrierten Ausschüttung von thrombozytären Wachstumsfaktoren, die die Wundheilung beschleunigen sollen. Eine Beurteilung des neuen Verfahrens findet sich in der Literatur bisher nicht. Daher soll es hier vorgestellt und in einer Anwendungsbeobachtung an 8 Patienten mit Wundheilungsstörungen bei Spalthautentnahmestellen hinsichtlich klinischer Eignung und ersten Ergebnissen überprüft werden.

*Methodik:* An unserer Abteilung wurden 8 Patienten mit autologen Thrombozytengel behandelt. Es handelte sich in allen Fällen um eine p.s. Heilung von Spalthautentnahmestellen, die länger als 1 Jahr bestanden und keinerlei Besserungstendenz zeigten. Jedem Patienten wurden 50 ml Blut abgenommen und mittels Autologous Platelet Separator Thrombozytengel (PRP) gewonnen. Dies ist ein thrombozytenreiches Plasma mit einer Thrombozytenkonzentration zwischen 412000/μl und 2114000/μl. Durch Kalziumchlorid beschichtete Glasfaserstäbe werden die Thrombozyten aktiviert und danach auf die vorher mit NaCl 0,9 % gereinigten Wunden aufgebracht. Die aktivierten Thrombozyten schütten jetzt Wachstumsfaktoren, wie platelet-derived growth factor (PDGF), transforming growth factor beta 2 (TGF β2), insulin-like growth factor (IGF), epidermal growth factor (EGF), epithelial cell growth factor (ECGF) und viele unbekannte Faktoren aus. Danach wurden die Wunden mit Folie für 24 Stunden okkludiert und dann ohne Änderung der Verbandanordnung gegenüber vor der Thrombozytengelbehandlung weiter verbunden.

*Ergebnisse:* In allen Fällen kam es nach 4 Wochen zu einer deutlichen Granulations- und Epithelisierungstendenz. Nach 3 Monaten herrschten bei 80 % der Patienten vollkommen geschlossenen Wundverhältnisse.

*Schlussfolgerungen:* In unserer Anwendungsbeobachtung zeigte sich eine deutlich beschleunigte Abheilungs- und Epithelisierungstendenz nach Aufbringen von autologen Thrombozytengel. Jetzt gilt es dieses Verfahren in klinischen Studien zu evaluieren und zu prüfen, für welche Indikationen es einsetzbar sein könnte!

## V 26-3

### *Chronic wounds and impaired perfusion of microvasculature – an interrelation*

### **Chronische Wunden und gestörte Mikrozirkulation – eine Wechselbeziehung**

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Chronic wounds are typically correlated with reduced blood flow in the surrounding microvasculature. Local, unspecific inflammatory reactions of the lining cell layer (endothelium) play a crucial role in occlusion of small blood vessels. The development of decubitus ulcer is a good example to demonstrate the correlation of local endothelial inflammation and wound formation. During ischemia hypoxanthine and xanthin-oxidase are accu-

mulated in the tissue. After reperfusion xanthin-oxidase activity continuously generate high levels of toxic oxygen species (TOS). These extremely reactive agents ultimately injure cells, fibers, and ground substance of tissues. Thus, paradoxically, reperfusion after long ischemic periods deteriorates tissue defects acquired under anaerobic conditions. Moreover, TOS trigger pathophysiological effects in endothelial cells and induce adherence of granulocytes leading to blockage of small blood vessels in the microvasculature. These processes were first recognized as major cause for organ failure after transplantation and multi-organ-failure after shock and were described as ischaemia-reperfusion injury or no-reflow phenomenon in the eighties. Persistent inflammatory reactions of endothelial cells and continuous granulocytes accumulation in the microvasculature severely impair blood flow and markedly reduce tissue pO<sub>2</sub>. In the beginning of wound formation the damaged and necrotic tissue area is often covered by apparently intact skin. Only after ulceration of skin the full extent of tissue destruction is revealed and a deep open wound becomes visible. The wound ground is covered with incrustations composed of cell detritus, fibrin, serum proteins, leukocytes and species of the bacterial flora of the skin. Wound incrustations are hot spots for generation of pro-inflammatory mediators and vasoactive substances. These agents reach the endothelial cells of the microvasculature by diffusion and maintain pathophysiological reactions. Healing of wounds remain impossible as long as inflammatory reactions of the endothelium block blood flow and oxygen supply.

*Conclusions:* Regular, complete and careful removal of wound incrustations is a prerequisite to improve healing of chronic wounds. Preferably solubilisation of incrustations should be performed by use of ready to use wound rinsing solutions containing detergents. Only after recovery of circulation in the microvasculature and sufficient tissue oxygen levels fibroblasts become able to repair the wound defect.

Chronische Wunden gehen immer mit einer Störung in der Mikrozirkulation einher. Früher wurde vielfach angenommen, die Zähigkeit (Viskosität) des Blutplasmas sei Ursache dieser Störung. In bestimmten Stadien von Diabetes kann dies durchaus der Fall sein. In der Regel spielen aber lokale unspezifische Entzündungsprozesse in der Mikrozirkulation eine entscheidende Rolle. Solche Prozesse können Ausgangspunkt von Multiorganversagen bei septischem Schock, von Arteriosklerose oder von chronischen Wunden sein. In der Frühphase der Störung, dem Stadium der endothelialen Dysfunktion, kommt es zur Anhaftung (Adhärenz) von Leukozyten an das Endothel. Spezielle Adhäsionsmoleküle auf Leukozyten und Endothelzellen vermitteln in diesem Prozess. An der Entstehung eines Dekubitus lässt sich exemplarisch nachvollziehen, welche entscheidende Rolle den Vorgängen am Endothel für die Durchblutung und die Entstehung und Chronifizierung von Wunden zukommt. Bei anhaltender Unterversorgung mit Sauerstoff (Ischämie) werden im Gewebe Stoffwechselprodukte angesammelt, die bei Wiederdurchblutung (Reperfusion) mit Sauerstoff reagieren und toxische, hochreaktive Moleküle („Sauerstoffradikale“) bilden. Diese lösen am Endothel von Kapillaren und nachgeschalteten Venolen pathophysiologische Reaktionen aus, die letztlich zu einer Verstopfung der Gefäße mit Leukozyten führen. Dieses Phänomen ist in der Transplantations- (Leber, Herz) und Herzchirurgie (Bypass) als no-reflow phenomenon, ischaemia-reperfusion injury oder Reperfusionsschaden schon Anfang der 80iger Jahre beschrieben worden. Hält die Entzündung des End-

othels und damit die Störung in der Mikrozirkulation an, kommt es zu einem massiven Gewebeuntergang, der häufig unter scheinbar intakter Haut unentdeckt bleibt. Erst wenn die Haut sich öffnet, wird die wahre Größe des Gewebedefekts sichtbar. In der dann offenen Wunde bildet sich schnell ein Wundbelag aus denaturierten Eiweißen und Bakterien der natürlichen Hautflora. In ihm entsteht ein Cocktail aus pro-inflammatorisch wirkenden Botenstoffen, die durch Diffusion die Gefäße am Wundrand erreichen und die pathophysiologischen Vorgänge am Endothel unterhalten. Die Wunde heilt nicht, solange die Entzündungsreaktionen am Endothel und damit die Störung der Mikrozirkulation anhalten.

*Fazit:* Die restlose und schonende Beseitigung des Wundbelags bei jedem Verbandwechsel ist eine entscheidende Voraussetzung für die Sanierung chronischer Wunden. Dabei sollten vorzugsweise gebrauchsfertige tensidische Wundspüllösungen eingesetzt werden. Erst wenn die Störung in der Mikrozirkulation beseitigt ist und wieder ausreichend Sauerstoff zur Verfügung steht, können Fibroblasten neues Gewebe bilden und die Wunde schließen.

## V 26-4

### **Autologous platelet concentrate enriched with growth factors (APC +) treatment for handling chronic diabetic foot ulcerations – implementing growth factors as a new treatment modality**

#### **Aktiviert autologe Thrombozytenkonzentrate (PRP +) in der Behandlung chronischer diabetischer Fußulzera – Wachstumsfaktoren als neue Therapielperspektive**

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*Introduction:* Diabetic foot syndrome is difficult/cost intensive complication of diabetes mellitus that can often lead to amputation. Pathogenesis derived from vascularization disturbances and polyneuropathy with loss of protective pain sensation. Despite optimized therapeutic treatment with pressure relief, infection control, revascularization surgery, measures such as, metabolic control, education and proper wound management, many wounds fail to heal. Publications concerning the control of wound healing through the implementation of cytokines have established a therapeutic strategy for Activated, Autologous Platelet Concentrate (APC+) which impact healing through the release of multiple growth factors.

*Methods:* The APC+ was prepared "point-of-care" directly prior to the application by the centrifugation (SmartPRP System)

of approximately 20 ml of whole blood. After appropriate wound bed preparation, ~2,5 ml APC+ was then simultaneously applied with Autologous Thrombin directly to the wound bed. The wound was then covered with polyurethane foam dressing and left undisturbed for 7 days. After an additional week with conservative moist wound treatment, a new treatment cycle of PRP was undertaken. 27 consecutive patients with non-healing, non-infected chronic foot lesions (Wagner Stage 1–3) previously treated for 6 weeks of standardized therapy congruent with the international consensus of the diabetic foot were treated additionally with PRP.

*Results:* A total treatment period ranging from 3–28 weeks (2–14 individual treatment cycles: mean 7,2) exhibited 16 from 27 patients (60 %) achieved full wound closure. 9/27 patients (33 %) presented significant benefit in wound size reduction or marked improvement of granulation tissue. The treatment of one heel fistula and one ulcer of the malleolus (both significant bone exposure) exhibited no marked improvement (7 %). In general 25/27 (93 %) showed marked improvement of the wound situation. Intermittent infection occurred in 2/27 patients (15 %) that were successfully managed. Note: Incidences of non-revascularized tissue, ischemic disturbances were present in 73 % of patient diagnosis (8/11) where full epithelialization was not achieved.

*Discussion:* The application of APC+ as part of a therapy regimen indicates that the release of growth factors is a safe method to initiate and accelerate healing of chronic, non-healing wounds. Questions regarding the routine use and efficiency as well as patient collection and wound circumstances require further evaluation.

*Einleitung:* Das diabetische Fußsyndrom ist eine schwerwiegende und kostenintensive Folgeerkrankung des Diabetes mellitus, die oftmals zu Amputationen führt. Ätiologisch sind Durchblutungsstörungen (pAVK) und die Polyneuropathie mit Verlust des schützenden Schmerzempfindens bedeutsam. Trotz optimaler Therapie mit Druckentlastung, Infektionskontrolle und ggf. revascularisierenden Maßnahmen, sowie Stoffwechselkontrolle, Schulung und ein geeignetes Wundmanagement zeigen viele Wunden einen chronischen Verlauf ohne Heilungstendenz. Zunehmende Erkenntnisse über die Steuerung der Wundheilung durch Zytokine und umfangreiche Erfahrungen in der Kieferchirurgie haben zur Etablierung von Therapiestrategien mit aktivierten autologen Thrombozytenkonzentraten (PRP +) geführt, deren Wirkung auf der Freisetzung multipler Wachstumsfaktoren beruht.

*Methoden:* Das thrombozytenreiche Plasma (PRP) wurde direkt vor der Applikation durch Zentrifugation aus ca. 25 ml Vollblut gewonnen. Zur Herstellung kam das SmartPRP System der Firma Harvest Technologies zum Einsatz. 2,5 ml PRP wurden zusammen mit parallel physiko-chemisch hergestelltem autologen Thrombin nach entsprechender Wundbettpräparation auf die Wunde aufgebracht, mit einem Polyurethanschaum abgedeckt und 7 Tage *in situ* belassen. Nach einer weiteren Woche mit konservativer feuchter Wundbehandlung folgte ein neuer Behandlungszyklus mit PRP. 27 konsekutive Patienten mit nicht heilenden, nicht mehr infizierten Fußläsionen (Stadium Wagner 1–3) und beginnender Granulation wurden nach mindestens 6-wöchiger standardisierter Vorbehandlung gemäß dem internationalen Konsens über den diabetischen Fuß zusätzlich mit PRP+ behandelt.

*Ergebnisse:* In einer Behandlungszeit von 3–28 Wochen mit 2–14 Behandlungszyklen (mean 7,2) konnte bei 16 von 27 Patienten (60 %) ein vollständiger Wundschluss beobachtet werden. 9/27 Patienten (33 %) zeigten einen Benefit der Therapie im Sinne einer Wundgrößenreduktion oder Verbesserung der Granulation, die Behandlung einer Fersenfistel und eines Ulkus im Malleolusbereich verlief ohne Erfolg (7 %), so dass bei 25/27 (93 %) eine Verbesserung der Wundsituation erzielt wurde. Interkurrente Infektionen traten in 4/27 Fällen (15 %) auf und konnten im Verlauf erfolgreich saniert werden. Relevante, oft nur partiell revaskularisierbare Durchblutungsstörungen fanden sich in der Diagnose von 73 % aller Patienten (8/11) ohne vollständige Epithelialisierung.

*Diskussion:* Über die etablierten Therapieprinzipien hinaus erwies sich der Einsatz von PRP+ mit der Freisetzung von Wachstumsfaktoren als sicherer Ansatz, die Heilung chronischer Wunden beim diabetischen Fußsyndrom zu induzieren und zu beschleunigen. Die Fragen nach der tatsächlichen Effizienz sowie besonders geeigneten Patientenkollektiven und Wundbedingungen bedürfen einer weitergehenden Evaluation.

## V 26-5

### Wirksamkeit verschiedener Wundspüllösungen gegenüber Biofilmen

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Während bakterielle Biofilme in vielen humanmedizinischen und technischen Bereichen eine herausragende, z. T. krisenhafte Bedeutung erlangt haben, wird deren Bedeutung bei der Behandlung von Wunden, speziell chronischen Wunden noch nicht entsprechend berücksichtigt. Dabei behindert die symbiotische bakterielle Lebensform „Biofilm“ in besonderem Maße die Wundreinigung, lokale Antiseptik sowie die Wirksamkeit von systemischen Antibiotika. Zur Bewertung der Wirksamkeit gegenüber Biofilmen von den in der klinischen Praxis zur Wundreinigung eingesetzten Lösungen wurde die Biofilmyl<sup>®</sup>-Methode verwendet. Diese erlaubt eine exakte Quantifizierung des Biofilms mittels der aus den bakteriellen Zellwänden freigesetzten Endotoxine. Hierzu wurden zunächst Biofilmprüfkörper mit der Spezies *Pseudomonas aeruginosa* auf Silikonoberflächen angezchtet und in getrennten Versuchen anschließend über jeweils 24 Stunden a) isotonomischer Kochsalzlösung, b) Ringerlösung sowie c) einer tensidischen Polihexanid-Lösung ausgesetzt. Als Ergebnis zeigte sich sowohl unter Einwirkung der Kochsalz- als auch der Ringer-Spüllösung keine Minderung Biofilm-Ausgangskonzentration, während für die tensidische Polihexanid-Lösung eine signifikante Wirkung ( $p < 0,001$ ) im Sinne einer Reduktion des Biofilms um 87 % erreichte. Neben der „Beeinflussung des Granulationspotentials“ und der „Therapeutischen

Breite“ einer Spüllösung sollte auch die Eliminationswirkung gegenüber Biofilm als relevante Parameter in die Gesamtbewertung einbezogen werden. Da Polihexanid-haltige Lösungen auch hinsichtlich dieser Parameter wesentliche Vorteile aufweisen, scheint es sinnvoll, die bisher gängige Praxis der Wundspülung mit Ringerlösung oder isotoner Kochsalzlösung im Rahmen klinischer Untersuchungen kritisch zu prüfen.

## V 26-6

### Clinical evaluation of the effectiveness of a multimodal static pressure relieving device

### Klinische Evaluation der Effektivität eines multimodalen, statischen luftgefüllten druckreduzierenden Systems

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*Introduction:* The aim of the study was to provide proof of the effectiveness of a support aid for the prevention or treatment of pressure sores. The system under review was REPOSE, a range of air-filled polyurethane products comprising a mattress overlay, a cushion, foot protectors and a wedge.

*Methods:* The study was conducted according to a randomised, comparative and explorative design. The ethical approval was given by the ethical committee by the University of Witten-Herdecke. All patients were supported either by the REPOSE system or by small or large-celled alternate pressure systems. All available patients in one hospital and residents of eight nursing homes who met the inclusion criteria (pressure sore minimum grade 2, geriatric patients, or those with neurological illness or patients undergoing operations) were randomly allocated to the included products for a total period of nine months. Measurement, realised by an standardised protocol which considered preventive and therapeutic aspects of the measured systems, occurred over a maximum of 28 days per subject. The main parameters were: general wound healing, weekly changes in wounds, wound healing success according to support system.

*Results:* 50 patients were included in the study. The study showed a clear superiority ( $p = 0,009$ ) of REPOSE compared to the small-cell support systems regarding of the wound healing tendency as well as the healing period. REPOSE were in those parameters comparable to the large-cell systems ( $p = 0,212$ ) in this study group. Patients were significantly more satisfied with the REPOSE system than patients who were cared for using the comparative systems ( $p < 0,001$  small-cell system and  $p = 0,024$  large-cell system).

*Conclusions:* REPOSE provides a highly effective system that can be used in multimodal fashion for both preventative and therapeutic purposes within the study group. Evidence was presented that patients with wounds in the classically exposed body points at risk of pressure sores who were supported on the REPOSE system showed an improved tendency to heal.

Mozart Saal

14.00–15.30

## V 27

## Pain, quality of life &amp; phenomenological studies

## Schmerz, Lebensqualität &amp; phänomenologische Studien

## V 27-1

***The lived experience of young adults with chronic pilonidal disease******L. Bradley*****Ulster Community & Hospitals Trust, Belfast, United Kingdom**

*Background:* Pilonidal disease affects a young population (18–40 years) and usually presents as an acute abscess or a chronic draining sinus requiring surgical intervention often leaving a large wound to heal by secondary intention (Allen-Mersh, 1990). Since the average duration of symptoms can exceed three years, many young adults are forced to endure a cycle of chronic intermittent infection and drainage with interference to activities of daily living at a time when they are embarking on a career or tertiary education. Despite this little research has focused on the patient experience.

*Aim:* The aim of this phenomenological study was to explore, over a trajectory of 6 months, the lived experience of young adults with chronic pilonidal disease.

*Design of Study/Methodology/Data Collection:* Using a Heideggerian hermeneutical approach and an analytical process developed by Deikleman et al (1989), the data from a series of unstructured face-to-face interviews with a purposive sample of 3 young adults, were analysed and interpreted within a Heideggerian philosophical framework based on Dasein or "being-in-the-world" (Heidegger, 1985).

*Data Analysis:* The following 3 constitutive patterns and 8 themes emerged: "ready-to-hand", "unready-to-hand" and "present-at-hand", with the themes, "active lifestyle", "noticing symptoms", "seeking help", "lifestyle changes", "demands on time", "perceptions of care", "coping mechanisms" and "fluctuating emotions". As the 3 participants sought to adapt to the challenges and changes of living with a discharging sinus or an open wound, a phenomenon common to all was the avoidance of physical activity, fearing that the "wound would rip open" or that "sweating would cause infection".

*Recommendations:* The findings pose a challenge to nurses caring for these young adults to adopt a more holistic and evidence-based approach. This research paper will present the rationale for the study, an outline of the audit trail, a discussion of the findings, and recommendations for further research, nurse education, changes in clinical practice and education of patients.

## V 27-2

***A template for assessing pain at wound dressing related procedures******H. Hollinworth*****Suffolk College, Ipswich, United Kingdom**

The aim of pain assessment is to reduce the discomfort associated with wound care procedures, and identify factors that exacerbate the patient's pain experience. This can only be achieved using a structured approach to pain assessment. A template, which can be adapted locally, provides a practical means of identifying and recording procedural pain.

Key opinion leaders from around the world have emphasized the significance of minimising pain at wound dressing-related procedures. While it may not be possible to completely eliminate pain related to wound care or dressing changes, it is realistic and achievable to modify the pain many patients currently experience. Inspired by the World Union of Wound Healing Societies' initiative (1), an assessment template has been developed.

It is reasonable to assume that virtually all wounds are painful; this is the normal physiological response to injury. However, the pain initiated by dressing-related activities is additional to background pain that can be unremitting, even at rest. Determining the type and bodily location of pain, enables sensitive handling, appropriate management, as well as attributing to our understanding of the patient's experience of living with their pain.

Assessment also requires identification of 'triggers' and dressing related activities that make an individual's pain worse. Just normal bodily movement can exacerbate wound related pain. Dressing removal has consistently been identified as the time when patients' experience the most pain (2). Conversely, patients are often able to identify 'reducers' or circumstances that makes the pain less.

Pain intensity, as perceived by the patient, should be recorded each time a dressing-related procedure is carried out. Pain should be evaluated before an intervention; otherwise pain assessment during or after the dressing-related procedure has considerably less value. Patient involvement is important, but clinicians should also assess for difficulties in removing adhered dressings, or excessive exudates causing tissue damage.

Although healthcare professionals are accountable for their practice, professional tensions can arise when unnecessary pain is inflicted on patients as a result of dressing-related procedures. If the person with a wound, rather than the professional, is cen-

tral a structured assessment process, then these issues can more readily be resolved.

### References

1. Principles of best practice: minimizing pain at wound dressing-related procedures. A consensus document, London: MEP Limited. 2004.
2. Pain at wound dressing changes. A position document. London: MEP Limited. 2002.

### V 27-3

## ***A qualitative investigation to identify patients' descriptions of their procedural wound pain in chronic leg ulceration***

***J. L. Mears, P. J. Franks, C. J. Moffatt***

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**Introduction:** This investigation represents the first, qualitative, phase in the development and validation of a novel procedural pain assessment tool. The aim is to identify words, phrases and feelings patients used and expressed to describe their pain during the dressing of their leg ulcers.

**Methods:** Seventeen recorded interviews were undertaken with patients whilst practitioners were carrying out a wound care procedure. Five interviews were conducted in leg ulcer clinics and the remainder were undertaken in the patients' homes. A semi-structured interview schedule was used for the interviews. Patients were encouraged to describe both their background and procedural pain and discomfort. The investigator used a reflexive diary.

**Results:** Patients experienced procedural pain, which was particularly associated with the ulcer being touched (e.g. cleansed), or redressed, (e.g. with iodine based dressings). Only a limited number of descriptors were used, such as "stinging", "throbbing", "needle like" and "fierce". Post-procedural pain and discomfort was reported and attributed to disturbance of the wound or the compression bandages. Others reported leg pain not obviously associated with their ulcer but exacerbated by the procedure. Some patients recounted overwhelming pain that eclipsed any procedural pain.

**Conclusions:** The interviews reinforced health related quality of life issues identified in previous studies. Patients used a limited number of words to describe their pain but identified a number of factors that influenced their background and ulcer pain. These factors will be considered in the construction of the novel procedural pain assessment tool

### V 27-4

## ***"If this pressure ulcer hadn't have developed I would have been all right!" Patient perceptions and experiences of the impact of a pressure ulcer and its treatment on their health and quality of life***

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**Introduction:** Pressure ulcers represent a significant health problem. Whilst clinicians generally accept that pressure ulcers impact on patients' quality of life, there is a gap in research exploring patient perceptions and experiences of a pressure ulcer and its treatment on their health and quality of life.

**Methods:** The aims of this study were to explore patients' perceptions and experiences of pressure ulcers and their treatment. Qualitative semi-structured interviews were carried out with a purposive sample of 23 patients with a pressure ulcer (5 male, 18 female; aged 33 to 92 years; grade 2 to 4 ulcers at various anatomical sites; varied reasons for hospital admission). Follow-up interviews were arranged with 7 patients at 3 months post-discharge. Data were analysed according to the broad principles and techniques of grounded theory.

**Results:** Patients indicated that pressure ulcers had a physical, social, emotional and mental impact on their health and quality of life and revealed how the development of an ulcer could be pivotal in their trajectory from illness to full recovery. The patients presented their perspectives on the development of a pressure ulcer, including causes for ulcer development due to mobility problems and not being able to see the ulcer developing because of its location. Patients described their ulcers in terms of their appearance ('black and nasty'), the pain that they experience ('red hot poker'), and the smell and leakage of fluid from the ulcer. Patients were keen to describe amounts and quality of care they received, commenting on levels of comfort associated with different dressings and pressure relieving equipment, the timing of interventions and their levels of dependence on others to treat, manage and care for their ulcer.

**Discussion:** This study makes a contribution to knowledge about the impacts of pressure ulcers on the patients who experience them. Clearly the impact of pressure ulcers varies depending on context, but these patients' voices provide insights into potential impacts, that ulcers can be pivotal in preventing full recovery, can result in lengthy hospital stays and ongoing treatments, and cause much pain and discomfort. The findings are of clinical importance for health care professionals providing care to these patients.

**This study was supported by a grant from the NHS R&D Health Technology Assessment Programme. The views and opinions expressed in the paper do not necessarily reflect those of the NHS Executive.**

## V 27-5

**Self-care of venous leg ulcer patients**S. M. Seppänen<sup>1</sup>, A. Livanainen<sup>2</sup><sup>1</sup>Oulu Polytechnic, Oulainen, Finland,<sup>2</sup>Mikkeli Polytechnic, Mikkeli, Finland

The aim of study was to describe health-deviation self-care activities of venous leg ulcer patients in Finland. The self-care activities were studied by WAS-VOB® (Panfil/ Evers), which is a catalogue containing propositions of self-care activities for venous leg ulcer patients. It includes 59 proposition of self-care activities describing them in eight items; general compression, wearing compression bandages, wearing compression hosiery, mobility, temperature, overloading of the venous system, prevention of skin damage and wound healing. For this study the WAS-VOB® was translated in Finnish and culturally modified. The background information of patients concerned 1) independency and social aspects, 2) medical and wound history and 3) current situation of wound. The data were collected in years 2003–2004 analysed by SPSS 11.0.

In the study participated 88 venous leg ulcer patients, 75 % percent were female. Most of the patients (80 %) were over 65-years old. They mainly lived at home or homely settings. 73 % of them coped with their daily activities independently or with minor help. All the patients had venous insufficiency and 85 patients had many episodes of venous leg ulcers. 74 of patients had an ulcer or ulcers in the moment of study (n = 112). The general compression was implemented every day by 72 % of the patients either by compression bandages or hosiery. One third of patients implemented compression therapy by themselves. The best implemented self-care activities were skin care, avoiding of overloading of venous system and high temperatures. The less implemented self-care activities were mobility, wound healing and implementation of compression therapy after a wound is healed. Only 35,4 % of the patients reported that they implement compression therapy also when a wound does not exist. The health professionals need to motivate venous leg ulcer patients to continue compression therapy after the wound is healed. Also mobility activities and asepsis in wound treatment need more attention in a supervision of self-care. The WAS-VOB® assess the self-care deficits of venous leg ulcer patients and it can be recommend to use as a tool for health professionals. In Finland there is deficits in health care system, supervision of venous leg ulcer patient is very minimal and exist only in wound episode phase. The prevention aspect should also be included as part of the caring process of venous leg ulcer patients.

## V 27-6

**Venous ulcers: patient experiences of contributing to self-care**

E. A. Nelson

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*Introduction:* There is an increasing prevalence of chronic conditions necessitating changes in health service provision. The public and patient are being recognised as important contributors to maintaining health and promoting recovery from illness, as well as managing chronic conditions, with support from professionals. New models of self-care have been not been described in chronic wound management. Managing leg ulceration occupies a significant proportion of nursing time, therefore effective self-management could impact workload, however, it is not clear if leg ulcer self-management occurs already, to what extent patients with leg ulcers could be come involved in their care, and what barriers and drivers there are to increasing self-care.

*Aim:* To describe the activities of self-care undertaken by people with leg ulcers, what helps/ hinders them in self-care, and what their attitudes and perceptions of barriers were to becoming more involved in their leg ulcer care.

*Methods:* In-depth, semi-structured interviews with people with venous leg ulcers in UK, Canada and New Zealand. Interviews were transcribed verbatim and charted using Framework (a matrix based analytic method); i. e. familiarisation with the text, identifying a thematic framework, indexing, charting and mapping and interpretation.

*Results:* Thirty three participants were interviewed: 16 Canada, 13 New Zealand, and 4 UK. Ages ranged from 50 to 92, participants had experienced the first ulcer between 2 months to 50 plus years previously, and had up to 27 ulcer episodes. All had experience of being cared for by community nurses. Patients commonly described self-care in physical terms (e.g. nutrition) and less commonly psychological approaches (e. g. yoga). In Canada and New Zealand, patients were regularly involved in ulcer care by removing dressings prior to nurse visit for bathing. Barriers to self-care included depression, fear of infection, and lack of physical ability. A strong desire to be independent, or having some-one else to care for encouraged participants to self-management.

*Conclusions:* Patients with venous ulcers focussed on physical aspects of self-care. The degree of involvement in ulcer care varied with patient characteristics, their circumstances and with care setting. Approaches to increasing self-care will need to address both individual and staff perceptions and skills.