Wound Care Means First Wound Prevention

Nutritional Aspects in the Management of Skin Ulcers
Muscaritoli M, Gioia, Esposito M
Rome, Italy

Abstract
Although the pathogenesis of skin ulcers (SU) varies largely depending on the reason that caused them, their ability to heal or to the contrary, their tendency to become chronic or delayed healing depends on the combined effect of several common factors that can significantly influence the prognosis of the wound and the patient. Among these, the most common are represented by care of the wound, hygiene and nutritional condition. It is widely recognized that protein-calorie malnutrition acts as a factor that favors the onset of SU and at the same time slows healing. The nutritional condition can in fact significantly influence the phases of the wound repair process, namely inflammation, proliferation (anabolic phase), and tissue remodeling. The pivot of nutritional support in the multidisciplinary care of skin wounds is based on an adequate intake of fluids, calories and proteins. However, very often the diet, even when integrated with specific nutritional supplements, is not able to maintain an optimal state of nutrition and hydration to favor wound repair. In addition, the dietary intake of certain nutrients that are particularly useful in the wound healing process may be sub-optimal. This makes exogenous supplementation necessary, in order to promote and accelerate the healing process, thereby giving way to a pharmaco-nutritional approach for the prevention and cure of SU.

Prevention of Pressure Ulcers in Children: Lessons Learned
Quigley S
Massachusetts, US

Abstract
Maintaining skin integrity in acutely ill and immobilized hospitalized patients is a priority for nurses. Whether all pressure ulcers are preventable remains controversial. No individual clinician working alone, regardless of how talented, can prevent all pressure ulcers from developing. Rather, pressure ulcer prevention requires activities among many individuals, including the multiple disciplines and individual team members involved in developing and implementing the care plan.

Furthermore, clinical practice does not change through didactic lectures alone, it changes through building a change team and gathering administrative support, collaboration of all team members and data collection with performance reporting that will heighten awareness throughout the organization.

The success of a pressure ulcer prevention program is based upon:
1. Establishing a Pressure Ulcer Prevention Policy
2. Use of a risk assessment scale in combination with a comprehensive daily skin assessment
3. Early identification of skin alterations and prevention protocols based upon individual risk sub-scores
4. Documentation and communication of patient risk and consistent use of evidenced based interventions
5. Creation of Skin Care Teams and the promotion of educational initiatives (ie, Skin Skills Fairs) to integrate practice changes into daily work

This session will provide insight into one some of the lessons I have learned:

• Implementation process must include all disciplines not only professional nursing staff
• Organizational obstacles such as monitoring compliance with skin assessment & risk assessments done daily, risk not often used to develop the prevention plan, risk scores are not routinely passed on in hand-offs
• Education, education, education: bedside hands on, discussion, slide shows, newsletters, Skill Fairs, computerized self learning modules
• Education must include patient, family, and caregivers to be successful
• Pressure ulcers due to medical devices is significant challenge in our high technology environments
• Health information technology support critical for data collection & monitoring trends.

Pressure Ulcer Prevention: The Role of Nutrition
Benati G, Bertone MS
Pisa, Italy

Abstract
Patients who experience a protein calorie malnutrition or who are at risk for this pathological condition may be considered at risk for a greater susceptibility to infections, less autonomy and so a greater risk to develop skin breakdown.

Nutritional therapy (enteral nutritional and oral supplements are first choice techniques) may help to prevent nutritional risk or treat malnutrition, and at the same time it could prevent the occurrence of pressure ulcers.

In 2003, a Cochrane review of 8 randomized controlled trials concluded that although there was insufficient evidence elderly people suffering from acute illness appeared to develop fewer pressure ulcers when given two daily supplement drinks.

In 2005 R. Stratton published a meta-analysis on the clinical benefits of nutritional support in patients with, or at risk of developing, pressure ulcers. Fifteen studies of oral nutritional supplements or enteral tube feeding were included. This meta-analysis showed that oral supplements (250–500 kcal, 2–26 weeks) were associated with a significantly lower incidence of pressure ulcer development in at-risk patients compared to routine care.

The mechanisms by which nutritional support prevented the development of pressure ulcers was likely to include an improvement in nutritional intake and status. It is clear that at that moment the potential role of protein calorie supplements was shown in
undernourished patients.

In 2010, Botella-Carretero JI et al showed that the administration of protein calorie supplements in non-malnourished or mildly undernourished patients was associated with a lesser risk of postoperative complications, including pressure ulcers.

Nutritional therapy with specific nutrients (arginine, proline, glutamine, beta-hydroxy bet-methylbutyrate) has shown to be more effective in prevention and treatment of pressure ulcers with respect to a standard nutritional intervention.

In conclusion, a specific nutritional approach with a pharmacological strategy could be considered the first choice in patients at high risk for skin breakdown, independently of their nutritional risk.

References

Searching Solutions for Avoiding and Diminishing the Effect of Local Pressure in Children
Garcia-Molina P, Balaguer-Lopez E, Quesada-Ramos C
Valencia, Spain

Abstract

**Introduction.** In 1988 Solis determined the relationship between body surface and interface pressure. Children with higher body surface than 1m² had higher pressure points pressure in sacral region and heels, while children with lower body surface had higher pressure in the area of the occiput. When children grow the corporal proportions are more similar to adult.

The latest studies show that the most frequent pressure ulcer (PU) locations could be classified for ages groups: Below 3 years: occipital region, ears, and feet. Above 3 years: sacral region and heels. But there are other locations where PUs are also common. Skin is also at risk for PUs where diagnostic and therapeutic devices are placed: feet, hands, fingers, nose, mouth, etc. If Health Care Professionals (HCP) know the main locations of PUs and have correct preventive materials, PU occurrence could be avoided.

**Aim.** To describe the main solutions for relieving and redistributing the pressure in pediatric and neonatal populations: Support surfaces (SS), local tools to redistribute
pressure in occipital region, heels, ears and those PUs caused by therapeutic and diagnostic devices.

Method. Due to the development of Valencian Community Pressure Ulcer Clinical Practice Guidelines, our Working Task Group made a systematic review of the literature of PU's infant literature and classified the evidence with the GRADE system. We also investigate the latest products from health industries collaborating in partnership with them and HCP to design innovative prevention surfaces and devices for Up’s prevention in children. Since 2008, our NICU and PICU teams have been observing and analyzing the PU risk factors and the effect of the main prevention tools.

Results. Support Surfaces: The selection of the mattress should be according to age, risk, body surface, PU severity and underlying pathology (moderate evidence). There are new reactive mattresses -constant low pressure- that have better results than static and alternating mattresses (moderate evidence). The high specific foam mattresses (5-10 cm thickness, 30-35 Kg/m3 density and 1-3 Kpa stiffness) redistribute the pressure better than standard mattresses and some alternating SS (moderate evidence).

-Local devices for relieving pressure: Using devices (foam or gel) to redistribute pressure in occipital area is the best solution in PICU, NICU and operating rooms (moderate evidence). The positioners (foam pieces, gel pad) are useful to redistribute pressure and to change the position of the infant’s position in critical state (very low evidence). Dressings are useful to redistribute pressure in areas like the ears, lower back and the elbows (very low evidence).

-Redistribute pressure of therapeutic and diagnostic devices: table 1 and table 2.

<table>
<thead>
<tr>
<th>Devices</th>
<th>Preventive intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-invasive ventilation</td>
<td>Withdraw the treatment as soon as possible (moderate evidence). Apply face (or nostrils), gel or foam dressings that redistribute the pressure (moderate evidence). Half-hour break after 4 to 6 hours of treatment (low evidence). Alternate binasal interface with nasal mask in newborns (low evidence).</td>
</tr>
<tr>
<td>Endotracheal tube</td>
<td>Use hydrocolloid dressings or polyurethane sprays between the child’s skin and the tape (low evidence). Use attachment devices as a bridge (low evidence).</td>
</tr>
<tr>
<td>Peripheral, arterial, central catheter</td>
<td>Apply hydrocolloid and foam dressings between child's skin and catheter (very low evidence).</td>
</tr>
</tbody>
</table>

Table 1. Therapeutic devices.

Table 2. Diagnostic devices

<table>
<thead>
<tr>
<th>Devices</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO2 probe</td>
<td>Change the sensor site frequently: 1 to 4 hours depending on risk (very low evidence). Do not attach the sensor with flexible tapes and do not press the tape firmly over the sensor. (very low evidence).</td>
</tr>
<tr>
<td>Capnography sensor</td>
<td>Change location every 4 hours and monitor the temperature sensor (very low evidence).</td>
</tr>
<tr>
<td>Electrodes</td>
<td>Attach to the back when the patient is lying on his stomach (very low evidence).</td>
</tr>
</tbody>
</table>
In 2009 we began educational interventions with the nursing staff. However in 2010 we also changed the standard mattresses at the NICU and PICU to another SS adequate for children risk (reactive SS, and high specific viscoelastic foams). The reduction of the prevalence between 2010 and 2011 was very significant (p<0,001). Prevalence in 2010 was 42% (61% category I), compared with 15% at 2011 (all PU were category I).

Discussion. Health industries and researchers should increase the development of SS and devices specifically for children and infants. They must be made according to the specific characteristics of each age group. Further research is necessary about this theme: we need clinical trials with low biases (good methodology and adequate sample).

References


Caregiver Training: Telemedicine and Optimal Organization Means Better and Happier Healing
Pillon S, Sbaffi M
Rome, Italy

Abstract
We started our experience 6 years ago in one of the largest public hospitals in Italy, San Camillo-Forlanin in Rome. Today the service (and not experimental service) is running, inserted in the public reimbursement system. We started from a strong experimental background (since 1987 we are in charge of telemedicine researches and later of telemedicine services for Italian Antarctic Expeditions).
We believe this could be a model for introducing telemedicine services in the public hospitals for every wound care unit.

(1) Strong scientific background, both from clinical and from process management,
(2) A detailed project with "launch and learn" implementation (needed in a fast changing world) with all hospital components involved (Budgeting, quality control, clinical governance, social impact),
(3) Personnel continuous training (used also as Trojan horse to introduce new paradigms),
(4) Results connected with salary.

1-2-3-4 strategy leads to a success story, now part of e-care excellence network indexed by Italian Ministry of Health.

Our main results (130 patients, 270 ulcers) are: 90% of patients healed (compared with 60-75% from literature), no hospital admission needed for complications, strong patient satisfaction. Lesson learned and a comparison will be presented between the While-e-Coyote (slow, big projects) and the Road-Runner (fast in getting the opportunities in a changing world) management strategy in eHealth Projects.

**Risk-Assessment Scales: Comparing the Performance of Different Tools**

**Skin and Risks in Pediatrics: Analysis of a Hard Problem**
Fornaciari M
Rome, Italy

**Abstract**

The use of a rating scale of the risk of skin lesions is certainly a strategic element. The rating scales of risk of pressure sores in adults have been fifty years, and in the pediatric population, around eleven at the time, have a little less than twenty years. What have we learned in the meantime?

We have learned that
- Need more rating scales, because the pediatric age are different between them and we do not have a scale suitable for all these ages,
- Of 11 scales, we have at least two scales for the pediatric age sufficiently reliable, though not suitable for all ages and all the pediatric setting: Braden Q and Glamorgan,
- Unlike other assessment and rating systems, you must retest and revalidate, according to several parameters, each time, contextualizing, the scale that we have chosen, before introducing it in use, time consuming and resource,
- There is no agreement and consensus about the use of sensitivity and specificity as indicators of the performance standards of the rating scales,
- There is no agreement and consensus about the clinical efficacy,
- The predictive value of these tools has rarely been assessed either separately for each item or total,
- Perhaps we have too much meaning attributed to the assessment tools, entrusting to them the identification of patients at risk,
- It is highly likely that the scales do not take account of racial differences and the different colors of skin,
- Scales assess the risk of pressure sores, while we know that, in view of the differences from adults, in children should not talk so much and not always of pressure sores, but skin breakdown (failure of the skin), a term that includes, in addition to pressure sores, all the insults to the skin integrity they see as the main causes friction, moisture, temperature and all the devices in contact with the skin of the child. The prevalence of skin breakdown, purified from pressure sores, is higher than the same pressure sores, and consists primarily of excoriation / diaper dermatitis, skin tears, and IV extravasation sites,
- There is no rationale to use PU risk scales as a quality indicator for care processes,
- As of today, there is no evidence that prevention is more effective if PU risk scales were used,
- The use of rating scales of risk alone does not improve clinical practice,
- Too often in Italy, these scales are used as the sole parameter is necessary to use a surface, both for the choice of type of surface: in the Italian health system we have an extreme need for priority allocation of resources,
- Risk assessment tools should only be used as an aide memoire and should not replace clinical judgment.

One limitation in addition, in pediatric ages, as listed above, is the fact that they assess the risk of pressure sores, while we know that the risk in those aged skin is multivariate and multifactorial, where the pressure is one of many causes: this should lead us to include, among the risk factors for skin, always new elements, such as edema, accepting the challenge of measuring them.

All of these can be considered good reasons for not using risk assessment scales in the pediatric age? Certainly not! But should be considered good reasons to induce us all to some reflection.

It is my opinion that, in addition to disseminate and implement the use of risk assessment scales, paying them a dominant role as an instrument of research and comparison, we should focus our efforts in developing a comprehensive approach to skin hazard in the pediatric age, putting it in a broader logic, mainly organizational, management of risk (such as “Quality Risk Approach”) so as to cover the focus on Quality, and Patient and Health Workers Safety, is intended as a psychophysical, as both in medical and legal responsibilities. We should therefore act on the process and health workers that is on ourselves and our environment, in a combination of training, continuity of care, and organization. Therefore, in this view, be relevant aspects such as skin care programs, documentation, emotional and educational spheres of health professionals, the selection of medical devices and aids, the involvement of parental figures, as far as the
economic policies of the health system, both the micro and the macro, and the exploration of the socio-economic and cultural environments and needs of our youngest patients.

The Braden Q Scale Today
Curley M
Pennsylvania, US

Abstract
Pressure ulcers represent a serious yet preventable iatrogenic injury. Numerous health care organizations track their pressure ulcer prevalence rates to describe, in part, the quality of care they provide within their institution. These data are also used to benchmark care quality across healthcare organizations. To better understand an institution's pressure ulcer rate, it is also important to understand their patient populations' level of risk for pressure ulcers. Successful pressure ulcer prevention programs should be assessed from a perspective of identifying at-risk patients who remain pressure ulcer free.

Tools that describe pressure ulcer risk should predict patients at risk and patients not at risk for pressure ulcer development. The Braden Q Scale for Predicting Pediatric Pressure Ulcer Risk is a widely used valid and reliable pediatric-specific pressure ulcer risk assessment tool. Since its original publication in 1996, requests for clarification on how best to use the tool across the wide spectrum of pediatric patients commonly cared for in health care organizations have been received. Common clarifications focus on using the Braden Q Scale as originally designed; specifically, not using untested derivations of the tool, and not using the Braden Q Scale to predict medical device-related pressure damage. This session will provide practical information on how best to use the Braden Q Scale and how to score a pediatric patient's risk for pressure ulcers. Accurate assessment of patient risk for pressure ulcers is the first step in guiding appropriate interventions that prevent pressure ulcers. Initiating pressure ulcer prevention strategies for at-risk patients, rather than all patients, will optimize the appropriate use of resources.

Risk Assessment Scales: Comparing the Performance of Different Tools. The Glamorgan Scale
Willock J
Wales, UK

Abstract
Glamorgan Paediatric Pressure Ulcer Risk Assessment tool was developed using statistical analysis of paediatric patient data. The data on 336 children (61 with pressure ulcers) was collected from an incidence study, a prevalence study and a multicentre study.

The content validity was established using Chi square analysis of the data and checked by calculating odds ratios of the component risk factors. A binary logistic regression analysis was also carried out.
The face validity was established by discussion with a member of the expert panel of the NPUAP.

The predictive validity was checked by calculating the sensitivity, specificity and area under the receiver operating characteristics (ROC) curve using the original data. A pilot study to assess inter-rater reliability was calculated with a sample of 27 nurses who had received training to use the Glamorgan Scale. A new set of incidence data was collected using the Glamorgan and Braden Q scales, and sensitivity and specificity were calculated. With this set of data the Glamorgan scale had very good sensitivity but poor specificity, in comparison the Braden Q scale had fairly good sensitivity and good specificity.

Is the “Risk” a Well-Known Entity? An AISLeC Multicentric Study
Bascelli E, Peghetti A
Bologna, Italy

Abstract
Not Available.

Pressure Ulcers: Key Words and Key Notes
The Prevalence. Referring to the Number of Cases of a Disease That Are Present in a Particular Population at a Given Time
Schlüer AB
Zurich, Switzerland

Abstract
A pressure ulcer is a localized injury to the skin and/or underlying tissue as a result of pressure, or pressure in combination with shear forces. While this care problem has gained a great deal of attention in adults, far less is known about pressure ulcers in children and neonates. Survival rates of both critically and chronically ill infants and children have improved dramatically in recent years, introducing new challenges for medical and nursing care. Recent investigations indicate that pressure ulcers are also common in infants and children: reported pressure ulcer prevalence rates including all categories range from approximately 3% to 28%. A study conducted in all 14 paediatric hospitals in the German-speaking part of Switzerland with a total number of participants n=412 showed an overall PU prevalence of 35% (including grade 1). Most of the patients (80%) had grade 1 ulcers, most of them caused by external medical devices. Patients in Paediatric Intensive Care Units (PICU) were affected most, followed by neonates and newborns. Conclusion: The prevalence of pressure ulcers in paediatric patients is greater than expected and the problem therefore requires further exploration. The high percentage of grade 1 pressure ulcer requires a focus on interventions to prevent lesions for these patients. Future studies are needed to further assess the risk factors especially for patients in PICU.

Pressure Ulcers in Premature Infants & Neonates
Baharestani, MM
Tennessee, US

Abstract
The epidemiological challenges associated with pressure ulcer (PU) prevalence and incidence determination among premature infants and neonates are multifactorial. In fact, most prevalence and incidence databases either exclude pediatric patients entirely, or lack age stratification in those ≤37 weeks, or < age 1 month; medical device related pressure ulcers (MDRPU) are often not captured, while other wound etiologies may be included, but not specified as such. Illustratively, in two separate studies by Huffiness & Logsdon (1997) (N=32) and Maguire (1999) (N=215) that examined the incidence of skin breakdown among premature infants in the NICU, incidence rates of 19-21% were reported, but ulcer etiologies were not specified. A 2011 Hill-Rom International Pressure Ulcer Prevalence Survey (IPUP) reported a point prevalence (PP) of 1.4% and a facility acquired prevalence (FAP) of 1.2% among those ≤37 weeks gestation (N=495) and PP of 1.6% and FAP 1.1% among neonates aged 1-30 days (N=1,092). Anatomical distribution was not provided and it is unknown if the skin under medical devices was examined. Yet in fourteen separate pediatric studies, MDRPU incidence rates ranged between 13-90%. Most commonly MDRPU occur as a result of pressure/shear forces secondary to nasal continuous positive airway pressure (CPAP), mask CPAP, arm boards, intravenous lines/hubs, head dressings/hats, pulse oximetry, tracheostomy plates/ties, blood pressure cuffs and name bands. Medical device related pressure ulcer development has been reported by Fischer & colleagues (2009) to occur within 3-9 days and incidence and severity to be inversely correlated with gestational age and birth weight. Key to PU prevention is early recognition of medical device related risk, inspection of skin under devices, preventive padding, adherence to manufacturer’ guidelines, use of age appropriate valid and reliable risk assessment tools, staff education, standardized prevention and treatment guidelines and incidence tracking.

Pressure Ulcer Data Collection and Improvement in Patient Safety. Benchmark for Pediatric Patients.
Clark M
Birmingham, UK

Abstract
The past 30 years have witnessed a widespread attention and enthusiasm for counting the number of people with pressure ulcers and the characteristics of these wounds (for example their anatomical location and presumed severity). However comparison between countries, health care organisations and the identification of any longitudinal trends in pressure ulcer occurrence have been hampered by the different methods used to collect information upon pressure ulcer occurrence. The presentation will briefly highlight these problems and discuss the European Pressure Ulcer Advisory Panel (EPUAP), a minimum data set for pressure ulcer prevalence surveys.

One common phenomenon in pressure ulcer surveys has been the general exclusion of paediatric populations. The presentation will review available data on
pressure ulcer occurrence in people aged less than 18 years and then consider the relevance of the EPUAP minimum data set as a means of standardising pressure ulcer data collection from paediatric patients. Finally the presentation will consider approaches used to use pressure ulcer occurrence data as a tool to improve patient safety with the strengths and limitations of these tactics considered in relation to paediatric populations.

Prevention of Conventional Pressure Ulcers Over Boney Prominences in Pediatric Patients
Nie AM, Schafer P, Bailey D, Stange M, Groeschen MA
Ohio, US

Abstract

Purpose. Pediatric patients are at risk for development of pressure ulcers due to decreased mobility/activity, limited and/or heightened neurological responsiveness, fluid retention, excess moisture, poor nutrition, compromised perfusion, the presence of medical devices, and immature skin. The purpose was to prevent pressure ulcers in all hospitalized patients in a large trauma, teaching pediatric medical center.

Methodology. A first prevalence survey was performed in January 2007, showing a facility acquired pressure ulcer rate of 9.2%. During July 2006 and July 2007, there were three facility acquired Stage IV pressure ulcers. All were in teenager/young adults with compromised respiratory status and critically ill when entering the hospital. A team was formed to look at components of pressure ulcer prevention, focusing originally on conventional pressure ulcer. Quarterly pressure ulcer prevalence was performed to evaluate the rate over time. First intervention implemented in March, 2008 were Static Air mattresses that have the capability of adding a pump to the bed to circulate the air for patient’s at high risk for pressure ulcer over bony prominences. A second intervention was the house wide implementation of an air fluidized positioning device in September 2008.

Results. From July 2007 to present, there have been no facility acquired Stage IV pressure ulcers in the medical center. There have been less than 10 conventional Stage III pressure ulcers that developed over the occipital and sacral/coccyx area. The patients were teenagers and young adults.

Conclusion. Accessibility of a pressure redistribution mattress and positioning devices on admission has led to a dramatic decrease in conventional pressure ulcers. There is a need for further exploration of patient age and diagnosis as factors related to the development of conventional pressure ulcers. Is increased pain level and severity of illness related to decrease compliance with repositioning?

Spinal Injury Patients

Pediatric Spinal Cord Lesion
Pascali MP, De Gennaro M, Palma P, Marras CE, Letizia Salsano M, Castelli E, Mosiello G
Rome, Italy
Abstract

This presentation would like to be an introduction to the pediatric Spinal cord lesions (SCL), concerns that will be presented, including demographics, pathophysicsology, manifestations, complications and rehabilitative needs of pediatric patients as well as the natural history in children and adolescents. Unique manifestations and complications of children who presented congenital lesions or were injured at 5 years of age or younger will be compared to older children and adolescents. Diagnostic tools will be presented including a discussion on spinal cord injury without radiologic abnormalities (SCIWORA) and delayed onset of neurologic findings. This overview will also include a discussion on autonomic and bowel dysfunction on the basis of our experience gained during time in our Spina Bifida Center and where actually 370 patients are in follow-up. The pediatric SCL can be classified considering congenital and acquired lesions. In the congenital lesion the most common type is spina bifida (SB) open or closed. Today SB is less common then in the past, due to folic acid supplement during pregnancy. Although rates of SB vary in the different countries, SB affects approximately 8/10,000 live births. The term SB includes: occultaSB, myelomeningocele (MMC), meningocele, and lipomeningocele. The most common location of the malformations is the lumbar and sacral areas and MMC is the most significant form. Disability is mainly related to the level of lesion and open or closed defect.

Pediatric-spinal cord injury (pedSCI) can be related to car accident, sports trauma, surgery and medical treatment. PedSCI received scant attention due to its rarity. In Europe the incidence is documented in Portugal and Sweden (27 children/million children/year and 4.6 children/million children/year respectively). For the other countries, the estimated incidence of pedSCI varied from 0.9-21.2 children/ million children/year in the ages 0-14 years. The management differs between the countries depending on the age of the child and the local organization of health care. Knowledge of incidence and etiology of pedSCI is important in pedSCI is unique with a high percentage of high cervical spinal cord injuries, very often associated to head trauma or politrauma. Particularly unique to children is the lap belt injury. Theoretically the neuro-urological approach is the same in children with spinal cord injury (SCI) and congenital lesions as spina bifida (SB), because urological goals are the same: to establish a satisfactory bladder emptying, to maintaining a safe bladder storage pressure, avoiding infections, in order to prevent upper urinary tract deterioration, with the final goal to reach continence. The importance of neurogenic bladder dysfunction (NBD) has been well described, renal damage remains a real risk and children require a careful evaluation and follow-up because NBD change during time. The management strategies will be not defined by urodynamics studies and urinary tract imaging only, and in our experience a multidisciplinary approach is mandatory. NBD are related to lesion level anyway the approach will be different when a head trauma will be coexisting. The children’s physical limitations, patient’s emotional status, as families social needs may play a critical role determining a different therapeutic strategy in the same clinical situation. Furthermore we have to consider that families’ psychological features are different in SCL or SCI, where often the injury can be related to a parents act. In any case before any surgical reconstruction all available medical management options as well as all endoscopic or minimally invasive procedures should be exhausted. Clean intermittent catheterisation
(CIC) and anticholinergic medications are still the mainstay of NBD management. When CIC may not be instituted vesicostomy button seems to be very useful. It has been suggested that sacral root stimulation facilitates bladder recovery, we have experienced sacral neuromodulation (SNM) in 12 children with incomplete injury and SNM seems to be a promising therapeutic modality for NBD in selected ones. Anyway the most important urological advancement in NBD treatment in these years remains the use of Botulinum toxin A (BontA). From 1997 we have successfully treated 80 children with BontA. For this reason today bladder augmentation it is still a therapeutic option, often associated to a Mitrofanoff procedure but dramatically reduced.

Regarding bladder outlet insufficiency treatment, this may be well managed by bulking agents or fascial sling or urethral lengthening procedures by laparoscopy. Children with SCL presented NBD as well as Bowel dysfunction. Actually bowel dysfunctions are well managed using advanced trans anal irrigation, and Malone procedure indications are reducing during time. Hip subluxation/dislocation can occur especially in congenital SCL or in SCI injured before age 10. Contractures of the joints, most commonly the hips, elbows, knees, and ankles, occur in almost all patients with SCL. Another concern of SCL patients is latex allergy. According to the Spina Bifida Association of America (SBAA); over 73 percent of people with spina bifida develop a latex allergy from mild to life threatening. The common use of latex in medical facilities makes this a particularly serious concern, and the best solution is to treat children in a latex free environment. In conclusion in our mind a child should undergo rehabilitation and treatment including surgery in a specialist paediatric spinal centre to obtain maximum functional and quality of life gain.

Wound Care Challenges in Children and Adults with Spina Bifida: An Open-cohort Study
Ottolini K, Harris AB, Amling JK, Kennelly AM, Phillips LA, Tosi LL
Washington DC, US

Abstract
Most individuals with spina bifida born in the United States now survive into adulthood. This extended longevity has expanded the orthopaedist’s role from enhancing ambulatory function and correcting spinal curvature to treating pressure ulcers resulting from insensate limbs and unprotected activity. Skin breakdown in spina bifida has been largely unexplored. We sought to determine variation in the incidence of pressure ulcers across the lifespan and functional neurologic level in spina bifida; identify the cause and nature of the skin breakdown, particularly looking for evidence of chronic, nonhealing wounds; and to develop criteria to improve wound monitoring.

Patients and Methods. An open-cohort study, examining the hospital and outpatient clinical records of all patients with spina bifida from July 1996 through June 2009, identified all reported wound episodes. Three hundred seventy-five wounds in 123 patients (average age, 18.01 years; range, infancy–56 years) were identified from a clinic population of 376. Current age, age at wound presentation, wound location, gender, weight, functional neurologic level, and presence of a shunt were recorded. Limited
documentation of wound histories restricted analysis. The average length of observation for the 376 spina bifida patients reviewed was 10.2 + 4.1 years.

Results. Patients requiring wheelchair mobility were at highest risk for developing pressure ulcers, particularly in the buttock region, and for having multiple wound breakdown episodes. Ambulatory patients were at high risk for skin breakdown about the feet and ankles. Twenty patients developed chronic wounds.

Conclusion. Most wounds in patients with spina bifida resolve quickly. However, the high incidence of chronic wounds highlights the importance of early identification of nonhealing wounds.

Sacral Ulcers in Childhood: Prevention and Treatment
Pilati C
Rome, Italy

Abstract
More than 50% of all cases of SCI occur in persons aged 16-30 years. The median age is 26.4 years, while the mean age is 31.8 years and the mode age at injury is 19 years. Traumatic SCI is more common in persons younger than 40 years, while non-traumatic SCI is more common in persons older than 40 years.

In a study on pediatric SCI (Vitale and Colleagues), using information from the Kids’ Inpatient Database and the National Trauma Database, it was found that the annual incidence rate of pediatric SCI is 1.99 cases per 100,000 USA children.

The major causative factors of pediatric SCI is reported with the following incidences:
• Motor vehicle accidents - 56%
• Accidental falls - 14%
• Firearm injuries - 9%
• Sports injuries – 7%

Many factors influence the development of pressure ulcers in children, particularly in special populations such as the spinal cord injured patients, but this complication has been less well studied, because of their relative rarity compared to adult populations. Pressure ulcers are most commonly located in the head area, followed by the sacrum, the ischium, the trochanter, and the heel.

Prevention is the key to managing pressure ulcers and it begins with a complete medical and nursing history, a skin examination and a risk assessment when the patient is admitted. All the pathomechanical and pathophysiologic factors that subject the tissue at risk to potential skin breakdown should receive particular attention.

Therefore, nursing plays a pivotal role in preventing this dreaded complication, using a “comprehensive care” approach, involving skin care, pressure relief and nutritional support.

For patients who develop pressure ulcers, these preventive measures must be used with the techniques of general wound care. Non-operative wound care may involve simple topical therapy, as for pressure ulcers with unbroken skin or superficial lesions with non-draining, non-infected granulation tissue. For draining necrotic or infected
lesions, treatment also may include absorption agents, calcium alginate dressings, wound coverings, debridement, and antimicrobial therapy.

Several options, at last, are available for surgical management of pressure ulcers, including direct closure, skin grafting, skin flaps and musculocutaneous flaps. When operative repair is considered, many other factors should be considered as well. The patient should be medically stable and the nutritional status must be considered, because good nutritional parameters are required for good wound healing and immune function.

Spinal Injury Child: From Research to Clinics
Meuli M
Zurich, Switzerland

Abstract
Not Available.

Burns: Stepping Stones

Quality of Pediatric Burn Scars is Improved by Early Administration of Basic Fibroblast Growth Factor
Akita S
Nagasaki, Japan

Abstract
Pediatric burn wounds can be problematic since accurate evaluation is difficult due to anatomically immature vasculature or immobilization failure, especially in second-degree burns, and the burn surface areas and the burn depth tend to worsen over time. Delayed wound healing results in unsightly scarring, such as hypertrophic scars, which are problematic both esthetically and functionally. Among cytokines and growth factors, basic fibroblast growth factor (bFGF) is clinically proven having demonstrated accelerated acute and chronic wound healing.

Accelerated wound healing may lead to improved scarring. To elucidate the effects of bFGF on second-degree pediatric burn wounds, a prospective comparative study was performed. Total 20 pediatric patients, from 8 month to 3 years, average 1 year and 3 month ± 6 months, who suffered from the burns by various causes divided into two groups of conventional (n=10) and bFGF treatment (n=10). A moisture meter, used to objectively measure the stratum corneum and epithelial-mesenchymal functions, was used to assess scars at least one year after wound healing. Clinical evaluation of pigmentation, pliability, height and vascularity demonstrated significant differences between conventional and bFGF-treated scars (1.7 ± 0.55 vs. 0.7 ± 0.58, 2.4 ± 0.82 vs. 1.1 ± 0.69, 1.8 ± 0.66 vs. 0.5 ± 0.57, 1.9 ± 0.63 vs. 0.8 ± 0.68; conventional vs. bFGF-treated, pigmentation, pliability, height and vascularity, respectively, p<0.01). The effective contact coefficient was significantly greater in conventional wounds than bFGF-treated wounds (14.6 ± 1.68 % vs. 8.7 ± 2.82 %; conventional, bFGF, p < 0.01) and bFGF-treated wounds demonstrated significantly less transepidermal water loss (TEWL) values than conventional treatment (8.3 ± 1.90 g/m2/h vs. 5.7 ± 1.85 g/m2/h; conventional, bFGF, p < 0.01). bFGF-treated pediatric burns showed less damaging
function of the stratum corneum after healing both in clinical assessment and moisture meteranalysis.

**Burns of preterm neonates**  
Rimdeika R  
Kaunas, Lithuania

**Abstract**  
Not Available.

**The Surgical Approach to the Burned Child in the Emergency Period**  
Palombo P  
Rome, Italy

**Abstract**  
Surgical treatment of pediatric burns represents a challenge for the surgeon. Children have nearly three times the body surface area (BSA) to body mass ratio of adults. Fluid losses are proportionately higher in children than in adults. Consequently, children have relatively greater fluid resuscitation requirements and more evaporative water loss than adults. Milestones in paediatric burned patients include: resuscitation of the patient and fluid replacement, control of catabolism and weight loss, prevention of infections, early escharectomies and reconstruction phase. Partial-thickness burns are very difficult to manage, especially in the pediatric population in which the correct assessment and the precise treatment can make the difference. In addition, because of disproportionately thin skin, a burn that may initially appear to be of partial thickness in a child may instead be of full thickness in depth. Thus, the child's thin skin may make initial burn depth assessment difficult. The main goal of the surgeon is to preserve dermis vital tissues, selectively taking away burned areas and preparing the wound bed for the best.

**Materials and Methods.** The age of patients varies from three months to 16 years. We took into account the possible treatments, highlighting their advantages and limitations, from surgical debridement with Versajet and/or dermabrasion, to advanced wound dressings containing silver and hyaluronic acid, to dermal substitutes. We developed a treatment protocol for pediatric partial and full thickness burns, which can easily help us in the management of these complex patients.

**Results.** Timeliness and selectivity of surgical treatment are crucial in order to preserve the healthy dermis areas. We also recommend the use of medications that control the infection and promote the formation of granulation tissue suitable for grafting or spontaneous recovery. It’s essential to distinguish between children and adults: in the first, where possible, we tend to use all available means to obtain a spontaneous healing ensuring a good quality scar; in the latter, on the contrary, the use of grafts, even today, is followed by the best cosmetic results. We highlight the use of Versajet (and dermabrasion) to preserve healthy skin and Hyalosilver and Hyalomatrix, in selected areas, to get a bed suitable for a subsequent reparative surgery with better cosmetic outcomes.
Conclusion. A fast restitution ad integrum is the gold standard in burn treatment. In order to achieve this goal the time between the necrotic area toilet and the lesion repair should be reduced to a minimum in order to avoid the deepening of the damage. In partial-thickness burns, it is well known that there are areas with different degrees of dermis involvement and only a conservative approach allows preserving healthy tissue.

The development of new materials and devices that help prevent infection and promote optimal healing brought us closer to achieving the result. They allow less invasive and better cosmetic result in partial thickness burns. In full-thickness burns, where the graft is unavoidable, they support the preparation of a perfect bed.

In children we believe that a conservative treatment is mandatory because of the strong tendency for scar hypertrophy, even with the use of grafts. One must use all those methods able to preserve healthy tissue and to better prepare the wound bed, so as to promote the best final cosmetic and functional result.

**Burns in Children: Emergency and Surgical Checklist**

Pancani S, Pinzauti E, D’Asta F, Messineo A
Florence, Italy

**Abstract**

Severe burns in children require an emergency surgical approach with possible need of escarotomy incisions in order to relieve compartment syndromes and central lines insertion, together with peculiar surgical procedures directly related to burn wound management. According to our protocol, patients with partial thickness burns are taken to the OR within 24 – 48 hours after the accident for dermabrasion. The debrided areas are then covered with skin substitutes. We generally use Biobran™*, (a temporary biosynthetic, conformable wound cover constructed of a silicone film bonded to a three-dimensional cross-linked nylon fabric, coated with porcine collagen peptides) or porcine derived xenografts. In the post-op period, dressings are moistened with a silver nitrate solution and are inspected on the third day after surgical procedure. On the basis of a schedule, a hydrotherapy session is performed and skin substitutes are gently removed. As soon as possible, tangential necrectomy and autologous skin grafting are then performed on the wounds not yet completely healed.

**Treatment of Burns in Children with Collagen Dressings**

Treadwell T
Alabama, US

**Abstract**

Burns, especially in children, continue to be one of the most common injuries around the world. Appropriate treatment of burns is critical to reduce mortality for extensive burns, to minimize complications of the burn injury, to lessen pain and scarring, and to reduce or prevent disability. Many times children suffering from second degree (superficial or deep partial thickness) burns are not treated aggressively since the burns...
Topical Therapy for Wound Lesions

Topical Wound Repair: From Negative Pressure Therapy to Erythropoietin
Teot L
Montpellier, France

Abstract
Topical wound repair is representing the cosmogony of wound care specialists. Surgeons, nurses, and physicians coming from multiple specialties attempt to propose, develop and defend the outcomes of a large evantail of devices and technologies. Among them a relatively small number of solutions look promising, seen from the clinician perspective. The last two decades have been rich in novelties, from the negative pressure therapy which emerged in 1994 as a « wow solution » for surgeons confronted to unhealable wounds, to high tech research derived molecules aiming to influence the cells, replace the impaired cells by bringing stem cells or to direct actions over cell genes, the new field of wound healing has gone out from the borders of science and touch now the ethical perspectives.

This official recognition by accumulation of numbers of new technologies regularly emerging is based on a new approach of chronic wounds, independent from age and related to local and general metabolic disorders. Wound healing represents a synthetic field of medicine, where contradictions are accepted as far as demonstrations of evidence can confirm the new proposals.

Hyperbaric Oxygen Treatment of Superficial Soft Tissue Lesions in Children
Cesca E, Garetto G, Frascella E, Cesaro S, Dall’Igna P, Cecchetto G
Montpellier, France

Abstract
Objective. To assess the feasibility and results of hyperbaric oxygen treatment therapy as supportive treatment of lesions of superficial soft tissues in children.

Design. A retrospective analysis and review of all records of children observed at Pediatric Department of the University of Padua and treated with HBO as adjuvant therapy.
Results. Between 1996 and 2010 28 patients were collected. The effectiveness of HBO therapy depended on the lesion treated. Twenty-six out of 28 patients were cured. The efficacy was mostly questionable in 2 patients with skin graft and flaps at risk. Compliance to therapy was close to 100%. In just one case HBO was interrupted for the appearance of local skin metastases close to the site of primary tumor.

Conclusion. HBO therapy revealed safe and effective in most patients (83%), even immunocompromised or critically ill children.

Device-related Pressure Ulcers in Pediatric Patients: Image Analysis and Strategies for Prevention
Nie AM, Visscher M, Schaffer P, Myers C, Mack L, Cahill T
Ohio, US

Abstract

Purpose. Pediatric patients are at risk for pressure ulcers (PU) due to compromised perfusion, decreased mobility, poor nutrition, limited and/or heightened neurological responsiveness, fluid retention, excess moisture, the presence of devices and immature skin (neonates). Inherent skin properties, eg, integrity, in the diverse hospitalized pediatric population can vary substantially, particularly in premature neonates where skin maturation continues well after birth. The purpose was to examine the ontogeny, severity and causative factors associated with facemask related pressure ulcers among patients in the high-risk units of a pediatric academic center.

Methodology. A descriptive retrospective review was conducted among patients in four high-risk units (NICU, PICU, Trach/vent unit, and rehabilitation unit) biweekly from September 2007 to October 2009 to identify the characteristics and causes of pressure ulcers. Subsequently, prospective assessments were made among patients wearing facemasks for respiratory support. The skin condition was evaluated over time using digital, thermal and three-dimensional imaging and measures of skin hydration. Frequency data within the population of patients with pressure ulcers was compared using z-tests (p < 0.05).

Results. The occurrence rate was 7.3% from 276 PUs in 3779 patients and the frequencies by stage were 26% stage I, 53% stage II, 11% stage III, 0% stage IV, 7.6% unstageable and 1.4% deep tissue injury. Medical devices accounted for 62%, in contrast to “conventional” PUs (e.g., over bony prominences) at 36%. The majority of device-related PUs (38 of 173) was caused by facemasks of which 58% were stage II and 16% were stage III. Most were on the nose (bridge). Some patients developed stage II ulcers within hours of mask application. Areas of early skin breakdown could be observed from analysis of serial images over time. Thermal images taken after mask removal revealed variation in temperature (attributed to perfusion) at the points of mask contact. Skin hydration was significantly higher for those points relative to adjacent (control) areas and to hydration prior to mask application.

Conclusion. The high frequency of stage II PUs is of particular concern as some may advance to more severe stages III and IV. Increased moisture over time can cause skin maceration and exacerbate shear effects. Success in early detection via digital and thermal imaging methods facilitate optimization of mask fit and reduce the skin trauma.
Systematic research to identify and/or develop better fitting BiPAP and CPAP masks for the pediatric population is essential. Studies to evaluate interventions designed to reduce moisture under the mask are underway.

Negative Pressure Wound Therapy: Standpoints in Childhood

Use of Negative Pressure Wound Therapy in Pediatrics
Baharestani MM
Tennessee, US

Abstract
Negative Pressure Wound Therapy (NPWT) is an adjunctive tool that has revolutionized wound care. While the clinical benefits of NPWT are multiple, the exponential proliferation of granulation tissue, decreased interstitial edema and bacterial clearance remain the cornerstones of therapy. Currently there are 1,161 NPWT related peer-reviewed articles published in English. Ninety-two percent (n=1,071) exclusively utilized the V.A.C.® Therapy System, 3% (n=30) used other commercial NPWT systems and 5% (n=60) used improvised systems. Only 5% (n=63) of these articles addressed NPWT in pediatric populations. Of the 63 pediatric specific articles, 29% were retrospective reviews, 66% were case descriptions and 5% were guidelines/reviews with a total of 632 patients treated. Ninety-one percent used the V.A.C.® Therapy System, 3% gauze-based and 6% were improvised systems. The most common pediatric wound types treated with NPWT were: post-sternotomy mediastinitis, fasciotomies post-compartment release, spinal cases, dehiscence secondary to surgical site infections, pressure ulcers, trauma, degloving injuries, pilonidal cyst excisions, necrotizing fasciitis and complicated gastroschisis/omphalocele repairs.

Overall NPWT has been reported to be safe and effective in the pediatric published literature. The infrequent complications in pediatric patients treated with NPWT that have been reported include: enterocutaneous fistula, hemorrhage from grafts and donor sites, retained sponge in the wound, minor bleeding, epidermal stripping/dermatitis and pain with dressing changes. According to the FDA (2011) the safety and effectiveness of NPWT in newborns, infants and children has not been established and there are no NPWT systems cleared for use in these populations. Thus the use of NPWT in pediatric patients is considered off-label.

Safety measures which should be implemented when using NPWT off-label in pediatric patients include, but are not limited to the following: use of smaller canisters, monitoring for excessive fluid loss and dehydration, pre-filling canisters to within acceptable fluid loss levels, protecting fragile periwound skin, consider using polyvinyl-alcohol foam to limit tissue in-growth and aligning pressure settings with mean arterial pressure in neonates and infants in critical care.

Negative Pressure Wound Therapy in Pediatric Age
Ciprandi G
Palidoro, Italy
Abstract

Introduction. NPWT has several current areas of application in all pediatric ages, from 0 to 18 years, without excluding the newborn and premature babies. Differentiating the pressure used, either congenital defects with ample skin-muscle (exomphalos) and post-traumatic or iatrogenic lesions (pressure ulcers, postsurgical dehiscence) may heal up to full re-epithelialization. The adaptability to lesions with I-II-III degree infection and on the other hand, the low complication rate reported in scientific literature are an ideal background for the use of NPWT in children.

Materials and methods. From January 2008 to November 2010, 60 patients (88 lesions – average age 8.5 years) were treated at the Center for Wound Care Surgery of the Department of Surgery and Transplant Center of the Bambino Gesu' Children's Hospital of Palidoro. 25% of the patients were less than 1 year old. Careful parental counseling and the presentation of the device to patients older than 5 years old always preceded application. The group with pressure ulcers, dehiscence (including complicated ostomy), recurring pilonidal lesions and spinal injuries make up 82% of the indications. The protocol excluded from the study patients with lymphedema, coagulation disorders, and diseases of the erythroid series, diabetes, and pathological obesity. Changes were performed every 72 hours (+/- 24 hours), without sedation, with modulation of negative pressure from 60 to 80mmHg, only in some cases over 10 years of age up to 104mmHg. Three main parameters were evaluated: the % of reduction of the lesion after 4 weeks of treatment, the pain and the acceptability of the method, the effects on the surrounding skin.

Results. Complete or nearly complete closure (80-90%) was obtained in 88% of the lesions: 62% closed by secondary intention, 8% with delayed primary closure. Twelve percent of the lesions were treated with major surgery (skin grafts, rotational flaps). Pain upon removal has never been reported, nor have incidents been observed affecting the skin surrounding the wound. Among the complications, in three lesions there was a mild bleeding from hypergranulation. No patient had premature remission of the device due to rejection of the method and no one migrated to a different therapeutic method. One patient was lost at the follow-up. Twelve percent of the lesions showed effective improvement: in all cases there was a polymicrobial infection from Methicillin-resistant Staphylococcus aureus (MRSA).

Conclusion. NPWT can be effectively applied to severe injuries and infections in patients admitted to the TIP and neonatal wards and can help accelerate healing of defects resulting from congenital lesions. The effectiveness of the methodology is completely independent of the location of the lesion and age, but is influenced by the ineffectiveness of the treatment for existing polymicrobial disease and mishandling of the "wound bed preparation" prior applying the NPWT. Indispensable requisites in pediatric age are the preparation of a team, parental counseling, also with the help of a psychologist, and the optimal choice of Negative Pressure to be used. The discontinuity of treatment may positively influence the subsequent course of the lesion. Follow-up of the lesion, with verification of the stability of the new tissue, must not be scheduled sooner than 3-6 months.

Focus on: The Bone Health Program
Tosi L  
Washington, DC, US  

Abstract  
Not Available.

Principles and Applications of VAC Instill in Childhood  
Bassetto F  
Padua, Italy  

Abstract  
Despite a still partial knowledge regarding the mechanisms of action and effectiveness of negative pressure therapy that are still under experimental and clinical investigation, the treatment has proved to be an efficient support in a plethora of cases. Thus, even if it has been mainly employed in adults, pediatric cases are growing in number since the enhanced potential of the therapy in association to the innate regenerative-healing capabilities of children. Epidemiologically, large traumatic injuries account for most of the pediatric cases that also include congenital defects and post-surgical sequelae. In these patients and in these clinical settings the highlighted features of negative pressure therapy give their optimal contribution in terms of reduction of the bacterial load, decrease of the tissue edema and osmotic pressure, increase in vasculogenesis and mesenchymal proliferation due to mechanical stimulation, stimulation of wound contraction and closure. Each of these features is emphasized in the healing pediatric patient. Nevertheless, the still partially immature immune system of these patients should pose a precise attention over appropriate cleaning of the wound and prophylaxis/treatment of any sovra-infection: in this light the therapeutic chances offered by a custom device can provide a considerable reduction of complications with a valuable improvement of clinical results. Therefore, negative pressure therapy represent a valid clinical support in the pediatric patient, as well as devices for custom wound on-site delivery of washing fluids or antibacterial topical treatments, and further clinical/experimental investigation should be stimulated.

Vacuum Drainage in the Management of Complicated Abdominal Wound Dehiscence in Children  
Pauniaho SL  
Seinäjoki, Finland

Abstract  
Vacuum-assisted closure (VAC) therapy is the intermittent or continuous controlled application of subatmospheric pressure to a wound. The VAC therapy helps to promote wound healing by removing exudate, approximating the wound margins, reducing edema, promoting granulation tissue formation, and increasing perfusion.¹

The management of an open abdominal wound is particularly challenging when combined with enteric fistula, enterostomy, bowel anastomosis, or patch abdominoplasty. The decision to apply VAC to a complex dehisced abdominal wound often arises in the
setting of previous failure of surgical control, where the relative risks posed by a recent anastomosis or fistula are subordinate to the risk of worsening the situation at further laparotomy.

In complex dehisced abdominal wounds treated with VAC, exposed bowel must be protected with one or more layers of a fine-meshed nonadherent material interposed between the foam dressing and the underlying bowel. Dressings are usually changed every 48 hours.

There is some experimental evidence that intermittent rather than continuous vacuum therapy promotes more active granulation tissue formation. However, when there is exposure to enteric content in the wound, the continuous vacuum modality may be more beneficial.

The application of VAC in the setting of recent anastomoses and enterocutaneous fistulae remains controversial. In our series that also included premature infants, we found VAC therapy useful in managing established fistulae. However, our results suggest that recent bowel anastomoses may be compromised using VAC, which in this circumstance, should be used with caution.

As local sepsis comes under control and wounds granulate, conventional dressings can often be reinstated. The requirement for VAC dressings therefore has to be continuously reevaluated according to clinical need.

The associated discomfort of frequent dressing changes significantly affects the patient's quality of life. In our experience, VAC dressing application has simplified the management of these complex wounds. The dressings are comfortable and well tolerated by children. We advocate caution in the setting of an anastomosis that has not been defunctioned but would recommend early application of VAC with an established enteric fistula.

Fig 1. Twelve-week old girl born at 25 weeks of gestation with perforate necrotizing enterocolitis

Fig 2. Same patient 5 days after the completion of one continuous series of VAC treatments lasting 14 days with 7 dressing changes.

References


**Deep Infections in Neuromuscular Scoliosis: A NPWT Approach**
De Klerk, L
Rotterdam, The Netherlands

**Abstract**

The risks in scoliosis surgery in pediatric patients include neurological damage or deterioration, (deep) infection, pseudarthrosis and failure of instrumentation. Patients with a neuromuscular scoliosis are even more prone to these complications. Surgery in neuromuscular scoliosis is associated with increased bleeding, less satisfactory bone stock, the need for a longer fusion, and a higher risk of infection because of metabolic compromise and the length of the spinal fusion procedure. Diminished pulmonary function, seizures and mental retardation often contribute to the increased risk. The infection rate in neuromuscular scoliosis surgery ranges from 4% to 20%. Treatment of these infections is a challenging problem, especially in the early postoperative period. Because fusion has not yet been established, removal of the instrumentation will probably result in a severe progressive deformity. Therefore, removal of instrumentation should be avoided whenever possible. At present, treatment of infections consists of surgical debridement and irrigation, whether open or closed. Up to 28% removal of instrumentation has been reported in order to achieve control of the infection.

Between 2001 and 2005 six consecutive patients with a neuromuscular scoliosis with a deep wound infection have been treated the Vacuum-assisted wound closure system (NPWT). Wound closure averaged 3 months. Infection parameters were normalized within 6 weeks. Removal of instrumentation was not necessary in any patient, and there were no signs of infection at 48 months follow-up.

The use of vacuum-assisted wound closure combined with antibiotics can be a good solution for treatment of deep wound infections after instrumented spinal fusions. It is safe and probably helps to prevent removal of the spinal instrumentation and extensive and multiple surgical debridement.

**Infected Skin Lesions: The Real Broad-Spectrum Challenge**

**Wound Cleansing in a Modern Era**

Percival SL
Manchester, UK
Abstract

The human body is known to support the growth of an estimated $10^{14}$ cells with only 10% of these cells classed as mammalian and the rest being prokaryotic. The prokaryotic cells constitute the microbiota of the body and have the ability to contaminate a wound. Once a wound is contaminated with microorganisms, preventing their proliferation becomes very important. This is because microorganisms are known to affect wound healing. Other factors, including the presence of non-viable or devitalised tissue, also constitute a concern to effective wound healing. This is because devitalised tissue and slough on a wound stimulates an inflammatory response and biofilm formation.

Healthy patients in general have a competent immune response, which naturally helps to cleanse the wound of contaminating microorganisms and debris. However, immuno-compromised patients often need assistance to help reduce the wound microbial bioburden and level of necrotic tissue. Devitalised tissue, together with microorganisms, can generally be removed via debridement. However, loosely attached devitalised tissue has also been shown to be removed with appropriate irrigation and cleansing agents. Wound cleansing has been defined as a process to ‘remove surface contaminants, bacteria and remnants of previous dressings from the wound surface and its surrounding skin’. Later, as documented in the Cochrane Collaboration Review cleansing was defined as ‘the use of fluids to remove loosely adherent debris and necrotic tissue from the wound surface’. Interestingly whilst the Cochrane Review definition is the most recent definition it lacks any reference to the removal of microorganisms and more importantly biofilm, both of which represent a major issue in non-healing wounds and infection.

Historically employed cleansing agents have included saline and sterile water. There is a vast array of evidence that has been generated over the last twenty years that support the use of agents such as water and saline for cleansing wounds. Although normal saline is most widely used for wound cleansing there is mounting evidence that suggests tap water is equally as effective and constitutes a cost-effective alternative to sterile saline. The value of saline and water as wound cleansing agents during the 1980s and early 1990s became significant to wound care because of the mounting in vitro evidence that the use of topical antiseptics were harmful to healing tissue. In particular the hypochlorites and iodine’s were considered to adversely affect wound healing although, their ability to help debride a wound was well recognised. Because of these early concerns with antiseptics many of these agents are still today stigmatised with cytotoxicity concerns today. Recently however a large number of publications have demonstrated that many cleansing agents containing appropriate antiseptics, when compared with sterile saline as an example, have positive effects on wound healing.

As the science of wound healing undergoes a paradigm shift towards biofilmology the use of cleansing agents containing antiseptics has become an even more important tool in our wound management toolbox. Biofilms are complex microbial communities embedded in an extracellular matrix of proteins, nucleic acids and polysaccharides often attached to a surface. They have inherent resistance to the body’s immune response and antimicrobial agents. Consequently a different management approach is required in wound care for the removal of biofilms, an approach now being employed in other medical conditions.
In summary, many studies have highlighted the positive benefits of using water or saline in cleansing wounds. However, it is now clear that a wound cleanser with an appropriate antiseptic will more significantly help to reduce the wounds microbial bioburden and to a small degree the biofilm. As all chronic wounds are considered to be infected with a biofilm it is now more important for us to rethink our approach to wound cleansing and avoid being influenced by historical interventions that were employed prior to the biofilm era.

Technique Protocol for Microbiological Sampling of Infected Pressure Ulcers
Carletti M
Rome, Italy

Abstract
The numerical determination of the number of bacteria in a wound has an important role in clinical practice, in order to predict the risk of infection and the chances of recovery. In addition, the microbial count is important to monitor the healing of the lesion. To do this, the gold standard for quantitative determination would be the biopsy, however, in addition to being traumatic for the patient, it is not a routine practice. For this reason we have revalued noninvasive microbiological sampling techniques, such as sampling by swab. Today we have flocked swabs to absorb larger volumes of sample and release in the transport medium over 95% of the sample, compared with traditional rayon swabs. With flocked swabs, standardizing the collection, and with the aid of an instrument capable of performing the bacterial count in a few hours, you can fully assess a wound. The accuracy and timeliness of this information has a significant impact on patient care and monitoring of wound healing.

Safe Topical Antimicrobial Use in Paediatric Wounds
Denyer J
London, UK

Abstract
Epidermolysis bullosa encompasses a group of genetically determined blistering and skin fragility syndromes. The inheritance pattern is dominant or recessive and within each group there is a wide scale of severity.

In common with other genetic disorders those with dominant forms tend to be less severely affected.

EB predisposes to the formation of chronic wounds many of which become critically colonised and infected at an early age. These wounds may indeed be described as palliative as the stakes against healing are high – the underlying gene defect refuses to give strength to healed skin, scarring in the dystrophic form causes increasing fragility and in the older patient the stem cells become exhausted and can no longer fulfil their function. In addition to all these obstacles noncutaneous complication such as anaemia, chronic pain, colitis, cachexia and chronic inflammation further impede the potential to heal.
This talk will discuss the role of anti microbial products and in particular use of silver dressings in children with epidermolysis bullosa. The challenges faced in caring for children with this complex condition mean management is applicable to other paediatric wounds.

Whilst many complications of EB are insurmountable with emphasis of medical management placed on symptom relief and improved quality of life; reduction of the bioburden in chronic wounds undoubtedly increases their potential to heal albeit transiently. The added benefits of reduction in levels of pain, exudate and odour help to allow better acceptance in social situations, in school and within their peer group.

Wound care products that have the potential to reduce the bioburden are therefore helpful. Without an antimicrobial agent colonization is rapid and risk of infection raised. In line with other caregivers our service aims to minimise the use of systemic antibiotics as the risk of development of resistant organisms is high.

It is important to consider products in terms of comfort and patient choice, safety and ability to perform over a long period of time.

Many children with chronic wounds suffer from neuropathic pain and refuse application of creams or ointments. For this group impregnated dressings are preferable.

Whilst silver dressings are very effective we have experienced raised silver serum plasma levels following their long-term use and these should be used with caution and monitored carefully. We recommend silver dressings be used for a maximum of two weeks.

Evaluation of treatment should be undertaken regularly with changes of the antimicrobial agent recommended if no improvement.

Topical antimicrobial agents used within our caseload include glucose oxidase-lactoperoxidase alginate gel, honey, and DACC coated dressings.

The Light Scattering Microbiological Analysis: New Perspectives in Rapid and Accurate Assessment of Infected Wounds
Di Felice G
Rome, Italy

Abstract
The current bacterial detection systems of biological material is provided for cultivation by the use of Petri dishes containing soil for the specific detection of various species and manual colony counter, with reading times between 24 and 48 hours. The HB&L is an automated analyzer that allows the execution of the bacterial culture, the quest for power antimicrobial residue (PAR test) and sensitivity of different human body fluids in 3-6 hours. The system uses "light scattering" in which a laser beam is directed to specific tubes containing the broth and inoculated samples, and the signals that arise from the diffusion (scattering) of light is recorded at regular intervals, analyzed, processed using special software and patented and translated into growth curves. Analysis of the kinetics of growth provides the count of any bacteria (CFU/ml) in a very short time. Thanks to the patented software tool returns a result on the actual viability of the bacteria may be present, eliminating the non-specificity due to the presence of leukocytes, erythrocytes, cell exfoliation, and others.
**Skin Substitutes: Searching the Best One**

**Skin Substitutes: An Overview**
Laeuchli S
Zürich, Switzerland

**Abstract**

The treatment of chronic wounds typically involves diagnosing and treating the underlying cause of the wound, optimal wound bed preparation and considering patient centered concerns. Wound bed preparation includes removing debris and dead cells from the wound bed, controlling infection, establishing moisture balance and promoting epithelialisation of the wound. To speed epithelialisation, the most common tools are skin grafts and skin substitutes. In the past few years, a wide choice of skin substitutes has been developed and some products are already marketed in many countries.

Skin substitutes are tissue-engineered products that are either acellular or cellular. They can support some of the functions of fibroblasts and keratinocytes such as promoting cell migration, angiogenesis and growth factors. Amongst the cellular products, the epidermal substitutes with keratinocytes aid epithelialisation whilst the dermal or composite substitutes stimulate many factors in wound healing effectively. The acellular products mainly provide a scaffold with an extracellular matrix from naturally occurring substances or synthetic materials, directing cell differentiation and thus accelerating tissue regeneration.

Whilst the experience in pediatric patients is limited, there is vast clinical experience in many types of chronic wounds with some of the available skin substitutes and several examples will be shown.

**Current and Upcoming Applications of Biomatrices and Biological Materials to Pediatric Wounds**
Mulder G
California, US

**Abstract**

The past 3 decades have witnessed an unprecedented growth of wound care products progressing from simple dressings to medications and biological products. Currently, biomatrices and biological materials have become one of the newer modalities used to expedite tissue repair. The majority of new products have focused on problematic and chronic wounds including pressure, venous and diabetic ulcers presenting on the adult population. Clinical research trials and indications have been primarily for the non-pediatric population although product characteristics and function are not necessarily determined by patient age. This presentation will focus on the various biological materials that may be considered for pediatric use including their overall safety, effectiveness, and characteristics. Possible applications to expedite closure of pediatric wounds will also be presented. It is important to stress that the clinical data available...
relevant to pediatric use is extremely limited and warrants more extensive investigation and publication.

Tissue Engineered Skin in Infants and Children
Treadwell T
Alabama, US

Abstract
Skin defects can occur in infants and children as a result of congenital problems, trauma, burns, operative procedures, and medical interventions. All these problems require restoration of the integrity of the skin. Tissue repair techniques used on adults do not always result in a satisfactory outcome since infants and children may respond differently to interventional procedures than do adults. Our experience with bi-layered, living cell, tissue engineered skin for the treatment of infants and children with skin defects from pressure ulcers, burns, trauma, and interventional therapies has shown superior efficacy and safety in this group of patients compared to conventional therapies. The speed of healing with this advanced therapeutic product seems to make it ideal for the treatment of these young patients.

Scar Wars- Use of Dermal Templates in Reconstructive Surgery After Burn Injuries in Children
Schiestl C
Zürich, Switzerland

Abstract
Post-burn hypertrophic scars and keloids can cause severe functional impairment as well as devastating disfigurement, especially in the growing organism. Despite early and vigorously installed scar prevention regimens including physiotherapy, occupational therapy, pressure garments, contact media, and splints, post-burn reconstructive surgery is quite often mandatory to solve problems refractory to conservative measures. In fact, scar revision and postoperative management remains a major challenge in the field of reconstructive surgery, especially in infants who do not understand rationales and may have difficulties to comply with rules.

Integra Artificial Skin®, a biosynthetic dermal template, is well established in acute burn surgery. The aim of my presentation after an experience for more than 10 years using this innovative dermal substitute is to illustrate the role of Integra in the surgical treatment of post-burn scars in children. I want to demonstrate that Integra can be successfully used as a novel technique for extensive post-burn scar revisions in younger patients. In particular, our more than 50 cases illustrates that this rather intricate and long-lasting surgical two-step procedure is reliably applicable especially when extensive scar areas in challenging locations are to be treated. It is associated with a relatively low complication rate, and yields very satisfactory long-term results with regard to both function and cosmesis.
I also want to present technically details: it is of paramount importance to implant Integra only after having achieved perfect hemostasis. Furthermore we highly recommend applying the V.A.C. System running as a fixation device.

Also, we have learned that complex reconstructions warrant hospitalisation for the entire duration of both surgical steps, i.e. 5-6 weeks in total.

Finally, we advocate exactly the same standard scar prevention program as for any other grafted patient. Although we have not formally addressed this point in our study, we noted that skin maturation occurred earlier than usually seen in conventionally grafted patients (about 8 months versus 12–18 months).

Of note, we do not claim that Integra should substitute other methods, but we distinctly suggest that this technique is a valid addition to the current options. In our opinion, the classical indication is a large scarred area (with or without contracture) covering several percents of TBSA in any location of the body where tissue expansion and/or flap techniques cannot solve the problem either because of the location, paucity of healthy skin, or the sheer size of the lesion.

In summary Integra is a valid new option for post-burn scar revision in adolescence. It appears efficient, safe, and yields excellent functional and cosmetic long-term results in most cases. We feel that the ultimately favorable outcomes justify long-lasting two-step surgical procedures requiring enormous compliance and endurance from patients and parents.

Skin Substitutes, Advanced Dressings and the Conservative Management of Skin Lesions in Children
Pancani S, Pinzauti E, D’Asta F, Messineo A
Florence, Italy

Abstract
Skin substitutes and advanced dressings are commonly used in the therapy of superficial II degree - deep II degree burns as well in skin/soft tissues losses. These products, improving healing time and stimulating epithelial growth, frequently allow these lesions to heal without the need of any surgical procedure.

Authors describe a series of challenging wounds, conservatively treated, for whom surgical therapy was impossible to perform or not indicated (burns of face and external genitalia, major occipital encephalocele, bleeding angioma of the buttock in a newborn, necrotizing fasciitis of the dorsum).

According to author, who has been using skin substitutes and advanced dressings since several years, they appear to be an extremely useful tool in the treatment of children with peculiar skin and soft tissues lesions, even during neonatal period.

Tissue Repair, Regeneration and Scarring

Wound Healing and Blastema Formation in Regenerating Digit Tips
Bassetto F
Padua, Italy
Abstract
Clinical experience and experimental investigation has shown that healing in children is led by significant regenerative potential. In hand surgery the replantation of distal digital amputated tips represent a typical clinical situation: despite advancement and innovations in microsurgical techniques, replantation cannot always provide an effective results for distal injuries. In these cases composite graft of the amputated segment is still the gold standard treatment. Survival of composite graft in children has been demonstrated to be supported by the reduced volumes of ischemic tissue and the sustainable distances for diffusion of substances and cells but these features may not explain alone the observed phenomenon and the differences with adult patients. Recently, an increasing number of in-vivo animal studies has shown how the presence of residual stem cells in the apex of limbs is responsible for the creation of a blastema that provides limb regeneration. Similarly, fingertips of pediatric patients may lead to the formation of a blastema-like nucleus promoting the healing of injured fingers, composite grafts and distally replanted digits. Despite clinical evidence and diffused consensus regarding surgical management, further investigation regarding the regenerative potential of digit tips in children, their evolution over years and their employment as a therapeutic tool should be more actively supported.

Tissue Repair and Regeneration in Foetal and Paediatric Surgery: Focus on Research
Saxena AK
Graz, Austria

Abstract
Out of all of the surgical specialisations, the remit of the pediatric surgeon encompasses the widest range of organ systems and includes disorders from the fetus to the adolescent. As such, the recent emergence of tissue engineering, in the field of regenerative medicine, is of particular interest to the pediatric surgical community. Tissue engineering is a multidisciplinary subject, combining the principles of physical and chemical engineering with those of the biological sciences, with the aim of restoring loss function to diseased or damaged tissues and organs. The individual challenges of tissue engineering depend largely on the nature and function of the target tissue. In general, the main issues currently under investigation include, but are not limited to, the sourcing of an appropriate cell source, design of biomaterials for guided tissue growth, provision of a biomolecular stimulus to enhance cellular functions and the development of bioreactors to allow for prolonged periods of cell culture under specific physiological conditions. This presentation aims to provide a general overview of tissue engineering in the major organ systems, including the cardiovascular, digestive, urinary, respiratory, musculoskeletal, nervous, integumentary and lymphatic systems. Especial attention is given to pediatrics as well as recent clinical applications.

Pathologic Scars: An Overview of Surgical Therapies
Teot L
Montpellier, Italy

Abstract
Scars have been at the origin of most of the new technical improvements in plastic surgery. The recently developed microsurgery, in the 1970s, was immediately applied on extensive pathologic scars, in order to excise scars and replace the skin and the surface of the body. Skin grafting was left apart. However flaps were not a panacea, and irregularities of surface, cake flaps and nonmatching colours were noted, especially in children where each part of the body has its own specificity.

The emergence of negative pressure therapy in the late 1990s signed a revival of the layer-by-layer reconstruction of the skin, especially when dermal substitutes appeared as a complementary option for skin reconstruction. Excision was followed by a controlled promotion of granulation tissue, covered using dermal substitute and skin graft or thin flaps. Skin gaps and adherences to the floor could be prevented.

New technologies in dermal replacement were developed more recently, using collagen and elastin, bringing hyaluronic acid in the substitute and offering a scaffold for matrix cell recolonisation.

Cell cultures were initially promising but the absence of underlying dermal component complicates the issues in tem of scarring, creating adherences to the underlying structures. However, recently developed local cell stimulation techniques, focused on skin keratinocytes coming from the patient himself and done in the OR, offer a new techniques for colour matching resurfacing techniques.

Surgeons should be aware of these complementary technologies in managing scars. New international guidelines are on their way.

Tissue Engineered Skin Substitutes for Pediatric Ages
Meuli M
Zurich, Switzerland

Abstract
Not Available.

Gauntlets: Everything but Medieval Gloves

Surgical Treatment of Dystrophic Epidermolysis Bullosa
Rimdeika R
Kaunas, Lithuania

Abstract
The term Epidermolysis Bullosa (EB) refers a group of disorders best characterized by blister formation as the result of skin fragility. Clinical manifestations range widely, from localized blistering of the limbs to generalized blistering of the skin and oral cavity, and injuries to multiple internal organs. EB subtypes are known to arise from mutations within the genes encoding for several different proteins, each of which is
intimately involved in the maintenance of adhesion of the keratinocyte to the underlying dermis or structural keratinocyte stability. EB is best diagnosed and subclassified by the collective findings obtained via detailed personal and family history, in concert with the results of various laboratory findings. All types and subtypes of EB are rare; the overall incidence and prevalence of the disease is approximately 50 per one million live births and 9 per one million population. Out of these 92 percent are cases referred to EB Simplex and 5 percent of referred to Dystrophic EB. Optimal patient management requires a multidisciplinary approach, and involves the injury prevention of susceptible tissues, use of advanced wound dressings, nutritional support, and adequate medical or surgical interventions to correct whenever possible the extracutaneous complications. Prognosis varies considerably and is based on both EB subtype and the overall health of the patient.

The hands and feet due to intensive use during normal daily activity are especially exposed to blistering, with secondary scarring leading to pseudosyndactily, adduction contracture of the thumb, and flexion or extension contracture of the fingers. The standard surgical approach for the correction of these deformities is based on the degloving of affected limb, combined blunt-to-sharp release of pseudosyndactily and contractures, skin grafting of the secondary wounds.

Author will give a short overview on classification, etiology, epidemiology, diagnostics of various subtypes of EB, as well as personal approach to surgical techniques of dissolving syndactily and contractures, intraoperative splinting of separated fingers, wound management after the surgical release of deformations and post op nursing. The author concludes that an individual surgical attitude, along with an adequate intra and post-operative rehabilitation, ensures a good restoration of function and a satisfying delay of inevitable recurrence.

IV Infiltration Injuries in Pediatric Patients
Treadwell T
Alabama, US

Abstract
The intravenous administration of medications and fluids has become standard therapy in recent years. Unfortunately, this technique is not without hazard. Extravasation of the fluid and/or medication is thought to occur in 10-30% of infusions. The incidence may be higher in neonates, infants, and children because of their small, delicate veins, fragile skin, and the large size of the catheters (55% of the patients with intravenous fluid and medication injuries in our previously reported series). Numerous medications can cause serious tissue damage when they leak into the subcutaneous tissue. The treatment of these injuries includes the use of other medications to counter or minimize the effect of the extravasated medication. Unfortunately despite good therapy, tissue necrosis and loss of significant amounts of skin can occur as a result of these injuries especially in the very young. Methods of treating skin necrosis and skin defects in the different age groups can present significant challenges. A protocol for the management of intravenous extravasation injuries in neonates, infants, and children will be presented.
Extravasation in Prematures and Neonates: the Surgical Point of View
Scalise A, Torresetti M, Langella D, Di Benedetto G, Grassetti L
Ancona, Italy

Abstract
Management of extravasation injuries should be conservative whether possible. Delayed debridement and reconstructive surgery is required if the area of skin loss is extensive.

However, scar management remains a problem. Prevention of these injuries with the education of both medical and nursing staff remains the last aim.

Introduction. Over the years, neonatal care has significantly increased the survival of very low birth weight and extremely premature infants.

Despite the overall benefits, endovenous (e.v.) therapy can be associated with a variety of local and systemic complications, such as catheter infections, phlebitis and extravasation. Many of the solutions used to treat neonates (such as Total Parenteral Nutrition, 10–15% dextrose solutions, antibiotics, sodium bicarbonate infusions or blood products) can cause ischaemia, necrosis and skin loss.

The incidence of some degree of extravasation, within neonatal population, has been reported to range between 23% and 63%; 70% of these injuries occurred in neonates of 26 weeks gestation or less.

Extravasation injuries are more commonly associated with peripheral venous catheters than central venous ones. Newborn babies are at high risk for extravasation injury due to the delicate nature and the small diameter of their peripheral veins. Additionally, infants are unable to articulate pain.

Review. In a period from 2007 to 2011, we followed 1544 cases of premature. Extravasation injuries occurred in 17 cases, with an incidence of 1.1%.

Newborn babies are particularly at risk for extravasation injury due to the delicate nature and small diameter of their peripheral veins. These types of injuries can create significant morbidity such as secondary infections, skin loss, nerve and tendon damage. The pathophysiology of these injuries includes iperosmolarity, mechanical compression and direct cellular toxicity.

Treatment recommendations are not based on data from randomized studies, as due to ethical considerations these are difficult to perform in patients with extravasations. Current knowledge is mainly based on small, uncontrolled studies and the results of animal trials. The lack of data from controlled clinical studies is also one reason that official guidelines of the most relevant societies of medical specialties on the management of extravasations have been not published.

Prevention of e.v. injury is the target of healthcare professionals, to assess and document injuries accurately and in a timely manner. Assessment of e.v. catheters requires experienced nurses, it is the key factors in the prevention, detection and management of these injuries.

Many different approaches were identified regarding the management of extravasation injuries, without a gold standard treatment. However, according to the literature, particular care should be provided before administering e.v. therapy to prevent
We propose some recommendations about extravasation injuries management:

- if the patient reports pain or other sensations during the infusion, it must be stopped immediately
- the extravasate should be immediately aspirated as much as possible through the intravenous catheter still in place, with a 5 ml syringe, without simultaneously applying pressure
- the limb should be immobilized and elevated
- irrigation with sodium chloride (NaCl) 0.9% through the catheter and percutaneous NaCl injections into the area of extravasation are recommended
- the use of dry ice creates local vasoconstriction that reduces spread of the extravasated solution; cold application should always be performed initially for 24 hours, and several times 15 minutes daily afterward
- Hyaluronidase breaks down hyaluronic acid, a major dermal component, does promoting an increased transport of the extravasate out of involved tissue.

Surgical approach is rarely necessary if the extravasation is promptly recognized and appropriate treatment is early started. However, the surgical treatment of extravasation injuries consists of three main options: flap, skin grafts and dermal substitutes.

First, a surgical consultation within 72 hours is recommended; immediate consultation should be obtained if ulceration, compartment syndrome, very extensive extravasation or therapy-refractory pain over 48 hours overcomes.

Our clinical experience suggests the use of a conservative surgical protocol combined with a medical treatment that consists of dilution and aspiration of the extravasated solute by means of abundant irrigation of the infiltrated area.

Surgical therapy usually consists of a two-step procedure. Debridement is widely performed in healthy tissue, as the size of the involved area is often undervaluated. Conservative follow-up treatment is generally done with sterile moist dressings and wound gauzes, but also by using modern wound therapy with advanced dressing and vacuum devices. Extensive necroses in the further course usually display superficial re-epithelialization.

**Infected Burns**
Teot L
Montpellier, Italy

**Abstract**
Burns are acute wounds easily becoming chronic, due to the high risk of infection. Prevention of infection in burns start from the beginning, with international guidelines proposing to extensively use all possible weapons against germs, including antiseptics and silver derived creams and dressings.
Debridement under general anaesthesia are needed to excise and eliminate all skin debris and the usual mode of management includes a quick excision of all deeply burnt areas followed by skin grafting. Others would advocate the use of highly antibacterial topical therapies, combining silver and cerium nitrate.

Once infected, systemic antibiotics are needed to protect infected burns to become source of septicaemia, and the emergence of resistant germs makes the general infection a permanent risk for the patient.

Infection can contaminate the skin grafts, with special managing options in order to kill germs and allow the keratinocyte to recolonise the lost surface. Infected burns are a recognised source of pathologic scars and hypertrophy, and should be prevented by an early anti-infection plan and strategy, especially in children.

Advanced Biological Therapies: Fact, Not Fantasy

Pediatric Corneal Ulcers: State of the Art
Buononetti L
Rome, Italy

Abstract

The microorganisms that cause microbial keratitis in children are similar to the causative agents in adults, with herpes simplex and bacteria being the predominant causative agents. The risk factors for pediatric corneal ulcers include colonization of the eyes during birth and trauma of the cornea. Some microbial factors involved in microbial keratitis frequently include adhesion to the cornea, penetration into the cornea and destruction of the corneal stroma. Treatment for pediatric corneal ulcers is usually the same as for adult patients. Recently new treatments and surgical approaches have been proposed for pediatric corneal ulcers treatment, however further researches need in order to increase the specific responses in case of microbial keratitis in children.

Nerve Growth Factor: Effects on Human Corneal and Skin Ulcers
Aloe L, Lambiase
Rome, Italy

Abstract

Despite the vast amount of knowledge acquired in the last few years and a number of therapeutic options available, the management of human trophic cutaneous ulcers, such as diabetic and pressure, might be problematic and the result uncertain. We will present evidence that topical application of nerve growth factor (NGF) can be a potential valuable molecule for healing human cutaneous ulcers. NGF is a signaling molecule that, in addition to its general role as a growth factor and survival factor in the nervous system, possesses diverse biological action outside the nervous system, including an effect of proliferation of keratinocytes and cutaneous wound healing. The first clinical evidence regarding the healing action of NGF was reported by Lambiase et al in 1998 on human neurotrophic corneal ulcer. Subsequent studies revealed that topical application
of NGF is able to heal cutaneous ulcers induced by pressure, vasculitis, rheumatoid arthritis and diabetes, unable to be healed by other available conventional treatments.\textsuperscript{6-9} Moreover, it was also shown that patients affected by crush syndrome and ischemic hind limbs with damaged blood vessels and inflammation will also benefit from topical NGF administration.\textsuperscript{10-12} With the forthcoming availability of human recombinant NGF should facilitate clinical trials and hopefully the pharmacological utilization of this molecule not only in neurological diseases, but also in human cutaneous ulcers. Our studies on laboratory animals and humans support this hypothesis and suggest the possibility that topical NGF application may be useful to devise a novel pharmacological strategy to promote the healing properties of human cutaneous ulcers.

References


A Human Recombinant Manganese Superoxide Dismutase (rMnSOD): A Role in the Prevention and Care of Pressure Ulcers

Borrelli A, Schiattarella A, Mancini R, Mancini A
Naples, Italy

Abstract

A new recombinant isoform of manganese superoxide dismutase (rMnSOD) has recently been isolated (Int J Cancer. 2006). The protein shows unusual characteristics compared to the native form. Certainly the most surprising property is its easy administrability in vivo and its ability to penetrate all the cells where it exerts its enzymatic function, according to the following reaction:

\[
\begin{align*}
\text{O}_2^* &\quad \text{rMnSOD} &\quad \text{H}_2\text{O}_2 \\
\text{OH}^* &\quad \text{Catalase} &\quad \text{O}_2 + \text{H}_2\text{O} \\
\text{NO}^* &\quad \text{GTX}
\end{align*}
\]


When rMnSOD has been injected in animals exposed to lethal doses of X-rays, all animals survived to irradiation, on the contrary animals irradiated in the absence of rMnSOD died 5 days later (Free Radicals Biology & Medicine. 2009;46:110-116).

In this scenario, we have used the rMnSOD for the recovery of skin tissue exposed to damages from ischemic vascular ulcers and pressure, both generated by ischemic conditions caused by high concentrations of free radicals.

A topic preparation containing the rMnSOD, was used for the treatment of skin lesions of various types (burns, pressure ulcers, vascular ulcers), often contaminated with resistant bacteria such as Pseudomonas. The treatment has allowed to repair these injuries, restoring the functionality of the tissue in a significantly smaller time than those observed by using the commercial products.
We believe that the protein's ability to reach and penetrate the damaged cells makes it capable of providing molecular oxygen, and we think it deserves to be considered as a new tool for the better treatment of vascular and pressure ulcers.

Role of Neurologic System in Tissue Repair: Stochastic Resonance and Electrical Stimulation
Ricci E
Turin, Italy

Abstract
 Aim. Medical research on endogenous alternating current (AC) has primarily focused on action or injury of nerves, but there has been a paucity of research on endogenous AC in wounds. Our goal was to explore the role of somatosensory nerve intervention in wound healing with focus on the phenomenon of stochastic resonance. Our specific aim was to identify endogenous stochastic signals around wounds and to evaluate if they are specific.

Methods. We measured stochastic signals on more than 600 human subjects by using an approved data acquisition system*. We recorded electrical signals in patients with tissue damages and healthy volunteers. The effect of stochastic resonance was further studied by treatment of chronic wounds with stochastic electrical noise stimulation (an approved device)**.

Results. Chronic wounds patients (n=83) exhibited specific stochastic signals versus healthy subjects (n=48) p <0.001. Patients with neurological comorbidities (n=29) show lower signals (p <0.001) around wounds. Specific stochastic signals detected at discrete wound bed conditions (n=164) p <0.001. During debridement of chronic wounds (n=15), significant higher stochastic signals triggered around wound and simultaneously on contralateral asymptomatic limb. Stimulation with stochastic noise (50) affected endogenous signaling. Measurements around tissue damages (n=320) show the nervous system effects on stochastic electrical signaling.

Conclusions. We report on novel stochastic signaling in wound healing. We have confirmed our findings by showing that stimulation by stochastic noise accelerated healing presumably by stochastic resonance.

* PowerLab/4s system (ADInstruments, Milford, MA)
** LifeWave Ltd. Israel

The Mission: A Painless Hospital

The Wound Pain Management Model
Price P
Wales, UK

Abstract
Chronic wound pain is not well understood and the literature is limited. Six out of 10 venous leg ulcer patients experience pain with their ulcer, and similar trends are observed for other chronic wounds. Chronic wound pain is more than just pain at dressing change, and can lead to depression and the feelings of constant tiredness. Pain related to the wound should be handled as one of the main priorities in chronic wound management together with addressing the cause. Holistic management must be based on a safe and effective mix of psychosocial approaches together with local and systemic pain management. The Wound Pain Management Model starts from the basic premise that all wounds are painful until proven otherwise, but begins by emphasising the importance of good wound assessment leading to accurate wound diagnosis to assist in ensuring that fundamental aspects of underlying pathology are addressed. In addition many aspects of local wound management, if dealt with swiftly and appropriately, can lead to a reduction in the patient’s pain experience – for example, resolution of infection or reduction in inflammation. This presentation will aim to increase the healthcare professional’s awareness that persistent wound related pain is a common experience that requires appropriate assessment and treatment. It is no longer adequate to concentrate on the pain during dressing change alone. The presentation will provide useful recommendations and statements for assessing and managing wound pain for patients, healthcare professionals and other policy makers. Unless wound pain is optimally managed patient suffering and costs to healthcare systems will increase.

Ariadne’s Thread: Painkilling
Marri M
Rome, Italy

Abstract
THE PAIN
- To “treat” the pain we have two approaches:
  - try to reduce the excitatory system by filtering or inhibiting transmission of the message “Pain.”
  - reinforce the inhibitory system
- The means available to reduce pain are numerous and complementary. To get good results is often necessary to associate many.
  - Means not involving the use of drugs.
    - Information.
    - The prevention of iatrogenic pain.
    - The presence of "loved ones".
    - The “distraction.”
    - The acupuncture & auricular acupressure.
    - The psychological- behavioural techniques.
  - Means involving the use of drugs.
    - Analgesics.
    - Adjuvant drugs.
    - Botulinum Toxin.
    - Local Anaesthetics and Analgesia Loco - Regional.
    - Nitrous oxide.
General Anaesthesia.

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The Mission: A Painless (and Other Wound Care Environments) Hospital
Torra I Bou, JE
Iberia, Spain

Abstract
Pain is an issue in a close relation with wound care. In the last ten years this problem has been highlighted and taken in serious consideration as an important component of wound care strategies. An example of this is the EWMA’s positioning document “pain at Wound Dressing Changes” published in 2002 (http://ewma.org/english/position-documents/all-documents.html#c507).

As Paediatric wound care (PWC) is emerging as an important issue related to paediatric and wound care, pain is becoming an important and crucial dimension to be considered in all environments where PWC can be provided, mainly, Hospital and community settings (home).

A holistic approach of pain and wound care involves more dimensions than merely wound dressing changes.

Although many wounds present in children may be avoided and prevented, the most cost-effective and logic approach for avoiding pain related with PWC is to prevent what is preventable, that’s to say, the great majority of pressure ulcers, for which we have nowadays specific mattresses that cover all risk scenarios from pre-term born children up to teenagers as well as local measures for preventing pressure damage due to the position of the patient or therapeutic devices. Other preventable problems include incontinence related problems and complications in acute wounds like surgical site infections (SSI).

Once the wound has appeared a basic measure for controlling pain related problems is to treat not only the wound by itself, but also, and at least as more important, the cause of it. So, another time systemic and local pressure measures as well as protection of skin
against incontinence and other aggressive body fluids and surgical wounds effective protection.

If we focus on the local treatment of the wound, a first element to be considered is the definition of wound care strategies oriented to avoid or diminish the possible impact of pain in wound care. Under a general point of view Moist environment dressing as an alternative to the use of traditional dressings like gauze represent different aspects with influence in reducing the impact of pain like: more respect to the fragile wound environment, less problems related to the adherence of dressings or tape to the wound and the periwound skin, less duration of episodes, less dressing changes, more compatibility with daily life activities (DLA). Since a more specific approach, nowadays we have available in the market dressings with specific properties oriented to a gentle performance in fragile skin and wound environments fully compatible with the needs of PWC patients as well as with strong evidences in their local pressure reduction properties.

There are also pharmacological and no pharmacological resources and strategies that may be applied for reducing or minimizing pain at PWC. Some of them need to be adapted to the peculiar characteristics of pediatric patients and highlight an important area of PWC research.

In the cases related with chronic PWC, the treatment of pediatric patients with skin conditions like Epidermolysis Bullosa is a very clear and challenging example, on how the creation of a positive environment (room, place, changes of dressings in coincidence with bath, with parents support and empowerment, adaptation of materials for a “normal kid life”) can reduce the anxiety and pain related with PWC in children and their parents and improve the results and the effectiveness of wound care.

There are also other situations to be considered on the pain management in PWC, one is the possible impact of advance therapies like negative pressure therapy (NPT) that can benefit the treatment of many wounds in children and needs different and specific approaches than in adult patients, another is the case of patients with specific pain requirements like oncological patients or restricted mobility patients (spinal cord injuries, politraumatic patients, ECMO patients or children with body deformities) for whom nowadays we have effective and compatible with their weight and clinical condition special mattresses like constant and reactive low pressure ones, that can be used in specialized (Hospitals) or non specialized (Home care) environments, reducing in the last case an important source of pain, having an ill kid outside its home.

The advance of wound care science in the last two decades is suitable to be adapted and applied to a world, pediatric care, where wounds (like it succeeded with adult patients some time ago) have been considered as a “secondary” or no relevant problem. A very important clinical, research and common sense challenge for pediatric and wound care health care professionals, as well as for the industry, with a great impact in the quality of life of children, their caregivers environment and the sustainability of the Health Care System in times of trouble.

**Negative Pressure Wound Treatment Reduces Pain and Fear of Injured Children Because of Lower Frequency of Dressing Change**

Masaki J, Kenji H, Chikako M, Yasushi K
Abstract

Background/Purpose. Extended avulsion injuries are associated with a significant loss of skin and subcutaneous fat, leaving the patient with pain and fear, especially children. Negative pressure wound treatment, which promotes wound healing by removing excessive exudates, increasing blood flow, and decreasing bacterial colonization, has become a widely accepted method to assist in optimizing the management of open wounds. Negative pressure treatment can also decrease the frequency of dressing changes, which may also reduce pain and fear in pediatric patients with severe injury. Methods: An 8-year-girl with massive lower extremity avulsion injuries underwent early debridement and free skin grafting, and received negative pressure wound treatment for 17 days.

Results. Although massive wound discharge was noted over the first 10 days, it was drained through a suction tube. Consequently, the dressing foam was changed only twice during the negative pressure wound treatment. Secondary split thickness skin grafting was performed 24 days later. The wound was resurfaced 36 days after injury, and she could walk 2 months after free skin grafting.

Conclusion. Negative pressure wound treatment reduces the frequency of required dressing changes, even though the wound releases massive exudates, which reduces pain and brings much comfort to injured children.

Pediatric Hand Wounds: How to Clear Hurdles

Hand: Traumatic Lesions
Vaienti L
Milan, Italy

Abstract

Not Available.
**Hand: Burns**  
Caleffi E, di Castri A, Marchesini A, Quarta L, Raposio E  
Parma, Italy

**Abstract**

“A child is not a small adult;” “a child's hand is a growing super-specialized organ which is used to learn about the world.” Starting from these 2 reflections, over the last 5 years admissions at the Major Burns Center of the University Hospital of Parma have been revisited, with statistical and epidemiological assessments: annual cases, adult/child burns, body locations, percentage of hand burns, blistering agent, burning mechanisms, etc.

Local information is compared with that of other Italian Burn Centers and with national statistics of the SIUST (Italian Burns Society), which is creating the first National Register, in relation with the numbers of the ABA (American Burn Association) and with the most recent worldwide literature.

The vast majority of pediatric burns occur at home (boiling liquid, contact with hot solids) and the most affected is the hand.

A child usually suffers burns to the hand due to a combination of two groups of causes:

1 - intrinsic to the child (absence of the sense of danger, the need/desire to know, reduced removal reaction time)
2 - extrinsic to the child, that is the adult, who in turn can voluntarily (abuse/maltreatment) or involuntarily (distraction, inadequate security, war, etc.) contribute to the cause.

Hand burns in children are proving to be a relatively frequent detrimental event, while representing a pathology of "super-specialized niche" which focuses on three specific clinical and therapeutic criticalities:

1) Burn 2) Child 3) Hand

This in fact complicates, and to date is still subject to discussions and research, proper treatment which to be optimal should consider exclusive parameters: 1) burn pathology (burn disease, maintaining ABCDE vital signs, fluid and electrolyte balance, local/general treatment, admission/outpatient, etc.), 2) the child’s age (e.g., poor cooperation, pain, fear, education, growth, etc.) and 3) the anatomical site (maximum residual functionality, reduced aesthetic damage).

There are two distinct anatomical/topographical areas with subgroups: hand (back/palm) and fingers (long fingers/1st finger/5th finger) that react differently to the damaging agent and for which the most appropriate therapeutic approach must be examined.

A burn on a child’s hand must come under the functional group "upper limb" and involvement of major joints (axilla-elbow) affects treatment and prognosis.

An analysis is made of the treatment steps that are essential and are grouped in 4 phases:  
1- emergency
For each of the 4 phases the care protocols are compared, the priorities assessed and the results obtained with the various medical/surgical approaches are discussed.

The collaboration between the Parma Burns Centre and the School of Specialization in Plastic Surgery at the University of Parma gives us the opportunity to mention two protocols that can be considered new and useful:
1) Keratinocytes spray: With this technique, a pool of keratinocytes obtained from partial-thickness graft are sprayed, in order to obtain a ratio 1:5 - 1:10 with the receiving site;
2) Local measurement of free radicals: with this method, that requires the collection of a small local blood sample, it is possible to obtain early detection of tissue damage in the burn lesion.
Two specific conditions, although less frequent: A) shock and B) chemical burns, require specific protocols.

The school of thought in favor of radical and early surgical treatment (escharotomy, escharectomy, graft, etc.) confronts and clashes with the approach that favors waiting (mechanical/chemical debridement, tutors, physiotherapy) and the numerous topical treatments available (antiseptics, antibiotics, semi-permeable dressings, transparent dressings, pain relief medications, skin substitutes, bio-engineered skin, synthetic dermis, bank tissues, laboratory keratinocytes/fibroblasts etc.) confirm that you cannot select the "always the best way" to treat burns on a child's hand.

The best way to take charge of a small patient with burns to the hand can be:
1 – Family pediatrician
2 – Emergency room
3 - Pediatric emergency room
4 - Plastic Surgery clinic
5 – Burns center;

Methods that can be correct or deeply inadequate depending on: A) clinical stage (emergency, urgent, election, aftereffects), B) the complexity of the disease (extent, depth, body site, blistering agents, co-morbidities, etc.) and C) the social context; but which in any event must guarantee the means (equipment, analgesia, advanced dressings, 24-hour availability etc.) and capability (local/general expertise with medications and children, experience with resuscitation treatment, wealth of reconstructive plastic surgery, etc).

The result expected from the treatment of child burns once was survival, today it is the residual morpho-functional quality; this result it is often difficult to assess due to the variability of clinical conditions, the unequal treatment and incompleteness of follow-up.
The contexts: 1) local (environment, home, etc.), 2) social (peace/war, poverty, immigration, technology, etc.) and 3) general (city/country, nation, etc.) play essential roles in the causes and results; it is therefore not possible to make outright predictions and pinpoint the treatment that is easiest (execution), most effective (result), most accepted (painless), cheapest (company/family); but only by evaluating all the various parameters analyzed, filtered through the sensibility and experience of the clinician is it possible to trigger the most appropriate strategy and the best result for that individual case, and only very rarely for macro-categories.

A hand burn in a child is a complex multidisciplinary pathology (burns specialist, plastic surgeon, pediatrician, resuscitator, physiatrist, physical therapist, psychologist, sociologist, etc.) whose treatment begins before the burn (family/school prevention, social care, accident prevention aids), and extends several months or years after the burn, with the stabilization of scarring, through acute surgical stages and treatment of the results, rehabilitation and functional recovery continued throughout adolescence.

Hand: Congenital Malformations: New Frontiers
Landi A, Gaglian MC, Leti Acciaro A, Lando A
Modena, Italy

Abstract
Object. In human fetus dermal wound healing occurs with a minimal inflammatory response and lack of excessive scarring due to the high presence of Hyaluronic acid in fetal tissue that inhibits the inflammatory response. So the main difference between fetal and adult skin wound healing is that in adult we have a tissue healing with scarring, on the other hand in fetus a tissue regeneration without scare. In little child regeneration is limited but possible.

Basing on this knowledge, we decide to utilize Hyaluronic acid (Hyalomatrix) to fill skin defects after surgical correction of such congenital hand malformations. The purpose of this prospective observational study was to ascertain if Hyaluronic Acid allows avoiding the use of skin grafts and eventually the age limit of scar-less healing in congenital malformation at the hand.

Materials and methods. From September 2008 to September 2010, 11 children, 8 males and 3 females ranging from 1 to 10 years old, underwent surgery for congenital deformities of the hand. Seven children were affected by syndactyly, one by amniotic scar, 2 arthrogryposis, 1 Apert Syndrome.

Children with syndactyly underwent surgical correction according to Ostrowski’s or Eckerot’s technique, children with arthrogryposis and Apert Syndrome underwent to firs web t space’s opening recurring to Gana’s flap. In all cases the skin defect was filled with Hyaluronic Acid. No rigid immobilization was applied.

Dressing was removed at 3 weeks from surgery and a night splint was provided.

Results. On follow-up, the authors assessed the grading of the web creep, skin quality according to the Vancouver Scar Scale, and flexion or lateral deformations at the separated finger. In 7 cases we had a complete skin healing after 3 weeks, without any complication. In one case wound healing was obtained in ten days (the patient was 1 year old). While in one case wound healing was reached in 5 weeks because of hypertrophic
granulation tissue. One case was complicated by an infection. A skin graft was necessary and healing occurred in 3 months. In another case a (opening of fist space in arthrogryposis), skin graft was necessary because of a wide lack of skin, but Hyaluronic acid application improved quality of subcutaneous tissue and graft aspect.

Conclusion. In 9 patients we obtained wound healing without using skin graft, with minimal scarring. Probably in young children dermal tissue preserves fetal characteristics. So applying Hyaluronic acid on wound we can induce a skin healing process that is more similar to regeneration than to tissue repair.

Biotechnologies: From Research to Clinics
De Luca M, Corradini F
Modena, Italy

Abstract

Adult stem cells are cells with a high capacity for self-renewal that can produce terminally differentiated progeny. Stem cells generate an intermediate population of committed progenitors, often referred to as transit amplifying (TA) cells that terminally differentiate after a limited number of cell divisions. Human keratinocyte stem cells are clonogenic and are known as holoclones. Human corneal stem cells are segregated in the limbus while limbal-derived TA cells form the corneal epithelium. Cultivated limbal stem cells generate sheets of corneal epithelium suitable for clinical application. We report long-term (up to 10 years) clinical results obtained in a homogeneous group of 112 patients presenting with corneal opacification and visual loss due to chemical burn-dependent limbal stem cell deficiency. Grafts of autologous cultured limbal keratinocytes have restored the corneal epithelium and the visual acuity of these patients. In post hoc analyses, success was associated with the percentage of p63-bright holoclone-forming stem cells in culture. Graft failure was also associated with the type of initial ocular damage and postoperative complications.

Autologous cultured keratinocyte, have been widely used for permanent coverage of full-thickness burns. Follow-up studies over a 20-year period proves that epidermal stem cells can be preserved in culture and can maintain their stemness also after transplantation. Mutations in genes encoding the basement membrane component laminin 5 (LAM5) cause junctional epidermolysis bullosa (JEB), a devastating and often fatal skin adhesion disorder. Epidermal stem cells transduced with a retroviral vector expressing the b3 cDNA can generate genetically corrected cultured epidermal grafts able to permanently restore the skin of patients affected by LAM5-b3-deficient JEB. The implication of these results for the gene therapy of different genetic skin diseases will be discussed.

Children in Disaster and War: A Global Approach

Military Health and Children’s Hope: The Goal is Better Quality of Life
Abstract

In the military missions abroad, the children's conditions are the marker of local civilian population's conditions and expectations. One of the objectives of the military aid to the public local health system is a children's better quality of life; this goal is pursued by two ways: directly on the field by military medical specialist staff, when available, and by military telemedicine support of the health staff from a distance, through military satellite communications. In fact, the satellite stream is an excellent instrument in order to reach badly damaged zones, where the common nets of telecommunications are destroyed or have not yet been realized.

The implementation of telemedicine by the Italian Armed Forces has happened as a result of the military mission in the Bosnian territory (1996), in order to contribute to the application of the Dayton’s peace accords, by SHARED plan (acronym of Satellite Health Access for Remote Environment Demonstrator). This has determined the foundation of a telemedicine centre at the Military Hospital “Celio” of Rome, among whose promoters we remember medical general Michele Anaclerio. The “shared” plan was elaborated by Alenia Spazio, S. Raffaele Institute of Milan and the Armed Forces in collaboration with the European Space Agency (E.S.A.).

The ATHENA project of the Defence General Staff, realized by Telbios, has constituted since 2003 the interforce technological and organizational evolution of the Celio telemedicine’s centre, according to the criteria of interoperability, connectivity and technological research (stanag 2517 NATO).

To the advantage of the military staff in service abroad, also thanks to the military telemedicine, it has, on many occasions, been possible to avoid evacuations to the native country, with obvious health and logistic advantages, both for the interested staff and for the entire organization.

In the Italian military missions abroad, military doctors of the Italian Army have carried out thousands of visits on behalf of the local population (particularly for the children) and the military staff on the mission. In the periods in which a specialist was not available on the field, the military telemedicine support was precious (about 25% of the total recorded findings at the Celio telemedicine centre made for the children were dermatological).

For example, among the Balkans civil population, a great prevalence of dermatological infectious diseases has been observed in children; in order of frequency: mycoses, piodermitis, parasitisms, virosis, other cutaneous infectious pathology. In noninfectious dermatological pathologies there were in order of frequency: dermatitis, psoriasis, acne, others.

Also in the mission in Iraq (Nassiriya), in Chad and in Afghanistan, among the children population a high prevalence of infectious dermatological pathology (particularly impetiginizations) has been found; not infrequently pathologies like the cutaneous leishmaniasis have been relieved.

In conclusion, our data therefore confirms the usefulness and reliability of Military Health to the advantage of military missions, in order to provide good medicine in bad places.
Earthquake in Haiti- Despair to Hope: the Wound Care World Responds
Macdonald J
Miami, FL

Abstract
The catastrophic earthquake that ravaged the already fragile Haitian capital, Port-au-Prince, on January 12, 2010, unleashed an unprecedented humanitarian crisis. The devastation and human suffering were horrific! An impassioned global humanitarian response was triggered. The University of Miami and Project Medishare responded immediately and established a 25,000 Sq Ft tent facility eventually treating over 30,000 patients supported by 2,700 medical volunteers.

This presentation will describe the immediate effects from the earthquake and the response from the medical teams as they struggled to bring chaos to order and hope from despair. The critical importance of wound care and the evolvement of a wound care program will be discussed. The management of Pediatric injuries and open wounds will be highlighted. Pediatric wound care was suddenly on center stage and the lessons learned will give strength to the importance and success of effective wound care in everyday practice.

Plastic Procedures in Burn Patients: What we can do in a Field Hospital
Durante CM
Rome, Italy

Abstract
The therapeutic “policy” of a field hospital, anywhere in the world and in every country that sets one up, meets the criteria of: simplicity, efficiency and effectiveness. The specific bibliographic search and analysis of the range of medical services provided during humanitarian operations, confirms the high incidence of complex lesions of the soft tissues caused by high-energy trauma.

Health care provided to the civilian population is generated by both triage (elective) and emergency (emergency) activities. The facilities and equipment of a type Role 2 Enhanced field hospital meet specific logistic-organizational criteria that derive from predefined “tasks” or the health care commitment that the facility must face in the territory. The preliminary phases (orientation and decision-making) for evaluating the characteristics of the hospital to be deployed in theater operations must be preceded by an activity of socio-political health “intelligence” capable of roughly predicting the static and dynamic health care needs of that territory.
In humanitarian operations the main therapeutic task of the surgical team of a field hospital, with regards to high-energy tissue trauma, is to implement all the principles of “combat wound care” in order to stabilize integumentary lesions for subsequent medical evacuation to better equipped hospitals in safer areas.

**Combat Wounds in Children**
van Niekerk WJC
Birmingham, UK

**Abstract**
One of the saddest consequences of war and armed conflict is its devastation on the lives of children. Children are part of the collateral damage, they are used as human shields, and they are increasingly utilized as “willing” or unwilling combatants. The injured child presents a clinical challenge in an environment which is not necessarily optimally set up to deal with paediatric casualties, and places additional intellectual and emotional stresses on medical and paramedical staff who might not have much experience in their treatment.

The pattern and management of paediatric war wounds is presented with especial reference to the experience gained and lessons learnt in recent theatres of war. The differences and similarities between adult and paediatric patients are highlighted, specific pitfalls are elucidated, and a general approach to the management of combat wounds in children is discussed.

**Atypical Wounds in Pediatric Dermatology**

**Atypical Wounds: Connective Tissue Disease**
Kirsner R
Miami, FL

**Abstract**
This lecture will present an update of inflammatory atypical wounds, specifically highlighting connective diseases and ulcers. Dr. Kirsner will highlight the evaluation of the atypical wounds. He will present case based clinical information related to the diagnosis, evaluation, and treatment of connective tissue disease and wounds.

**Objectives**
1) To understand the importance of inflammation in the pathogenesis of chronic wounds
2) To learn the various causes of atypical wounds
3) To appreciate evaluation and treatment of wounds and connective tissue disease
**Pediatric Wounds in Genodermatosis**
Romanelli M, Dini V, Barbanera S
Pisa, Italy

**Abstract**
Varying degrees of cutaneous lesions are commonly seen as an associated finding in children presenting with genodermatosis. Examination of total body skin including oral mucosa should be part of the general examination of a child’s skin. Epidermolysis bullosa is a group of inherited disorders in which skin blisters develop in response to minor injury. There are four main types of epidermolysis bullosa:

- Dystrophic epidermolysis bullosa
- Epidermolysis bullosa simplex
- Hemidesmosomal epidermolysis bullosa
- Junctional epidermolysis bullosa

Another rare type of epidermolysis bullosa called epidermolysis bullosa acquisita is an autoimmune disorder. It may be difficult to tell this condition apart from another autoimmune skin disorder called mucous membrane pemphigoid. Identifying the exact type of epidermolysis bullosa is complicated. Even within the main types listed above, there are many subtypes. For example, Weber-Cockayne is the most common form of epidermolysis bullosa simplex. This type involves blistering of the palms and soles and may include excess sweating. Epidermolysis bullosa can vary from minor blistering of the skin to a lethal form involving other organs. The condition generally starts at birth or soon after. Epidermolysis bullosa acquisita usually appears in adults over age 50, although it can occur in children. It is linked to Crohn's disease (an inflammatory bowel disease) and possibly lupus. Adults with this type of epidermolysis bullosa may also have symptoms of these other conditions. Mild cases of epidermolysis bullosa simplex may not be diagnosed until adulthood. All types of epidermolysis bullosa are usually inherited. Having a family history of the disease, and especially having a parent with it, is a risk factor. Wounds range from simple to complex and from acute to chronic. Each has its own features and nuances that make caring for it a clinical challenge. The role of wound care specialist is to facilitate and support nature’s path through choices that promote healing and prevent complications.

**Wounds in Paediatric Vascular Malformations**
D’Epiro S, Giancristoforo S, Salvi M, Macaluso L, Richetta AG
Rome, Italy

**Abstract**
Aplasia Cutis Congenital (ACC) is an uncommon disorder characterized by the absence in newborns of a portion of skin and occasionally the underlying structures in a localized or widespread area.
It most commonly manifests as a solitary defect on the scalp, occasionally involving the meninges and skull. Maternal medications and infections are frequent causes.

The appearance of the lesions ranges from alopecic scar to ulceration variable in depth, depending on when they occur during intrauterine development. Small local defects usually heal spontaneously, while full-thickness scalp defects show a mortality rate estimated to be as high as 20-50%. Infection, sagittal sinus thrombosis and hemorrhage are the major complications of ACC. Although both surgical and conservative treatments have nearly equal risks, an initial attempt with conservative management using new wound dressing materials could be useful to avoid possible complications from surgical procedures.

Ostomy: A Useful Device Oftentimes Complicated

Digestive Ostomy: The Wide Spectrum of Complications
McNichol L
North Carolina, US

Abstract

Introduction. For the pediatric patient with an ostomy, the following complications are common: dehydration, prolapse, hernia, skin irritation and stoma color alterations. Specialists are often needed to guide the generalist practitioner in the management and care of these conditions and to teach and prepare caregivers for aftercare at home. When specialists are not available, the generalist is required to intervene in their place.

Aim. The aim of this presentation is to provide an overview of the more common complications in pediatric ostomy care, to highlight some of those directly pertaining to skin integrity and the interventions proven to be most effective.

Discussion. In this forum, skin integrity for the pediatric population is addressed. Pediatric ostomies occasionally present challenges even to those with the most developed skill sets in the containment of effluent. Most pediatric ostomy products available today have gentle adhesives incorporated into the barriers to protect and maintain the epidermis of the pediatric patient. Irregular contours such as those resulting from surgical procedures and complications such as herniation and muco-cutaneous separation require creative strategies.

References

Prevention and Management of Peristomal Skin Disorders in Children
Van den Bulk R
Brussels, Belgium

Abstract
Stoma formation in childhood is generally a temporary surgical measure needed to manage congenital diseases (Hirschprung), abnormalities or to allow bowels to heal after perforation. The majority of stoma formation in childhood is carried out in the neonatal period. Stomas are generally a temporary measure until definitive surgery is performed. One of the most important considerations when managing a stoma on a baby is to keep the peristomal skin in an optimal condition in order to avoid leakage. Compared to the adult there is less space on the abdomen to apply securely the pouch; the navel, hips and rib cage are close to the stoma.

The use of an adequate stoma bag with an opening at the right size is important to prevent the majority of skin disorders. If the skin is exposed to urine, stool or digestive enzymes the child may experience some distressing and painful symptoms around the stoma.

The skin of the premature neonate or of the young children is identified as a skin at increased risk regarding peristomal skin disorders. Premature neonates present a diminished cohesion between the dermis and the epidermis and can be at risk for systemic toxicity (Association of Women’s Health, Obstetric and Neonatal Nurses, 2008).

Epidermal stripping readily occurs with the removal of adhesives applied to premature skin, because they create a stronger bond with the epidermis than the epidermis has with the underlying dermis.

The skin is also more susceptible to friction injury and blistering. Some of these breakdowns are minor and improve quickly, some other ones, as wound dehiscence, may require the use of dressing to heal.

Care of the preemie and babies with an enterostomy can be challenging. Loss of the epidermis results in serous exudate. This moisture accumulation under the wafer may impair the pouch adhesion.

Identification and treatment of the underlying cause and reevaluation of the pouching system is essential when managing peristomal skin disorders.

Complicated and Infected Peristomal Deep Tissues in Inflammatory Bowel Diseases: How to Manage?
Ceriati E, Marchetti P, Rivosecchi M, Ciprandi G
Rome, Italy

Abstract
Management of ostomies is an important aspect of any general surgical practice, especially in pediatric ages. If a proctocolectomy is performed as surgical treatment of Ulcerative Colitis (UC) or Crohn’s Disease (CD) a temporary terminal ileostomy is always associated in order to protect the ileoanal anastomosis. Rarely, a permanent intestinal stoma is used when attempt at reconstruction have failed. Complications with surgically placed ostomies are common and their causes are multifactorial. Management of complicated and infected peristomal tissues deals with a skin complication disease and not a skin disease. The most frequent and often coexisting peristomal skin complications are: ulcer, fistula, dehiscence, infection, chemical burn, peristomal disease, stomal instability and retraction and pyoderma gangrenosum. In children, peristomal excoriation, following chemical irritation can lead to peristomal breakdown and ulceration. Skin irritation is more common in ileostomies than colostomies. It may be secondary to contact dermatitis, mechanical irritation, trauma, infection, or peristomal hyperplasia which is main responsible of a local bleeding. Ileostomy effluent contains digestive enzymes and electrolytes that are extremely corrosive and damaging to the skin. Despite various containment strategies, effluent may leak and spill over to the peristomal skins particularly in patients with hyperactive bowels, diarrhea, and enterocutaneous fistulas. The mainstay of treatment is local wound care and identifying the underlying cause of the problem. Peristomal skin complications as well as subcutaneous fat necrosis and cellulitis negatively affect patient adjustment. For the healthcare system, peristomal skin complications usually mean resource utilization - increased patient care needs and the struggle to attain an optimal functional status or comfortable state of well being are expensive. When addressing prevention and treatment, an outcomes measurement plan that tracks and documents both clinical effectiveness of the intervention with impact on functional status, good health and satisfaction with care provided, should be considered, especially dealing with children or adolescents. Our experience when treating cases in which a more permanent barrier is required in order to prevent such complications (with film dressing such as Hydrocolloid or Hydrofiber® Technology that lock in exudate, contour to the wound bed, respond to changing wound conditions by reducing critical contamination and local infections forming a cohesive gel with or without 1.2% of ionic silver) will be presented. The architecture of the complex dress is explained, in order to clarify the different steps used in children, implicating an appropriate healing. This strategy sometimes suppresses the possibility for a surgical revision and in other situations makes it possible in the right time.

How to Avoid Incontinence-related Wounds with the Malone Procedure
Crispin B
Brussels, Belgium

Abstract
Children with a spina bifida, in roller seat, often suffer from faecal incontinence. This incontinence can cause pressure ulcers or deteriorate them. Bowel management offers two different cares according to the patient’s situation.
If the patient always has stools during the day, enemas can be proposed to achieve faecal cleanliness. If the results of this technique are good, a further solution can be proposed to increase patient’s autonomy: enema through a Malone appendicostomy. These propositions have helped a lot of patients to improve their quality of live avoiding chronic wounds and stool’s odor.

Pressure Ulcer: Organization and Management

Children and Newborn Skin Features: Understanding Skin Care and Providing the Best Organization
Gryson L
Brussels, Belgium

Abstract
Wound healing with children is very often based on knowledge of wound healing and skin care of adult patients. Science proves that skin care for children is quite different from adult skin care. Also, once the wound is healed, scars are more often clearly present with children than adults. In fact, there is an improvement of scar cosmesis with age. What does this mean for the caregiver?

Do we need specialized wound management professionals for children with wounds or do we need to elaborate the knowledge of wound management specialists in the direction of children with wounds and their skin care.

Also specific attention must be given in choosing the right topical wound management product. Topical agents include anything that touches the infant's skin. The skin is crucial to the way the infant perceives and responds to the care environment. What do we need to take in consideration before treating a child’s wound?

The Hospital Pharmacist in the Management of Advanced Dressings
Corsetti T
Rome, Italy

Abstract
Skin ulcers, decubitus, in children, appear more rapidly than at adults, and over 60% of pressure sores tend to occur as early as the second day of hospitalization in Intensive Critical Areas.

Medical therapy is to use newer medications "advanced" (Semi-permeable films, hydrocolloids, alginates, hydrogels, foams), capable of interacting with the lesion site, as well as provide an optimal moist environment for the process of tissue repair.

Care management of these injuries requires a substantial commitment of resources, believing that more attention should turn to the appropriateness of treatments and optimization of resources.

According to Muir Gray, in clinical practice the assessment of appropriateness should be affected by the benefit-risk profile of medical treatments and the preferences /
expectations of the individual patient, without being influenced by the costs. The reasons for this apparent paradox is simple: to integrate economic considerations into clinical decisions hinders decision-making already very complex and interferes with the doctor-patient relationship.

For decisions that affect groups or entire populations of patients, however, the assessment of appropriateness should definitely consider the impact on economic resources. As the central institutions at the level of healthcare technology market is not governed by extremely strict filters, regional and local health authorities should develop additional tools (local formularies, technology assessment), so that professionals get confused in a market of seductions that make it unmanageable demand of citizens.

In our hospital is intended to set out a checklist of medications advanced hospital in collaboration with the Clinical and Nursing Services.

The identification phase of the Handbook are as follows:

- Analysis of the data collection sheets for how management of chronic wounds in the operating units and analysis of the type of medication used in past years and the costs associated with these devices
- Analysis of the data sheets of products purchased
- Analysis of clinical and cost effectiveness of medications on the market (Health Technology Assessment)
- Defining and sharing Handbook
- Periodic review of the Handbook by all’ Evidence Based Medicine

(You will then choose between medications with the same indication, those with clinical efficacy based on scientific evidence and best value for cost-effectiveness: This will reduce the types of advanced medications purchased in a rational manner and to commit the resources devoted to treatment of chronic wounds)

On Stage: Dermatologist. Best Practice. Lessons Learnt from Adults
Greco A
Torino, Italy

Abstract

Each phase of life has its forms of fragility: the fragility of the newborn, of the toddler, of the old and of the sick. This vulnerability is the major cause of the development of pressure ulcers.

Besides the well-known morphological differences between a child and an adult, with the skin there are actually no substantial structural differences. In the newborn, but especially in the premature baby, the skin has many histological similarities with the skin of an old person: the thinning of the corneum layer, the flattening of the reticular layer and the inefficiency of the pH mantle.

These similarities in anatomical conditions determine the insurgence of some of the more common dermatological pathologies such as pressure ulcers and contact dermatitis, just to name a few. The similar pathologies allow for similar applications of clinical pathways, principles and procedures in the treatment of pressure ulcers for these patients.
Analysing and taking into consideration the diversity and similarities of paediatric and geriatric wounds with regard to form and location, wound type, grading, prognosis, favourable skin conditions, all allow us to obtain new data on how to improve the therapeutic approach.

In conclusion, fragility, similarities and diversities are there fundamental concepts upon which to base our clinical practice in the management of these categories of patients.

From Minor to Major Surgical Procedures for Pediatric Pressure Ulcers
La Scala G
Geneva, Switzerland

Abstract

Introduction. Pressure sores are not uncommon among pediatric patients, mostly occurring in patients admitted to the intensive care unit, where the prevalence is over 30%, but also in up to 5% of the patients admitted to a non-intensive care ward. The anatomical location of pressure sores is different in children compared to adults, with the highest frequency in the occipital area, because of the larger size of the head in children. The greater majority of lesions are superficial (grade I and II), occurring in previously well patients who present an acute and time-limited illness, and therefore usually do not require any surgical intervention.

Indications. Younger patients, especially newborns, have a great potential for spontaneous healing even for deep lesions, if the causing factor is eliminated and the appropriate conditions for healing are provided.

In patients with a congenital heart defect, the correction of the heart defect combined with an appropriate caloric and nutritional supplement greatly improves the course of pressure sores, allowing for spontaneous healing or for simpler treatment. It is therefore very important to carefully consider the patient before deciding if a surgical treatment for a deep pressure sore is the best choice. With this approach it is possible to avoid repeated general anesthesia, which would be necessary for dressing changes in case of open wounds, and that can be associated with severe morbidity in cardiac patients. From the age of 4 to 5 years, premixed nitrous oxide and oxygen (MEOPA, laughing gas) can be used for dressing changes that do not cause too much discomfort, avoiding general anesthesia.

Pediatric patients who should be considered for reconstructive surgery for pressure ulcers are those presenting chronic illnesses, for example paraplegia, quadriplegia or spine malformations such as myelomeningocele. As for adult patients, it is paramount to have a cooperative patient, who agrees to change habits and postures to which she/he is used; without good patient compliance the surgical correction is doomed for failure. Appropriate selection of the pediatric surgical candidate allows treatment with a recurrence risk limited to 5%.

Surgical technique. In a patient with a good nutrition status, without underlying osteomyelitis, the basic principles of the surgical treatment of deep pressure ulcers are:

• Surgical biopsy bacterial cultures-targeted antibiotic treatment
• Through surgical debridement, with collections drainage and bursa excision
- Conservative removal of bony prominences
- Bleeding control and suction drainage
- Residual cavity filling with well-vascularized tissue (i.e. by prior application of negative pressure dressing)
- Tension free closing (from simpler to complex: direct closure, skin graft (the preceding options not be considered for a chronic illness patient), tissue expansion, local flap, free flap)
- Postoperative protection of the operated area (pressure relieving mattress/bed)

Occipital lesions. This is the most common (18%) location of pressure sores in pediatric patients, frequent also in younger patients with a good nutritional status.

Unless faced with an extensive grade IV ulcer, it is preferable to let the lesion heal spontaneously without surgical excision, just preventing infection. The ulcer will heal by contraction and the residual area of alopecia can be secondarily corrected if necessary. An expanded scalp flap can cover large deep lesions, but in case of significant wound colonization there is a major risk of expander infection.

Sacro-coccygeal lesions. Frequently (14%) present in cachectic or paralyzed patients. The size of the lesion can be greatly reduced and filled using negative pressure dressings, allowing closure with a skin graft or even complete healing.

In patients with a recurring pressure ulcer or who chronically laying on their back, a local skin flap (Gluteus or rhomboid such as Limberg-Dufourmentel), provide excellent coverage. For deeper defects a musculo-cutaneous flap (Gluteus maximus V-Y advancement flap) is to be preferred; this flap causes however a significant motor deficit, reducing the ambulatory patient ability to extend the hip joint, and in these patients a fascio-cutaneous flap (V-Y advancement or propeller flap) can provide good cover without compromising hip function.

Heel lesions. It is an often-overlooked pressure point, which represents 14% of pediatric pressure ulcers. The treatment in this area can be limited to negative pressure dressing followed by a full thickness skin graft. In a bed-ridden patient requiring a thicker coverage, a local flap can be used (axial, lateral calcaneal artery V-Y flap, medial plantar artery island flap).

Conclusions. There are limited indications for the surgical treatment of pressure sores in the pediatric patient, thanks to the significant spontaneous healing potential in this population. Negative pressure therapy has further reduced the need for flaps that remain however the mainstay form of treatment of secondary correction of scalp lesions and of recurrent or extensive lesions in chronic care patients.