

# LINK<sup>®</sup> Wound Healing CONGRESS 2017

POWERED BY



Negative Pressure Wound Therapy



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Learn. Inform. Network. Knowledge.



# Welcome

The Journal of Wound Care (JWC), the Vivano Competence Network and HydroTherapy experts are delighted to invite you to the first **LINK for Wound Healing Congress**, which will take place on the 18th and 19th September 2017 in Belfast, Northern Ireland.

This international congress marks represents a unique opportunity for delegates to engage with key opinion leaders from all over the world in the field of advanced wound healing including negative pressure wound therapy (NPWT). It is therefore an unparalleled chance to chart the progress in these areas that has been documented in the past few years.

In order to promote networking and knowledge exchange under the LINK umbrella (Learn, Inform, Network, Knowledge), and following the repeated success of the Vivano Congress, this international event will discuss NPWT and other innovative approaches to treat hard-to-heal wounds. This will be done in two parallel conferences: Negative Pressure Wound Therapy and Advanced Wound Healing.

We believe this is an exceptional occasion to fully understand the challenges in wound healing, and discuss the different perspectives from which these could be addressed.

We look forward to seeing you in Belfast!

With warm regards,  
JWC, Vivano Competence Network and HydroTherapy experts

## Conference information

### Monday, 18th September 2017

16:30 - 18:00 Speakers registration at the Waterfront Congress Centre  
18:30 - 21:30 Congress dinner (Dresscode: business casual/elegant)

### Tuesday, 19th September 2017

08:00 - 09:00 Registration  
09:00 - 09:10 Word of Welcome from Hartmann  
09:00 - 10:30 Plenary session  
10:30 - 17:00 NPWT Congress  
10:30 - 17:00 Advanced Wound Healing Congress

**Congress venue:** Belfast Waterfront; 2 Lanyon Place, Belfast, BT1 3WH

**Congress dinner venue:** Titanic Museum; 1 Olympic Way, Queens Road, Titanic Quarter, Belfast BT3 9EP



# Programme overview NPWT

	Hall 2B	Meeting room 3
9:00-10:00	<p><b>Congress introduction</b>; Prof. Hans Smola</p> <p><b>Clinical challenges to wound bed preparation</b>; Prof. Sabine Eming</p> <p><b>How does epithelialization work?</b>; Prof. Tomic-Canic</p> <p><b>Introduction of topics and key speakers</b>; Prof. Hans Smola</p>	
10:00-10:30 <b>Coffee Break</b>		
10:30 - 12:00	<p><b>Open Abdomen</b> Chairs: Martin Hut'an, Tomasz Banasiewicz</p> <p><b>From craft systems to existing negative pressure systems</b>; Oswaldo Borraez</p> <p><b>NPWT in open abdomen as potential prevention of intraabdominal adhesions formation</b>; Tomasz Banasiewicz, Adam Bobkiewicz, Wojtek Francuzik</p> <p><b>Management of open abdomen with NPWT – state of the art and tips and tricks</b>; Dominik A. Walczak, Łukasz Krakowczyk, Adam Maciejewski</p> <p><b>Pressure distribution during NPWT in experimental abdominal compartment syndrome</b>; Zsolt Szentkereszty, Klaudia Balog, Zoltán Attila Godó, Katalin Pető, Deák Adám, Mariann Berhés, Norbert Németh, Adrienn Csiszkó</p> <p><b>Application of negative pressure dressing for the purpose of temporary abdominal closure in the management of ruptured abdominal aortic aneurysms following open surgery</b>; Zielinski M, Zawadzki P, Oszkinis G</p> <p><b>NPWT improves patients outcome in abdominal sepsis even in severe postoperative complications</b>; R. Scurtu, I. Cetina, C.C.Ciuce, R. Apostu, C. Ciuce</p>	<p><b>Special Indications 1</b> Chair: Csaba Toth, Darko Kucan</p> <p><b>Combination of NPWT and a marine Omega3 wound matrix in chronic wounds</b>; Georgios Meimarakis</p> <p><b>May the use of negative pressure therapy reduce the length of cicatrisation in pilonidal sinus. A prospective observational study</b>; C. Sabbagh, J. M. Regimbeau</p> <p><b>Synergic effect of hyperbaric oxygen therapy and NPWT in necrotizing fasciitis and necrotizing soft tissue infection treatment</b>; Mrázek T., Strnadl O., Hájek M.</p> <p><b>NPWT: indications in pediatric population</b>; M. C. Plancq, C. Klein, F. Deroussen, R. Gouron</p> <p><b>Use of NPWT as a treatment of Fournier's gangrene</b>; Darko Kucan MD, Janko Oreskovic MD</p>
12:00 - 13:30 <b>Lunch break &amp; poster viewing</b>		
13:30 - 15:00	<p><b>Orthopedics &amp; Trauma</b> Chair: Rolf Becker, Rita Lages</p> <p><b>Application of NPWT in spinal infections</b>; Istvan Klemencsics, Aron Lazary, Peter Pal Varga</p> <p><b>A last resort before exarticulation</b>; Geza Pallag, Kristof Hajdu</p> <p><b>Surgical procedure protocol in septic chest cavity complications</b>; Sándor Pellek</p> <p><b>Management of wound healing complications of above-knee amputation stump</b>; Rita Lages, Alice Pimentel, Teresa Santos, Marta Serra, Catarina Ribeiro, Paulo Menezes, Catarina Fernandes, Filipe Ribeiro, António Oliveira, Angelo Figueiredo, Amélia Vieira</p> <p><b>NPWT in treatment of an infected, postraumatic wound of the knee joint area</b>; Wojciech Panz</p>	<p><b>Special Indications 2</b> Chair: Christian Willy, Martin Hut'an</p> <p><b>The risk of surgical site infection (SSI) and SSI prevention with closed incision negative pressure therapy (cinPT)</b>; Christian Willy</p> <p><b>Closure rate of enteroatmospheric fistula in open abdomen management using NPWT. A multicenter observational study in Poland</b>; Adam Bobkiewicz, Dominik Walczak, Szymon Smoliński, Tomasz Kasprzyk, Tomasz Banasiewicz</p> <p><b>Place of NPWT in the algorithms of wound healing</b>; Hutan Martin, Kutarna Juraj, Loncsar Gerhard</p> <p><b>The role of NPWT in treatment after surgery for patient with colorectal cancer</b>; J. Bartos, M. Skrovina, A. Jurkovic</p> <p><b>Trans-tibial amputation associated with Vivano NPWT applied on closed wound. 32 consecutive cases</b>; G. Maxant, C. Deharvengt</p>
15:00 - 15:30 <b>Coffee break</b>		
15:30-17:00	<p><b>Technological Aspects in NPWT</b></p> <p>Chair: Mike Laukötter, Christian Willy</p> <p><b>The "optimal" pressure level using NPWT- Some technological aspects</b>; Christian Willy</p> <p><b>Which pressure in NPWT: literature review and experts' opinions</b>; Mike G. Laukoetter, Tomasz Banasiewicz, Rolf Becker, Marco Fracalvieri, Martin Hutan, Csaba Toth, Lenka Veverkova, Zsolt Szentkereszty</p> <p><b>"Pitfalls in NPWT": Analysis &amp; lessons learned</b>; Lenka Veverková, Kateřina Krejsová, Jan Žák, Michal Reška, Petr Vlček</p> <p><b>Is there any correlation between level of negative pressure used and rate of enteroatmospheric fistula formation in open abdomen management using NPWT? Analysis of 632 patients and outcomes of worldwide observational study</b>; Bobkiewicz Adam, et al</p> <p><b>Management of enteroatmospheric fistula with NPWT - state of the art and tips and tricks</b>; Dominik A. Walczak, Łukasz Krakowczyk, Adam Maciejewski</p>	<p><b>Special Indications 3</b></p> <p>Chair: Tomasz Banasiewicz, Zsolt Szentkereszty</p> <p><b>Management of large chronic venous leg ulcers with NPWT</b>; Dominik A. Walczak, Michał Wojtyński, Rajmund Jaguścik, Wojciech Fałek, Piotr W. Trzeciak</p> <p><b>Use of NPWT in the management of pediatric septic wounds</b>; M. C. Plancq, C. Klein, F. Deroussen, R. Gouron</p> <p><b>NPWT as a safe and effective method in complicated neurosurgical complication with exposed dura mater</b>; Tomasz Banasiewicz, Witold Ledwosiński, Kinga Zastawna, Bartosz Sokół, Joanna Biłska-Stokłosa</p> <p><b>NPWT allows a successful salvage of acute infected mesh after hernia repair</b>; Alicia Mettoudi, Yohann Renard</p> <p><b>The efficiency and safety of negative pressure wound therapy in open abdomen. A hungarian multicentric, prospective, observational study</b>; Szentkereszty Zs., Csiszkó A., Susán Zs., Vereczkei A., Szöllösi A., Svéda Sz., Kincses Zs., Nagyházi J.B., Sugár I., Bakity B., Harsányi L.</p> <p><b>The role of NPWT in the treatment of severe burns in children</b>; Sidonia Susanu</p>

# Oral presentations overview

## Open Abdomen

**From craft systems to existing negative pressure systems**, *Oswaldo A., Borráez G.*

**Negative pressure wound therapy in open abdomen as potential prevention of intraabdominal adhesions formation**, *Tomasz Banasiewicz, Adam Bobkiewicz, Wojtek Francuzik, Poland*

**Management of open abdomen and enteroatmospheric fistula with negative pressure wound therapy – state of art and tips and tricks**, *Dominik A. Walczak, Łukasz Krakowczyk, Adam Maciejewski, Poland*

**Pressure distribution during negative pressure wound therapy in experimental abdominal compartment syndrome**, *Zsolt Szentkereszty, Klaudia Balog, Zoltán Attila Godó, Katalin Pető, Deák Ádám, Mariann Berhész, Norbert Németh, Adrienn Csiszkó, Hungary*

## Orthopedics & Trauma

**Application of negative pressure dressing for the purpose of temporary abdominal closure in the management of ruptured abdominal aortic aneurysms following open surgery**, *Zielinski M, Zawadzki P, Oszkinis G, Poland*

**Negative pressure wound therapy improves patients outcome in abdominal sepsis even in severe postoperative complications**, *R. Scurtu, I. Cetina, C.C.Ciuce, R. Apostu, C. Ciuce, Romania*

**Application of negative pressure wound therapy in spinal infections**, *Istvan Klemencsics, Aron Lazary, Peter Pal Varga, Hungary*

**A last resort before exarticulation**, *Dr. Geza Pallag, Dr. Kristof Hajdu, Hungary*

**Surgical procedure protocol in the septic chest cavity complications**, *Sándor PELLEK MD PhD, Hungary*

**Management of wound healing complications of above-knee amputation stump**, *Rita Lages, Alice Pimentel, Teresa Santos, Marta Serra, Catarina Ribeiro, Paulo Menezes, Catarina Fernandes, Filipe Ribeiro, António Oliveira, Angelo Figueiredo, Amélia Vieira, Portugal*

**NPWT in treatment of an infected, postraumatic wound of the knee joint area**, *Wojciech Panz M.D., Poland*



## Technological Aspects in NPWT

**The "optimal" pressure level using NPWT- Some technological aspects**, *Christian Willy, MD, PhD, Prof., Colonel, Germany*

**Which pressure in NPWT: literature review and experts' opinions**, *Mike G. Laukoetter, Tomasz Banasiewicz, Rolf Becker, Marco Fraccalvieri, Martin Hutan, Csaba Toth, Lenka Veverkova, Zsolt Szentkereszty, Germany*

**"Pitfalls in NPWT": Analysis & lessons learned**, *Lenka Veverková, Kateřina Krejsová, Jan Žák, Michal Reška, Petr Vlček, Czech republic*

**Is there any correlation between level of negative pressure used and rate of enteroatmospheric fistula formation in open abdomen management using negative pressure wound therapy NPWT? Analysis of 632 patients and outcomes of worldwide observational study**, *Bobkiewicz Adam, Banasiewicz Tomasz, Bertelsen Anders, Caro Aleidis, Di Saverio Salomone, Kääriäinen Minna, Kjossev Kirien, Lehwald-Tywuschik Nadja, McBride Craig, Mutafchyiski Ventsislav, G. Novelli Giuseppe, Carles Olona, Popivanov Georgi, Szeberin Zoltán, Szczepkowski Marek, Tavares de La Paz Luis Alberto, Tugnoli Giorgini, Willms Arnulf Gregor, Veverkova Lenka, Yetisir Fahri, Zawadzki Marek, Lorenc Zbigniew, Poland*

## Special Indications 1

**Combination of NPWT and a marine Omega3 wound matrix in chronic wounds**, *Georgios Meimarakis, Klinikum Landshut, Germany*

**May the use of negative pressure therapy reduce the length of cicatrisation in pilonidal sinus? A prospective observational study. The Pilopressure study**, *C Sabbagh, JM Regimbeau, France*

**Synergic Effect of Hyperbaric Oxygen Therapy and Negative Pressure Wound Therapy in Necrotizing Fasciitis and Necrotizing Soft Tissue Infection Treatment**, *Mrázek T., Strnadel O., Hájek M, Czech republic*

**Negative pressure wound therapy: indications in pediatric population**, *M C Plancq, C Klein, F Deroussen, R Gouron, France*

**Use of negative pressure wound therapy (NPWT) as a treatment of Fournier's gangrene**, *Darko Kucan, MD, Janko Oreskovic MD, Croatia*



## Special Indications 2

**The risk of surgical site infection (SSI) and SSI prevention with closed incision negative pressure therapy (cinPT)**, *Christian Willy, MD, PhD, Prof., Colonel, Germany*

**Closure rate of enteroatmospheric fistula in open abdomen management using negative pressure wound therapy. A multicenter observational study in Poland**, *Adam Bobkiewicz, Dominik Walczak, Szymon Smoliński, Tomasz Kasprzyk, Tomasz Banasiewicz, Poland*

**Place of NPWT in the algorithms of wound healing**, *Hutan, Martin, MUDr., PhD., Kutarna Juraj., MUDr., PhD., Loncsar Gerhard, dr. med., Austria*

**The role of NPWT in treatment after surgery for patient with colorectal cancer**, *J.Bartos, M.Skrovina, A.Jurkovic, Czech Republic*

## Special Indications 3

**Trans-tibial amputation associated with Vivano negative pressure therapy applied on closed wound. About 32 consecutive cases**, *G. Maxant, C. Deharvengt, France*

**Management of large chronic venous leg ulcers with negative pressure wound therapy**, *Dominik A. Walczak, Michał Wojtyniak, Rajmund Jaguścik, Wojciech Falek, Piotr W. Trzeciak, Poland*

**Use of Negative Pressure Wound Therapy in the management of pediatric septic wounds**, *M C Plancq, C Klein, F Deroussen, R Gouron, France*

**Negative Pressure Wound Therapy as a safe and effective method in complicated neurosurgical complication with exposed dura mater**, *Tomasz Banasiewicz, Witold Ledwosiński, Kinga Zastawna, Bartosz Sokół, Joanna Bilka-Stokłosa, Poland*

**NPWT allows a successful salvage of acute infected mesh after hernia repair**, *Alicia METTOUDI, Yohann RENARD, France*

**The efficiency and safety of negative pressure wound therapy in open abdomen. A Hungarian multicentric, prospective, observational study**, *Szentkereszty Zs., Csiszkó A, Susán Zs., Vereczkei A., Szöllősi A., Svéda Sz., Kincses Zs., Nagyházi J.B., Sugár I., Bakity B., Harsányi L., Hungary*

**The role of NPWT in the treatment of severe burns in children**, *Sidonia Susanu, Iasi, Romania*



# From craft systems to existing negative pressure systems

Oswaldo A.<sup>1</sup>, Borráz G.<sup>2</sup>

1) *Professor of Surgery, National of Colombia University*

2) *General Surgery, National of Colombia University*

It is widely known the great efforts of surgeons over time to properly handle intra-abdominal infections. In 1.979 the Doctor Steimberg decided to manage the abdominal cavity as if it were an abscess, leaving it open, but he had the drawback that the evisceration was presented in his patients. In 1.980 the Doctor Teichmann decided in these patients to cover the abdominal viscera with a mesh to which he added a zipper. In his patients he had better results but he had many intestinal lesions as much as the mesh as by the rack.

In 1.984 at the San Juan de Dios hospital of the National University, in Bogotá, Colombia where I was a resident of General Surgery in a young patient with a closed abdominal trauma who required right hepatectomy and presented several complications, requiring reinterventions. In the fourth surgery I could not close it and because of the lack of resources I decided to leave the patient with the open abdomen covered with a plastic bag that I fixed to the fascia aponeurotic. This patient was practiced periodic drainage through the plastic bag. Way was born the so called Bogotá Bag or Borráz bag. For these patients we knew much better another pathology, such as abdominal hypertension. The same manner have existed intestinal fistulas. With the management of the open abdomen appeared other complications that we knew better: severe adherence syndrome, large herniated defects in the abdominal wall and the dreaded enteroatmospheric fistulas. In 1.994 two Orthopedists, Doctors L. Argenta and M. Morykwas managing a patient with osteomyelitis developed a negative pressure system, which gave them excellent results: removed the infected material and purulent, in addition to allowing the granulation and healing of the tissues. This system of negative pressure called Vaccum assisted closure. This system in its beginnings was very expensive which forced many people to develop systems crafts. In the San Blas hospital in Bogotá, Colombia and in the year 1.995, I developed a negative pressure system with a vegetable product called scouring pad or scrubber (*Luffa cylindrica*). It is used for a body bathing. Why it is?: because it has large holes and because of its consistency that makes it difficult to collapse. Thus allowed that when used the intestinal secretions derived from intestinal fistulas could pass through it and thus facilitate the organization and closure of intestinal fistula in 17 patients. In the world pharmaceutical industry has developed different negative pressure systems, making them simpler and easier to handle as well as reducing the cost.

We in recent years have been using the negative pressure system (Vivano) implemented by the Hartmann Group which is easy to handle and very economic. We have used it in some patients after passing the acute phase and has allowed us to contract the wound in such a way we can close it early without the use of mesh. We have also managed patients with intestinal fistulas, which have closed within 4 weeks. We have abandoned now the use of the systems of negative pressure crafts and we are using the system of negative pressure called Vivano. This system is very easy to use and it is contemplated within the plan of health benefits in our country like others negative pressure system .

We continue to use the Bogotá Bag or Borráz Bag with some modifications introduced to the technique over the years, in different pathology, in order to reduce complications and facilitate the early closure of the abdominal wall without the use of meshes.

The indications in which we consider the use of the this system of the negative pressure are: in patients who require the technique of open abdominal management and could not be closed in the first week, but where has given way to the inflammatory aspect of the intestines and there is no greater risk of injuring the intestine by pressure and patients with abdominal trauma with intestinal and / or vascular lesions. These patients in the initial phase should be handled from my point of view with the Bogotá Bag or Borráz Bag and after the acute phase with the negative pressure system.

# Negative pressure wound therapy in open abdomen as potential prevention of intraabdominal adhesions formation

*Tomasz Banasiewicz, Adam Bobkiewicz, Wojtek Francuzik*

*Department of General, Endocrinological Surgery and Gastrointestinal Oncology, Poznan University of Medical Sciences, Poznan, Poland*

**Aim:** Open Abdomen (OA) technique is commonly used in complications of the GI tract, vascular or trauma surgery. Negative Pressure Wound Therapy (NPWT) seems to be very effective to improve the results of the therapy, reduce the number of complications, reduce mortality and increase the quality of life of treated patients. The main goal of NPWT in OA treatment is reduction of mortality and morbidity in this group of patients. In some of these patients further operations for different reasons are sometimes necessary or indicated. The main indication for resurgery is probably the restoration of the GI tract, because of the stoma formation in many patients. The potential problems for surgeon are the intraabdominal adhesions leading to the complications or making in some cases GI tract restoration impossible. Little is known about intraabdominal adhesions formation during OA treatment as well as during NPWT therapy. The aim of the study was to define the subjective opinions of the surgeons about abdominal adhesions during OA with NPWT.

**Methods:** The simple questionnaire was sent into the 250 authors published papers considering OA and NPWT. The questionnaire included among others questions about the subjective score of adhesions in reoperated patients, fistula formation, stoma occurrence

**Results:** 35 questionnaires were sent back with total number of 628 patients, what is in our knowledge biggest group of patients with OA treated using NPWT. Reoperations with subjective adhesions evaluation were performed in 194 cases. In 98 patients adhesions were described as „less adhesions than I expected“, 75 patients have „adhesions according to my expectations“ and in 21 patients „more adhesions than I had expected“ were observed. The fistula had developed during NPWT therapy in 34 patients, in 7 multiple.

**Conclusion:** In subjective opinion of surgeons the NPWT can potentially reduce the adhesions formation in OA. The further examination with an explanation of the potential mechanism is indicated.

**Clinical relevance:** Reduction of intraabdominal adhesions in OA patients treated with NPWT can be additional, previously not described advantage of the NPWT.

# Management of open abdomen and enteroatmospheric fistula with negative pressure wound therapy – state of art and tips and tricks

*Dominik A. Walczak, Łukasz Krakowczyk, Adam Maciejewski*

*Department of Oncologic and Reconstructive Surgery, Maria Skłodowska-Curie Memorial Cancer Centre and Institute of Oncology, Gliwice, Poland*

Laparostomy and open abdomen (OA) are terms used to describe temporary controlled open abdominal wounds due to severe peritonitis, damage-control surgery or abdominal compartment syndrome. Several methods have been tried to control the situation and to assist in its management however the negative pressure wound therapy (NPWT) seems to have the best overall results.

Development of an entero-atmospheric fistula (EAF) in the midst of an open abdomen represents a surgical nightmare, with an extremely challenging critical care problem set, including the full spectrum of surgical, metabolic, nutritional, and nursing issues. The control and drainage of effluent from fistula is a separate issue. Because there are no fixed algorithms for treatment of EAF, the surgeons need to develop their own, often unconventional solutions. As each case is complex and unique, NPWT is a key technique to provide an individualized approach because NPWT can provide different actions at different stages of treatment.

The objective of this study was to conduct a review of the literature on NPWT as temporary abdominal closure. We describe evidence based recommendations for the use of negative pressure wound therapy in the open abdomen. Moreover, we present some useful tips and tricks which may improve the rate of fascial closure and help in successful management of EAF fistulas.

## **References:**

- [1] Bruhin A, Ferreira F, Chariker M, Smith J, Runkel N. Systematic review and evidence based recommendations for the use of negative pressure wound therapy in the open abdomen. *Int J Surg.* 2014 Oct;12(10):1105-14.
- [2] Chiara O, Cimbanassi S, Biffi W et al. International consensus conference on open abdomen in trauma. *J Trauma Acute Care Surg.* 2016 Jan;80(1):173-83.
- [3] Di Saverio S, Tarasconi A, Walczak DA Classification, prevention and management of entero-atmospheric fistula: a state-of-the-art review. *Langenbecks Arch Surg.* 2016 Feb;401(1):1-13.
- [4] Title of a book: Leczenie metodą otwartego brzucha - kiedy i jak. Editors: Dominik A. Walczak, Tomasz Banasiewicz, Piotr W. Trzeciak. Termedia, 2016

# Pressure distribution during negative pressure wound therapy in experimental abdominal compartment syndrome

Adrienn Csiszkó, Klaudia Balog, Zoltán Attila Godó, Katalin Pető, Deák Ádám, Mariann Berhész, Norbert Németh, Zsolt Szentkeresztzy

Medical and Health Science Center, Institute of Surgery, Debrecen, Hungary, Faculty of Informatics, Department of Information Technology, Debrecen, Hungary, Faculty of Medicine, Department of Operative Techniques and Surgical Research, Debrecen, Hungary, Faculty of Medicine, Department of Anesthesiology and Intensive Care, Debrecen, Hungary

**Aim:** Negative pressure wound therapy (NPWT) is a frequently applied open abdomen (OA) treatment. There are only a few experimental data supporting this method and describing the optimal settings and pressure distribution in the abdominal cavity during this procedure. The aim of our study was to evaluate pressure values at different points of the abdominal cavity during NPWT in experimental abdominal compartment syndrome (ACS) animal model.

**Methods:** In this study (permission Nr. 13/2014/UDCAR) 27 Hungahib pigs (15.4- 20.2 kg) were operated. ACS was generated by implanting a silastic bag in the abdomen through mini-laparotomy and filled with 2100- 3300 ml saline solution (37 C°) to an intraabdominal pressure (IAP) of 30 mmHg. After 3 hours, NPWT (Vivano Med® Abdominal Kit, Paul Hartmann AG, Germany) or Bogota bag was applied. NPWT group was divided into -50, -100 and 150 mmHg suction group. Pressure distribution to the abdominal cavity was monitored at 6 different points of the abdomen via a multichannel pressure monitoring system.

**Results:** The absolute pressure levels were significantly higher above than below the layer. The values of the pressure were similar in the midline than laterally. Amongst the bowels the pressure values changed periodically between 0 and -12 mmHg which might be caused by the peristaltic movements.

**Conclusion:** The porcine model of the present study seems to be well applicable for investigating ACS and NPWT. It was possible to provide valuable data for clinicians.

The pressure was well distributed by the protective layer to the lateral parts of the abdomen and this phenomenon did not change considerably during the therapy.

**Clinical relevance:** The porcine model of the present study seems to be well applicable for investigating ACS and NPWT. It was possible to provide valuable data for clinicians.

**Acknowledgements:** Hartmann GMBH for financial and technical support

**Conflict of Interest:** There is conflict of interest about this study

## References:

- Kirkpatrick AW, Roberts DJ, Jaeschke R, De Waele JJ, De Keulenaer BL, Duchesne J, Bjorck M, Leppäniemi A, Ejike JC, Sugrue M, Cheatham ML, Ivatury R, Ball CG, Reintam Blaser A, Regli A, Balogh Z, D'Amours S, De Laet I, Malbrain ML: Methodological background and strategy for the 2012-2013 updated consensus definitions and clinical practice guidelines from the abdominal compartment society. *Anaesthesiol Intensive Ther.* 2015;47:s63-77.
- Coccolini F, Biffi W, Catena F, Ceresoli M, Chiara O, Cimbanassi S, Fattori L, Leppaniemi A, Manfredi R, Montori G, Pesenti G, Sugrue M, Ansaloni L: The open abdomen, indications, management and definitive closure. *World J Emerg Surg.* 2015;10:32.
- Demetriades D, Salim A: Management of the open abdomen. *Surg Clin North Am.* 2014 Feb;94(1):131-53.
- Atema JJ, Gans SL, Boermeester MA: Systematic review and meta-analysis of the open abdomen and temporary abdominal closure techniques in non-trauma patients. *World J Surg.* 2015;39(4):912-25.

# Application of negative pressure dressing for the purpose of temporary abdominal closure in the management of ruptured abdominal aortic aneurysms following open surgery.

Zielinski M, Zawadzki P, Oszkinis G

Department of General and Vascular Surgery Poznan University of Medical Sciences, Poznan, Poland

**Aim:** Despite ongoing progress in the surgical treatment of ruptured abdominal aortic aneurysms (RAAA), thirty-day postoperative mortality reaches 30 to even 55 percent. Multi organ dysfunction syndrome (MODS) is postulated to be the main cause of patients' deaths following RAAA repair. The recognized underlining mechanisms comprises: intra-abdominal hypertension (IAH) leading to abdominal compartment syndrome, superimposed with visceral perfusion dysfunction. The objective of this study was to assess the effectiveness of delayed abdominal closure with the utility of negative pressure dressing in the improvement of ruptured aortic aneurysm repair outcome.

**Methods:** From January 2013 to December 2016, 97 patients with RAAA were successfully operated. In the initial 54 consecutive cases (group I), operative procedure ended with primary abdominal closure, whereas in 43 subsequent patients (group II), negative pressure dressing was used for the purpose of temporary abdominal closure aortic repair. The following parameters where comparatively analysed: duration of operation, mortality rate, reoperation rate, ischemic bowel complication rate, recovery time, intensive care stay and comfort of postoperative patients' care.

**Results:** Among evaluated variables, no significant differences between groups where noticed in exception of duration of operation, that was significantly longer in the group I. However, in group II we observed trend towards higher reoperative rate, with lower incidence of ischemic bowel complication. Also, average recovery time and length of intensive care stay was favourable for the group II. Subjectively assessed comfort of postoperative nursing care was similarly higher among patients obtaining negative pressure dressing abdomen closure.

**Conclusion:** Temporary negative pressure abdominal closure following RAAA repair is feasible and reduces the duration of operation. It also enforces second-look operation during suction dressing removal and final closure of the abdomen. This may contribute to the higher diagnostic accuracy of bowel ischemic complication. Temporary use of negative pressure abdominal closure, following RAAA operation affects positively patient's recovery, most probably via decompression of abdominal compartment, lowering intra-abdominal pressure. It also decreases nursing workload.

# Negative pressure wound therapy improves patients outcome in abdominal sepsis even in severe postoperative complications

R. Scurtu, I. Cetina, C.C.Ciuce, R. Apostu, C. Ciuce

First Surgical Clinic, University of Medicine and Pharmacy "Iuliu Hatieganu" Cluj-Napoca, Emergency Cluj County Hospital, Romania

**Background:** Negative pressure wound therapy (NPWT) is a valuable surgical technique in the management of a wide range of complex abdominal injuries and conditions including trauma, damage control, sepsis and relaparotomy. The present study aimed to identify the patients with abdominal sepsis and postoperative sepsis related conditions in which the NPWT would ensure the best results.

**Methods:** We reviewed the indications and the results of NPWT in patients with severe abdominal sepsis treated in our department from July 2015 to February 2017. We retrieve 19 patients with NPWT, 11 of them with secondary or tertiary peritonitis and the remaining 8 with postoperative fistula associated with peritonitis. We recorded the overall survival (OS), the ability to definitively close the abdomen, the length of hospital stay (LOS).

**Results:** There were 11 men and 8 women, with a mean age of 62.3 (35-74) years and a mean LOS of 43 days (14-101). The mean ASA score was 2.1. The mean number of vacuum dressings was 7, with a mean number of 5 for patients with peritonitis and 9 for those with postoperative complications. Abdominal closure using the mesh mediated fascial closure was achieved in 9 (47.3%) patients, while in one a double layer mesh had to be used. In another 7 (36,6%) patients abdominal closure was performed using split thickness skin grafts or direct suture of the overlaying skin with planned ventral hernia. In two patients abdominal closure could not be performed due to an important fistula output. The overall survival was 84.2%, while in hospital mortality was recorded only in three patients, all of them with postoperative fistulas and secondary organ failure.

**Conclusions:** NPWT improve overall outcome in abdominal sepsis. These results are clearly influenced by the etiology and patient status and seemed to be better when NPWT is associated immediately in the treatment of abdominal septic emergencies when compared to postoperative complications.

# Application of negative pressure wound therapy in spinal infections

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**Aim:** Surgical site infection (SSI) after spinal surgery especially among older patients with extended thoracolumbar spine surgery is a serious complication. Mainly in these cases treatment of SSI is a major challenge for both patients and clinicians too because of prolonged hospitalization and antibiotic therapy, or several times performed revision surgeries and debridements. NPWT can offer a valuable help for unmanageable SSI cases. Aim of our study was to analyse the success of NPWT application among patients who underwent thoracic or/and lumbar spinal surgery from dorsal approach and suffered from poorly healing, or/and deep wound SSI.

**Methods:** All of the patients were treated in a tertiary referral institution for the treatment of spinal disorders because of primary spinal infection, degenerative spinal disorders or deformity. Success of NPWT was defined as there was no need further surgical intervention (e.g. suture, debridement, and revision) because of SSI after the completion of NPWT. Duration of NPWT (days), fate of spinal implants (retain, exchange, remove) were also analysed.

**Results:** 31 patients clinical data were analysed between Nov. 2013 and Nov. 2016 retrospectively. All of the patients suffered from poorly healing, deep wound SSI after extended thoracic or/and lumbar spinal surgery from dorsal approach. The mean age of study population was 55.7 years (16 – 84ys). Most of the patients were female (N, female=21; N, male=10). The mean duration of NPWT was 24.6 days (6 – 110 days). There were 28 surgical interventions with the use of spinal implants. Most of the spinal instruments could be preserved (N=22) with the help of NPWT. There was no need further surgical intervention because of SSI in case of nearly two-third of patients (N=19).

**Conclusion:** NPWT can offer hygienic and comfortable wound care in even seemingly hopeless, unmanageable deep wound spinal SSI cases. NPWT can decrease the number of septic revision surgeries, or can prevent to propagation of septic process. Previously implanted spinal instruments can also be preserved retain the stability of spinal column.

# A last resort before exarticulation

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**Introduction:** As a last resort before exarticulation, authors performed debridement and application of Negative Pressure Wound Therapy (NPWT) in the operating theatre. No such usage of Vivano was performed before on their ward - the right femoral stump had a protruding femur. Wound discharge and high temperature have disappeared thanks to the inpatient usage of NPWT, granulation started. They used Sorbalgon T in the outpatient setting and healing by secondary intention was achieved.

**Discussion/Conclusion:** The authors would like to demonstrate that by using negative pressure wound therapy, previously un-curable septic wounds can be successfully treated conservatively.

# Surgical procedure protocol in the septic chest cavity complications

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**Aim:** The pyogenesis of the thoracic cavity has localised, a thick wall pus-sack has developed. In this clinical status, result cannot be achieved with minimal surgical methods.

**Methods:** Due to the psychic status of the patient the commenced thoracic tubing and the aseptic lavages were unsuccessful. We performed the partial removal of the 8th and 9th rib at the deepest point of the chest and the abscess cavity, we sutured together the pleura and skin and we developed a window on the wall of the chest. We closed up the thoracic cavity following antiseptic lavages, with the help of the sponge technique that was placed in through the working channel, and with VIVANO negative pressure wound therapy device (NPWT).

**Results:** With the open-chest management, and with the appliance of negative pressure wound therapy (NPWT) the lungs are able to perform full capacity dilation, residual fluid reservoirs and air inclusions are not performed, thus the septic focus can be directed towards the window on the wall of the chest. By eliminating the free cavity and with targeted antibiotic therapy, the septic procedure can be completely healed.

**Conclusion:** The negative pressure therapy performed in the thoracic cavity is a therapy that can be used safely. The sponge placed in the thoracic cavity needs to be changed on regular bases. With the combined use of the window of the chest wall we change the sponge every 3rd day. Following the primary surgical intervention we performed revision and the change of the decreasing size of the sponge; the free chest cavity has disappeared. We closed up the window of the chest wall with a muscle flap and with the skin, following we have achieved a sterile status.

**Clinical relevance:** The negative pressure wound therapy can be successfully used in the pyogenic process of the thoracic cavity, even in cases that were therapy resistant at the beginning. The well developed therapeutic protocol and the targeted antibiotic therapy may provide a proposable duration for the therapy, which provides pecuniary assistance of the method.

# Management of wound healing complications of above-knee amputation stump

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**Introduction:** The majority of patients undergoing amputation of the lower limb have peripheral vascular disease and diabetes, often resulting in significant wound healing problems. Negative pressure wound therapy (NPWT) has become increasingly helpful even in the worst cases.

**Case description:** The authors present the case of a 79-year-old male patient. He has a past history of diabetes, hypertension, stroke and a right knee replacement surgery. He was admitted in the emergency room with right foot ischemic necrosis and urinary tract and respiratory infections. He was submitted to limb amputation and prosthetic extration. Although infection was successfully managed, there was a complete dehiscence of the amputation wound, with bone exposure. Initially it was managed with chemical debridement and antibiotics. When the wound stabilized NPWT was applied with a silicone sheet protection between de muscles and the bone and 120 mmHg continuous pressure. After granulation tissue formation with partial bone coverage it was possible to surgically perform mioplasty and wound closure.

**Discussion/Conclusion:** NPWT has a complementary function with a wide range of indications in the treatment of complex wounds. The application of NPWT can accelerate wound healing, optimizing blood flow and tissue perfusion. It was possible to manage this complex stump dehiscence even with bone exposure, emphasizing multiple applications of silicone sheets

**Clinical relevance:** This case has clinical relevance primarily because wound healing complications are very common, beside the best care given. It is possible, in the light of new developments, to successfully manage complex wounds with bone or organ exposure with silicone sheets.

**References:** "Rutherford's Vascular Surgery, 8th Edition; Judy Harker "Wound healing complications associated with lower limb amputation", *World Wide Wound*, Sept 2006; C. Huang et al, "Effect of negative pressure wound therapy on wound healing", *Current Problems in Surgery* 51 (2014) 301–331; Jin Su Shin, Hwan Jun Choi, "Application of a Silicone Sheet in Negative-Pressure Wound Therapy to Treat an Abdominal Wall Defect after Necrotizing Fasciitis", *Arch Plast Surg* 2017 Jan, 44(1); 76-79.

# NPWT in treatment of an infected, posttraumatic wound of the knee joint area

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**Introduction:** Posttraumatic wounds of the lower limb are not often treated with a NPWT therapy. Most of them heal under ordinary wound dressing and do not require any additional medical procedures. However, healing becomes much more complicated following a crush injury with considerable skin depletion and accompanying infection of the fatty tissue and the prepatellar bursa.

**Case description:** A 41 -year-old female was admitted to the outpatient clinic in connection with a posttraumatic, infected wound with full-thickness skin depletion. Upon admission, she suffered from an infected posttraumatic wound in the area of the knee joint. The first surgical debridement and assesment of the wound was performed in the outpatient clinic. A microbiology swab was taken for laboratory exam. Upon the patient's admission to the Surgery Department, surgical debridement was carried out, including the infected prepatellar bursa, followed by a NPWT. The wound healed quickly and sealed up with a noticeable decrease in the amount of the exudate. There was no further loss of the remaining subcutaneous fatty tissue. After two weeks of therapy, the bed of the wound was ready for a full-thickness skin graft. The procedure was performed and a vacuum wound dressing was applied onto the graft site. After seven days, the wound was fully covered by the graft and it was healing properly.

The patient was discharged to the outpatient clinic for regular wound dressing changes. A compression stocking (2nd class) was applied to optimize the healing results.

**Discussion/Conclusion:** In posttraumatic wounds a NPWT is a valuable option for treatment. Combined with wound dressings containing silver, it may help the surgeon in the process of tissue debridement and non-surgical bursa debridement and closure. NPWT helps to prevent further loss of surrounding tissue and decreases the area of the wound requiring a skin graft. The benefits of NPWT in the protection of the skin graft site has been confirmed.

# The "optimal" pressure level using NPWT - Some technological aspects

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**Aim:** The objective of this study was to analyse pressure conditions in the foam-tissue interface zone during application of vacuum therapy. We also focused on the question of whether the applied suction is undiminished over a longer distance as would be required when foams of larger area-size are used and whether there are important differences between the two currently available foam materials, polyurethane (PU) and polyvinyl alcohol (PVA).

**Methods:** Pressure measurements were performed using a multichannel computer-guided pressure measurement system (ARGUS®, MIPM GmbH) that uses a piezoresistive principle for pressure registration. The measurement method is based on changes in specific resistance in certain semiconductors in response to pressure.

**Results:** The results of the study show that suction is distributed almost undiminished through the foam to the wound surface. This is possible in the suction range of 50-200 mmHg even at distances of over 50 cm using only one port/connector. When a PVA foam is used, there is a relevant reduction in suction strength at suction levels of > 150 mmHg that increases in proportion to the distance from the port/connector. It was also shown that positive pressures reaching >50 mmHg may develop the uppermost tissue layers. The shape of the wound (whether convex or concave) has a significant effect on the developing pressure conditions.

**Conclusions:** The currently recommended suction strength of 125 mmHg was based on an animal experiment by Morykwas et al. And Isago et al. compared suction strengths of 0, 25, 50, 75 and 125 mmHg in terms of associated wound healing success. They found that there were no significant differences between respective speeds of wound healing achieved at suction strengths of 50, 75 and 125 mmHg. Hence, it appears that suction strengths falling in the range of 50 to 125 mmHg are essentially equivalent in terms of suitability for vacuum therapy. Based on these findings, it appears that suction pressure should be selected so as to create non-homogeneous pressure conditions in the tissue yet not high as to cause extensive ischemia near the wound surface. The applied suction pressure should not, therefore, be standardized to 125 mmHg.

**Keywords:** Pressure level, NPWT, negative pressure wound therapy. Clinical relevance: Pressure level is the central setting criteria when using NPWT. Conflict of Interest: Presentations supported by Acelity and Hartmann AG

## References:

- C. Willy, H. v. Thun-Hohenstein, H.U. Voelker, M. Weymouth, T. Kossmann and M. Engelhardt (2006) Experimental Basis II - Pressure Values Under Vacuum Therapy Foams - An Experimental in vitro and in vivo Investigation. In: (Edited by Christian Willy) The Theory and Practice of Vacuum Therapy Scientific Basis, Indications for Use, Case Reports, Practical Advice, 71-86, Lindqvist Book Publishing, Berlin, 2006
- Willy C, von Thun-Hohenstein H, von Lubken F, Weymouth M, Kossmann T, Engelhardt M (2006) [Experimental principles of the V.A.C.-therapy -- pressure values in superficial soft tissue and the applied foam]. Zentralbl Chir 131 Suppl 1:S50-61
- Kim PJ, Attinger CE, Steinberg JS, Evans KK, Lehner B, Willy C, et al. (2013) Negative-pressure wound therapy with instillation: international consensus guidelines. Plast Reconstr Surg 132(6):1569-1579
- Back DA, Scheuermann-Poley C, Willy C (2013) Recommendations on negative pressure wound therapy with instillation and antimicrobial solutions - when, where and how to use: what does the evidence show? Int Wound J 10 Suppl 1:32-42
- Apelqvist J, Willy C, Fagerdahl AM, Fracalvieri M, Malmsjo M, Piaggese A, et al. (2017) EWMA Document: Negative Pressure Wound Therapy. J Wound Care 26(Sup3):S1-S154

# Which pressure in NPWT: literature review and experts' opinions

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**Introduction:** Negative pressure wound therapy (NPWT) is a commonly accepted method to improve the effectiveness of wound treatment.

The aim of the study was to find consensus regarding which therapy pressure and type can be applied in different clinical situations and when it is possible to increase or decrease the pressure.

**Methods:** PubMed was searched for articles analyzing NPWT with different localizations/ indications (1085 articles). After exclusion of review and meta-analytic articles and articles lacking pressure data, 174 papers were analyzed. The following parameters were analyzed for every

**Wound/treatment type:** therapy type (continuous versus intermittent); range of applied pressure; mean pressure; most commonly applied pressure.

**Results:** Data from 5796 patients treated by NPWT showed considerable variation in the applied pressure. The pressure ranged from –20 to –200 mmHg, with the most commonly applied pressure of –125 mmHg, described in 89 papers (51%). The mean pressures for sponge and gauze were –115 mmHg and –80 mmHg, respectively. Continuous therapy was used in 106 papers (61%) and intermittent in 6 papers (3%), with no data about pressure type in 62 papers (36%).

**Conclusions:** A pressure of –125 mmHg is considered the commonly accepted option on initiation of NPWT (excluding neonates and small children, particularly with open-abdomen treatment). The pressure can be altered during therapy dependent on individual reasons and indications. The pressure applied, therapy type, wound-dressing type, number of dressing changes, and therapy duration should always be indicated in NPWT publications to allow the comparison of the results of different studies.

**Clinical relevance:** The information for an informed choice of different pressures levels is obscured within a multitude of clinical studies, making it a daunting task for the average clinician to determine the optimal pressure level and mode of NPWT for a specific wound, for which there is little guidance.

**Conflict of Interest:** Tomasz Banasiewicz, Rolf Becker, Marco Fracalvieri, Martin Hutan, Csaba Toth, Lenka Veverkova, Zsolt Szentkereszty, and Mike G. Laukoetter are members of the Vivano Competence Network of the Paul Hartmann (AG) holding company (<http://vivanosystem.info/en/Expertenrat/Experten>). They have received fees for invited speeches on NPWT.

# “Pitfalls in NPWT”: Analysis & lessons learned

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**Aim:** Wound therapy represents a complex process and therefore, before the start of any treatment, we must know the answers to the following questions: IF, WHY, WHEN and HOW the NPWT should be used.

Currently, there already exist recommended procedures created by global and European associations followed by procedures issued by the national associations in the individual countries. In spite of all these preventive measures aimed at elimination of adverse events, there still occur cases of failures or treatments that failed to bring the desired outcome. The question “why” remains always there and we need to have the answer.

**Methods:** Prior application of NPWT, we have adhered to the following principle: select patients to be treated with NPWT carefully and only after reviewing the most recent device labeling and instructions. Know that: NPWT systems are contraindicated for certain wound types, and patient risk factors must be thoroughly considered before use. We have performed the analysis of 249 cases treated with NPWT within the period VI/ 2012 – III/ 2017 with various diagnoses. More than 160 patients were aged 60+. The largest patient group consisted of the patients with postoperative abdominal wound infection (93 patients), 55 patients were treated for open abdomen, 43 patients were treated for defect in lower limb - majority of them after an injury. In 28 patients, NPWT was used for the treatment of chest and thoracic wall. Out of the total number of 249 cases, 11 patients died. The deaths were not related directly to the use of NPWT.

**Results:** Within our file, faults in application were detected only in isolated cases and these were always caused by a human error. In total there were 5 errors. In one case, it was a wrong position of a sponge with larger size than the wound. In line with the recommended procedures, the applied negative pressure was set to -125 mgHg in the patient suffering from decubitus. It resulted in necrosis of the defect. Poorly positioned foil at the lower extremity under pressure led to development of blisters, circular application resulted in creation of temporary paresthesias. Insufficient size of the abdominal foil caused eventration of small intestinal loops.

**Discussion:** The most serious complication found by the pub med browser regarding the complications caused by NPWT was bleeding and death described in UPDATE on Serious Complications Associated with Negative Pressure Wound Therapy Systems: FDA Safety Communication. Majority of the article was describing rather the therapy failure than the serious complication with NPWT application. Currently there are 38 freely accessible videos, the most popular one has reached more than 135 thousand viewings. Even these videos show just the generally known causes of the therapy failures.

Within our file with 249 cases of application with 3.92 dressing changes on average, the total number of performed dressing changes reached 976.08. The 5 failures thus account for 0.10% cases. Even though we need to see here complications affecting the patient.

The second cause of the treatment failure is the patients themselves. The basic precondition of success is cooperation and acceptance of the therapeutic principle.

The third condition for elimination of potential complications is the use of reliable products and trust in their manufacturer.

**Conclusion:** Holistic view of the patient, mutual trust between the physician and patient and quality product are the guarantee of the optimal wound treatment.

**Conflict of Interest:** The authors declare they have no potential conflicts of interest concerning drugs, products, or services used in the study.

## References:

- Consensus Document. Closed surgical incision management: understanding the role of NPWT. Wounds International, 2016, Free download available from: [www.woundsinternational.com](http://www.woundsinternational.com)
- Topical negative pressure in wound management. London: MEP Ltd, 2007.

- Risk Factors for Unsuccessful Treatment and Complications With Negative Pressure Wound Therapy, Wounds. 2012;24(6):168-177
- Food and Drug Administration. FDA Preliminary Public Health Notification: Serious Complications Associated with Negative Pressure Wound Therapy Systems. November 13, 2009. Available at: [www.fda.gov/MedicalDevices/Safety/AlertsandNotices/PublicHealthNotifications/ucm190658.htm](http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/PublicHealthNotifications/ucm190658.htm). Accessed January 30, 2014

## Is there any influence of negative pressure level on rate of enteroatmospheric fistula formation in open abdomen management? Analysis of 632 patients and outcomes of worldwide observational study.

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**Aim:** Negative pressure wound therapy (NPWT) is a widely used technique for temporary abdominal closure. However, there is still lack of firm guidelines and evidence-based recommendations in the regard of negative pressure level used in open abdomen management. Moreover, the incidence rate of enteroatmospheric fistula (EAF) formation varies in published studies and depends on level of negative pressure used. The main goal of the study was to assess the influence of negative pressure on incidence rate of EAF as well as to evaluate the negative pressure level used by European leaders in OA using NPWT.

**Methods:** A simple questionnaire was send to authors published in the field of NPWT in OA management, based on PubMed database. The following data was included: number of patients, the mean level and range of negative pressure used in both OA complicated with EAF before NPWT implementation and in OA management without EAF, number of EAF formed de novo during NPWT.

**Results:** A total of 25 questionnaires from European centers were sent back. Finally, a total of 632 patients were qualified for analysis. A mean negative pressure from – 25 mmHg to – 150 mmHg have been reported. In all studies

continuous pressure mode was used. The mean negative pressure was  $-106.9 \pm 18.2$  mmHg in EAF- patients whereas  $114.5 \pm 17.9$  mmHg in non-EAF patients ( $p > 0.05$ ). The incidence rate of EAF formed de novo during NPWT therapy was 4.7% (30/632), whereas in 12.8% of patients (81/632) EAF was present before NPWT was introduced. There was no correlation found between level of negative pressure used and incidence rate of EAF formation ( $p = 0.06$ ).

**Conclusion:** There is no significant correlation between negative pressure used in range from  $-25$  mmHg to  $-150$  mmHg and formation of EAF. Randomized control trials are highly needed to establish the optimal and safe level of negative pressure used in OA management in both EAF and non-EAF patients.

**Clinical relevance:** A increased number of patients treated with OA has been observed. Thus, it is crucial to optimize the therapy in regard of level of negative pressure used.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

## Combination of NPWT and a marine Omega3 wound matrix in chronic wounds

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**Background:** A stagnation in wound healing after revascularization and wound debridement is common especially in patients with diabetes or end-stage renal failure. Subsequently the wound defect becomes progredient and is susceptible to superinfections until the wound is completely epithelialized. This often leads to a critical situation and a proximal amputation often cannot be prevented.

**Aim:** An effective therapy concept in this vulnerable wound phase after surgical debridement should include acceleration of the granulation and advance of the epithelialization. In stagnant or endangered wounds we proved the benefits of a combination of negative pressure wound therapy (NPWT) and a wound matrix. The Kerecis® Omega3 wound matrix is a decalcified skin matrix derived from codfish.

**Patients Methods:** Between August 2016 and April 2017 seven patients (6 male, 1 female, mean age 78 yr) with complicated wounds of the lower leg, partially with exposed bone areas, were treated according to this concept. In five patients the wound was located at the level of the thigh and in two patients in the forefoot. Four patients were diabetics, two patients had a terminal and two a pre-terminal renal failure, one patient had a kidney transplant.

Following initial debridement in the operating theatre the wound matrix was applied before NPWT. The change of the wound dressing was repeated every 5-7 days. After progression of the wound granulation a meshgraft was performed if necessary and the NPWT was applied for another week.

**Results:** In all cases a proximal amputation could be prevented. The wound granulation was fairly stimulated, so that in three patients without complete closure a meshgraft could be performed after 2-5 applications (8-32 days).

The wounds showed healing times between 3 and 14 weeks (mean at the level of the thigh 8,6 weeks, in the forefoot 7,5 weeks). A positive side effect was a subjective reduction of pain perception during the therapy with the wound matrix and NPWT.

**Conclusion:** The combination of NPWT with the Kerecis® Omega3 wound matrix represents a feasible and cost-effective treatment option in either stagnant or endangered chronic wounds of the lower limb in diabetic patients. However, it helps to prevent proximal amputation even in critical situations. In addition, it can accelerate the granulation and epithelialization phase and subsequently seal the wound and minimize the risk of a superinfection.

# The use of negative pressure therapy may reduce the length of cicatrisation in pilonidal sinus. A prospective observational study. The Pilopressure study.

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**Justification of the study:** Pilonidal sinus most commonly arises in the natal cleft of the sacrococcygeal area. Pilonidal sinus disease is a potentially morbid condition, because the disease and its treatment may cause significant discomfort, pain and delay in wound healing and thus to a delay in back to work. The pilonidal sinus are now managed in ambulatory surgery. The treatment of pilonidal disease consists of surgical and it has been demonstrated that primary closure leads to faster healing rates and a more rapid return to work, but at the expense of an increased risk for recurrence. Recurrent pilonidal disease after initial wound closure is less frequent after healing by secondary intention (a 58% lower recurrence risk than after primary closure). We are thus performing surgery in two stages. It is now necessary to improve the postoperative strategy. It has been suggested in recent case studies that negative pressure therapy as the primary treatment following wide excision of pilonidal sinus disease, could shorten the duration of wound healing and time to return to daily activities. However, no large case series on this subject have been reported in recent literature.

Aim of our study is to determine if the use of negative pressure therapy can reduce the time of healing in a secondary healing therapy.

Primary endpoint is the time of healing of the pilonidal sinus

Secondary endpoints are:

- Pain
- Length of stay
- Readmission rate
- Reoperation rate
- Quality of life
- Time before return to work

**Study design:** Prospective single-centre study with an historical comparison

**Number of patients:** 30 consecutive patients

**Inclusion criteria:** - All patients operated on for a pilonidal sinus in emergency and in elective surgery. Age >18 years old

**Non-inclusion criteria:** Pregnant women; Contraindication to surgery

**Course of the study:** Surgical procedure with the removal of the pilonidal sinus in ambulatory surgery. Dressing with algosteril. POD1 dressing using negative pressure therapy. Outpatient consultation every week until cicatrisation with the evaluation of the quality of life and return to work and normal activities.

**Duration of the study:** one year

# Synergic Effect of Hyperbaric Oxygen Therapy and Negative Pressure Wound Therapy in Necrotizing Fasciitis and Necrotizing Soft Tissue Infection Treatment

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**Objective:** To evaluate synergic effect of hyperbaric oxygen therapy ( HBO ) and negative pressure wound therapy ( NPWT ) in necrotizing fasciitis and necrotizing soft tissue infection treatment.

Hyperbaric oxygen therapy nowadays represents one of the casual methods in management of severe necrotizing fasciitis and soft tissue infections. Proper application of NPWT could significantly improve clinical outcome in patients, who underwent HBO.

**Method:** Authors compare two groups of patients with severe infections ( Fourniere gangrene, diabetic foot, hard bruised open fractures ), who underwent correct surgical management and HBO followed by negative pressure wound therapy or advanced moist wound therapy ( AMWT ).

**Conclusion:** Better clinical outcome was apparent in NPWT group except for perianal infection site ( Fournier gangrene ). The object of great importance is sensible timing of first NPWT installation after handling sepsis with surgical methods and HBO. In this circumstance synergic effect of HBO and NPWT in patients wound healing is evident.

# Negative pressure wound therapy: indications in pediatric population

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**Aim:** Last 30 years ago, negative pressure wound therapy (NPWT) became essential in management of severe wound defects, later for pediatric indications.

**Methods:** We report a retrospective review of pediatric patients from 2003 to 2016. Sixty children were treated with NPWT first with VAC dressing and last year ago with Vivano dressing. Five wound groups were identified and we developed indications, therapy modality, secondary surgical treatment, advantages and pediatric recommendations.

**Results:** The median age was 8, 6 years range from neonate to 16 years; 60% were boys. Traumatic wound defect was the major cause (31) with motor vehicle accident for 15 (26%), farm equipment trauma for four and lawnmower accident for twelve. The other diagnosis was pressure ulcers (9), surgical soft tissue defect (4), fasciotomy (4), abdominal defect (4), and septic wound (8). Wound healing occurred primary for 17 children. Closure secondary procedure was required for all the others with skin graft (35), flap (6) and artificial dermis (8). Good tolerance was observed in all the patients.

**Discussion:** In the first time, NPWT was used in failure or last indication. In the second time, NPWT was always performed in severe trauma with wound defects with or without fractures. It improves vascularity, decrease bacterial colonization, remove exudates, reduce defect size and optimize coverage surgery. We observed reduction of free flap indication and increased indication of artificial dermis combined with NPWT. We decrease indication of amputation revision.

It was very useful in treatment of severe cellulitis in critically ill patients, but combined, with surgical debridement and antibiotic support. NPWT promote postsurgical wound healing especially in children treated with chemotherapy. Last year ago, we enlarged indication in abdominal wall defects in neonates.

Some specificity should be recommended for young children: lower pressure of 50 to 75 is required and monitoring fluid volumes loss is important to prevent dehydration. The surrounding skin must be protecting with additional drape. Pain tolerance is better with continuous pressure mode.

**Conclusion:** Negative pressure wound therapy is very useful in the management of many wounds defect in children with good tolerance and simplified approach for coverage surgery.

## References:

- Negative pressure therapy is effective to manage a variety of wounds in infants and children. S S McCord et al. *Wound Rep Reg* (2007) 15, 296-301
- Use of negative pressure wound therapy in the treatment of neonatal and pediatric wounds: A retrospective examination of clinical outcomes. M M Baharestani. *Ostomy Wound Manage*, 2007, 53(6):75-85
- Outcomes of vacuum assisted closure for the treatment of wounds in a paediatric population: case series of 58 patients. A Gabriel et al. *J Plast Reconstr Aesthet Surg*, 2009, 62, 1428-1436.
- Acceleration of Integra incorporation in complex tissue defects with subatmospheric pressure. J A Molnar et al. *Plast Reconstr Surg*, 2004, 113(5), 1339-1346.

# Use of negative pressure wound therapy (NPWT) as a treatment of Fournier's gangrene

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**Introduction:** Fournier's gangrene (FG) is rare disease characterized by an acute, often polymicrobial, necrotizing soft tissue infection of the perineal and genital region, possibly extending into the abdominal wall. Diabetes mellitus, vascular diseases, morbid obesity, alcoholism, and intravenous drug abuse are found to be frequently predisposing comorbidities for FG.

**Case description:** 60 years old NIDDM male patient presented to ER with perianal abscess. Ambulatory incision, evacuation of pus and drainage was done immediately. 3rd day post incision readmission with fever, painful erythema with crepitation extending from perineum up to interspinal line, fluctuation on left scrotum L 28.14, CRP 191.2

Laparotomy, APN of transverse colon followed with multiple incisions and extensive debridement. Gram + and Gram – pathogens were isolated. 5th postoperative day we started with NPWT. 6 changes of NPWT dressings (in average every 4.2 days) in total.

**Discussion/Conclusion:** Use of NPWT as a treatment of Fournier's gangrene met our expectations. From each NPWT dressing change we observed rapid improvement of wound status and formation of granulation tissue. Patient compliance was excellent. 25 days after initial placement of NPWT wound edges were brought together with excellent result.

**Clinical relevance:** We advocate NPWT as a standard treatment of Fournier's gangrene

**Acknowledgements:** This case report is done with patient permission.

**Conflict of Interest:** No conflict of interest

## References:

- Santora T, Schwartz BF. Fournier Gangrene Yanar H, Taviloglu K, Ertekin C, et al. Fournier's gangrene: risk factors and strategies for management. *World J Surg.* 2006;30(9):1750–1754.
- Tahmaz L, Erdemir F, Kibar Y, Cosar A, Yalcyn O. Fournier's gangrene: report of thirty-three cases and a review of the literature. *Int J Urol.* 2006;13(7):960–967.
- Bronchard R, de Vaumas C, Lasocki S, et al. Vacuumassisted closure in the treatment of perineal necrotizing skin and soft tissue infections. *Intensive Care Med.* 2008;34(7):1345–1347.
- Cuccia G, Mucciardi G, Morgia G, et al. Vacuum-assisted closure for the treatment of Fournier's gangrene. *Urol Int.* 2009;82(4):426–431.
- Ozturk E, Ozguc H, Yilmazlar T. The use of vacuum-assisted closure therapy in the management of Fournier's gangrene. *Am J Surg.* 2009;197(5):660–665.
- Czymek R, Schmidt A, Eckmann C, et al. Fournier's gangrene: vacuum-assisted closure versus conventional dressings. *Am J Surg.* 2009;197(2):168–176.

# The risk of surgical site infection (SSI) and SSI prevention with closed incision negative pressure therapy (ciNPT)

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**Introduction:** Despite the many scientific and technological advances, such as the advent of antibiotics, high-level preclinical and intensive medicine, SSI continues to be a problem that haunts orthopaedic and trauma surgeons. There is a need for a comprehensive knowledge regarding risk factors (RF) and possible preventive measures to control SSI. Commercially available ciNPT may offer surgeons an additional option to manage clean, closed surgical incisions.

**Methods:** Medline literature search and analysis (EndNote / PubMed) 1968-2017 (as of march 1st 2017). Used keywords were (filter „title“): "surgical site infection" OR "postoperative infection". Trauma and orthopaedic associated risk factors were selected. Additionally, a literature search was performed using key words 'prevention', 'negative pressure wound therapy (NPWT)', 'active incisional management', 'incisional vacuum therapy', 'incisional NPWT', 'incisional wound VAC', 'closed incisional NPWT' published from 2000 to 2015.

**Results:** Identification of 858 relevant articles from the 50 years 1968-2017. Pooled SSI rate is 0,3% (hand surgery) and 19% (III° open fractures). For open fractures, there is no clear tendency towards lower infection rates during the past five decades. Identification of 115 RFs is possible from three subject areas (patient-dependent, organizational and procedural, trauma and operation dependent). The five most important RF are body mass index over 35 (kg/m<sup>2</sup>), increased duration of surgery, diabetes mellitus, increased blood glucose levels in the perioperative period even in the case of non-diabetics and errors in the perioperative antibiotic prophylaxis. The ciNPT search found >100 publications that fulfilled the search criteria. Based on higher evidence, high-risk incisions (sternotomy and incisions in extremities after high-energy open trauma) are principally recommended for ciNPT use. In 'lower'-risk incisions, the addition of patient-related or operation-related risk factors justifies the application of ciNPT.

**Discussion/Conclusion:** Inconsistent definition of "infection", interaction of the RF and the different follow-up duration limit the meaningfulness of the study. In the future considerable efforts must be made in order to achieve a noticeable reduction in the rate of infection, especially in the case of high risk patients. One successful option is ciNPT.

**Keywords:** surgical site infection, SSI, risk factors, open fractures, closed incision negative pressure therapy (ciNPT).

**Clinical relevance:** SSI is one of the most important postoperative complications

**Conflict of Interest:** Presentations supported by Acelity and Hartmann AG

## References:

1. Willy C, Rieger H, Stichling M (2017) [Prevention of postoperative infections : Risk factors and the current WHO guidelines in musculoskeletal surgery]. *Unfallchirurg* 120(6):472-485
2. Willy C, Agarwal A, Andersen CA, Santis G, Gabriel A, Grauhan O, et al. (2017) Closed incision negative pressure therapy: international multidisciplinary consensus recommendations. *Int Wound J* 14(2):385-398
3. Apelqvist J, Willy C, Fagerdahl AM, Fracalvieri M, Malmsjo M, Piaggese A, et al. (2017) EWMA Document: Negative Pressure Wound Therapy. *J Wound Care* 26(Sup3):S1-S154
4. Willy C, Engelhardt M, Stichling M, Grauhan O (2016) The impact of surgical site occurrences and the role of closed incision negative pressure therapy. *Int Wound J* 13 Suppl 3:35-46

# Closure rate of enteroatmospheric fistula in open abdomen management using negative pressure wound therapy. A multicenter observational study in Poland.

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**Aim:** The management of enteroatmospheric fistula (EAF) in open abdomen (OA) therapy is challenging and associated with high mortality rate. The introduction of negative pressure wound therapy (NPWT) in OA management significantly improved the healing processes and increased spontaneous fistula closure rate.

**Methods:** Retrospectively, we analyzed sixteen patients with a total of 31 EAF in OA management using NPWT in four referral centers in Poland between 2004 and 2014. EAFs were diagnosed based on clinical examination and confirmed with imaging studies and classified into low (< 200ml/day), moderate (200-500ml/day) and high (>500 ml/day) output fistulas.

**Results:** The study group consisted of 5 women and 11 men with the mean age of 52.6±11.9 years. Since open abdomen management was implemented, the mean number of re-surgeries was 3.7±2.2). There were 24 of EAFs located in the small bowel, whereas 4 were located in the colon. In three patients EAF occurred at the anastomotic site. 13 fistulas were classified as low output (41.9%), two as moderate (6.5%) and sixteen as high output fistulas (51,6%). An overall closure rate was 61,3% with the mean time of 46.7±43.4) days. In all remaining patients in whom fistula closure was not achieved (n=12), a protruding mucosa was present. Analyzing the cycle of negative pressure therapy, surprisingly we found that spontaneous closure rate was 70% (7/10 EAFs) using intermittent setting of negative pressure whereas in group of patients treated with continuous pressure 57% of EAFs closed spontaneously (12/21 EAFs). The mean number of NPWT dressing was 9±3.3 (range 4-16). In two patients, we observed new fistulas which appeared during NPWT. Three patients died during therapy as a result of multi-organ failure.

**Conclusion:** NPWT is a safe and efficient method for OA management with concomitant EAF. Although, closure of EAF is challenging, we found NPWT as a useful technique for spontaneous EAF closure. Based on our experience, low output fistulas as well as no mucosal protrusion positively influence on higher EAF spontaneous closure rate in OA using NPWT.

**Clinical relevance:** Because of lack of firm conclusions and recommendations, it is highly important to collect data and outcomes to create guidelines and consensus regarding NPWT in open abdomen management complicated with EAFs.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

# Place of NPWT in the algorithms of wound healing.

*Hutan, Martin, MUDr., PhD., Kutarna Juraj., MUDr., PhD., Loncsar Gerhard, Dr. Med.*

*Hainburg and der Donau, Austria*

Use of NPWT (Negative Pressure Wound Healing) is already well established in the wound healing algorithms. One of the main problems of its use is understanding its utilization as a sole wound management solution.

Authors in the presentation discuss and review the place and significance of NPWT in the holistic view on the wound healing. Authors present the possible combinations of use with other products as well, as state the pharmacologically effective place of NPWT in wound healing.

In conclusion authors state, that NPWT is not sole method for the wound healing algorithm, but rather, its use should be rationally combined with other systems of modern wound healing, as well as should be used in correct place and time of wound healing.

**Clinical relevance:** surgical acute and chronic wounds

**Conflict of Interest:** First author is a member of Competence Network and a Member of Board of Slovak Society for Wound Healing.

# The role of NPWT in treatment after surgery for patient with colorectal cancer

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**Introduction:** Negative pressure wound therapy (NPWT) is therapeutic technique with wide applications in treatment after colorectal operations.

On individual cases I would like to demonstrate the suitability and effectiveness of NPWT in shortening the healing time with early initiation of cancer treatment. In prevention we use NPWT in the primary application to wounds contaminated pus or intestinal contents. Intra-abdominal NPWT application after abdominal catastrophe reduces morbidity and mortality of patients and helps to complications such as intestinal fistula.

NPWT in treatment of wound infections with or without fasciitis saving soft tissues and accelerates healing with early initiation of adjuvant chemotherapy.

Very efficient application seems to us NPWT in primary or postoperative complications, such as abscessing phlegmon, infection in perineal wound after rectal amputation and anastomotic leaks.

**Cases description:** All patients were selected after radical surgery for adenocarcinoma of the colon or rectum, where in the NPWT administration site were not demonstrated tumor cells and at follow up tumor incidence wasnt observed.

**Conclusion:** NPWT compared with wet treatment therapy is more effective and healing time and comfort for patients and staff a definite benefit.

For patients with cancer at a more advanced stage of the disease is very important early postoperative oncological treatment, adjuvant chemotherapy or radiotherapy.

Wound infections previously completely excluded from adjuvant treatment. NPWT its efficiency by reducing the time and treat complications early allows patients to continue treatment.

# Trans-tibial amputation associated with Vivano negative pressure therapy applied on closed wound. About 32 consecutive cases.

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**Aim:** To evaluate the effectiveness of negative pressure therapy (NPWT) applied on closed wounds in the setting of trans-tibial amputation (TTA), regarding to the primary closure of TTA stumps and to the reduction of the trans-femoral amputation (TFA) rate.

**Methods:** 2 consecutive trans-tibial amputations (31 posterior, 1 skew flaps) with systematic application of NPT was realized.

The mean age was years. There were 21/32 men. The amputation was consecutive to a non-revascularisable critical ischaemia (20 cases), a non-viable acute ischaemia (3), a chronic osteomyelitis of the midfoot (8) and in one case a chronic infection of a previous unhealed TTA.

**Results:** Four patients died during the follow-up (day 1, 7, 22, 58). Any of those deaths was related to the wound.

When the NPT was ablated (day 5), two patients presented an infection of the stump, requiring a surgical revision, an iterative 'open-wound' NPT and an antibiotherapy. A secondary healing with conservation of the knee was obtained in both cases.

Another patient had a global necrosis of the stump (day 21), leading to a trans-femoral amputation (AKA).

Four patients experienced minor superficial wound defects, with a secondary healing following standard local cares.

An healed trans-tibial stump was obtained at day 60 in 27/28 of the survivors.

**Conclusion:** NPT applied on closed TTA stump improved in this population the results of TTA, and reduced the TFA rate.

# Management of large chronic venous leg ulcers with negative pressure wound therapy

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**Aim:** Venous leg ulcers (VLU) occurs in 1% of adult population and are associated with chronic disability, diminished quality of life and high health care costs. Treatment is often slow, difficult and recurrence is high because of inappropriate conditions of the wound bed. Negative pressure wound therapy (NPWT) very fast developing method of the wounds treatment. The aim of this study was to evaluate effectiveness of NPWT of large venous leg ulcers treatment

**Methods:** This study involves 14 patients with chronic venous ulcers larger than 100 cm<sup>2</sup> treated with negative pressure wound therapy. Patients underwent a radical debridement of all devitalised tissues and partial stripping of insufficient great saphenous vein in the first operation. After adequate haemostasis, NPWT kit was applied. Once the wounds were determined to be clean and adequate granulation tissue formation was achieved, split-thickness skin grafts were applied. Dressing impregnated with neutral triglycerides and silver ions was used as a first layer and the black polyurethane NPWT foam was applied over it. The pain assessment was performed for 7 patients using 10 cm visual analog scale (VAS).

**Results:** The mean number of NPWT dressing changes prior to grafting was 5.8. The mean number of NPWT foam changes was 2.8 after skin grafting. We accomplished complete healing of 92% of applied skin grafts surface. One patient had recurrence of venous ulcers in the follow-up period. Moreover, one patient required re-grafting.

**Conclusion:** The application of NPWT provides quick wound-bed preparation and high graft take in venous ulcer treatment.

# Use of Negative Pressure Wound Therapy in the management of pediatric septic wounds

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**Aim:** last thirty years ago, negative pressure wound therapy (NPWT) became essential in management of severe wound defects. Efficiency has been well demonstrated in optimization of wound healing but it also become very useful for avoiding and treating septic wounds although there's not general consensus.

**Methods:** We report our experience with treatment of septic wounds in pediatric population by a retrospective study, from 2003 to 2016. 60 children were managed with NPWT, 5 types of wounds were recorded: traumatic wound defect, surgical soft tissue defect, fasciotomy, pressure ulcers and septic wounds. 36 of them form together two groups: a high risk group of septic complication according to wound type and a second group with established severe infection.

**Results:** 23 children were sustained for severe traumatic injuries of the extremities with soft tissue defect and sometimes with open fractures, often first soiled (farm or lawnmower accident) or secondary by tissue necrosis. For this high level contamination wounds, NPWT improve vascularization, decrease bacterial colonization and optimize coverage surgery. We observed reduction of free flap indication, facilitation of skin graft and dermal substitute use and decreasing revision of lower extremities amputations.

13 children presented with evidenced soft tissue severe infection sometimes with necrotizing and extensive germs or mycosis and often in precarious population: neonate, patients treated with chemotherapy. For these fasciitis and cellulitis, combined use of aggressive debridement with systemic antibiotic and NPWT was a successful treatment and coverage wound technique was greatly enhanced. All the patients survived.

Wound healing was achieved primary for 18 children. Closure secondary procedure was required for all the others with skin graft for 37, flap for 6 and artificial dermis for 8, sometimes combined.

**Discussion and Conclusion:** NPWT is an important and useful treatment of septic wounds combined with surgical debridement and antibiotic support. It increase life survival, reduces amputation revision and optimizes coverage surgery. It is also efficient to prevent bacterial infection in initially soiled tissue injuries. Changes dressing must be change more frequently and an interposal contact layer with silver is used. NPWT should never be performed alone.

## References:

- Excessive pediatric fasciitis necrotisans due to pseudomonas aeruginosa infection successfully treated with negative pressure wound therapy. L Szabo and al. Dermatologic therapy, 2015, 28, 300-302.
- Negative pressure treatment for necrotizing fasciitis after chemotherapy. F Melchionda and al , pediatric reports, 2011, 3, 127-128.
- Negative pressure wound therapy for sternal wound infections following congenital heart surgery. J P Costello. J Wound Care. 2014, 23(1), 31-36.

# Negative Pressure Wound Therapy as a safe and effective method in complicated neurosurgical complication with exposed dura mater

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**Introduction:** Infected neurosurgical wounds are an enormous challenge in treatment, especially in the case of large bone defects. Negative Pressure Wound Therapy (NPWT) has been a valuable addition to therapeutic approaches from several years, but its use is still rare.

**Case description:** We present the case of patients with severe clinical course of infection, with full necrosis of cranial bone and exposed dura mater with advance septic complication. Because of severe clinical condition, un-effective conservative treatment and the lack of standard methods of treatment the combined therapy with Negative Pressure Wound Therapy (NPWT) was used. Patient was operated in general anesthesia, the surgical debridement of the skull (evacuation of septic exudation, necrotic tissues) was performed, dura mater was covered by the negative pressure wound therapy (NPWT) dressing. Due to the delicate tissue of the dura mater and the risk of miscarriage the polyvinyl alcohol sponge ("white sponge") was used and connected with VivanoTec device with continuous pressure -80 mmHg. To improve the tightness of the dressing the stoma paste was used on the wound margin. After introduction of the NPWT general condition of patients improved with significant reduction of inflammation biochemical markers. The wound dressing was change in next 4 days. The NPWT dressing with polyvinyl alcohol sponge was used in next wound dressing. The therapy was continued with good results, fast proliferation in the wound bed and good local condition for artificial bone implantation or flap reposition (decision pending). After 16 days (4 wound dressing changes) the better local condition of the wound has allowed reconstruction (skin and muscle patch).

**Discussion/Conclusion:** NPWT can be effective and safe in severe neurosurgical infection, also with direct application of the NPWT on dura mater (with "white" sponge and low pressure).

**Clinical relevance:** NPWT in neurosurgical complications can be safe and effective, there are no reason to avoid this method also in exposed dura mater.

# NPWT allows a successful salvage of acute infected mesh after hernia repair

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**Aim:** Occurrence of acute mesh infection after ventral incisional hernia surgery is 4-6%. The surgical management of these infections is highly challenging for surgeons, because very difficult and sometime particularly dangerous. Negative-pressure wound therapy (NPWT) has been recently reported as a therapeutic able to promote successful salvage of acute infected mesh after hernia repair, even if the literature is scarce about this topic. The aim of this study was to retrospectively review the folders of all patients with acute abdominal mesh infection treated conservatively using NPWT and to report our technique.

**Methods:** Our institution is a well known and very specialized parietal unit in France. The folders of all patients successively treated with NPWT for acute abdominal infection after hernia or incisional hernia repair were retrospectively reviewed from our database, between 2007 and 2017. For these patients with acute mesh infection suspicion, our technique consists in a wide surgical debridement, with exposure of the mesh, as well as irrigations and drainage of the mesh. The wound and the infected mesh is filled with foam and NPWT-Vivano® is applied with a continuous negative pressure of 90 mm Hg, changed every 3 days and maintained until the mesh is clean and covered with scar tissue.

**Results:** Three thousand one hundred and nine patients were operated on for hernia using a mesh during the study period. Among them, 148 had abdominal wall infection after the surgery, needing a second operation, representing 4 % of all parietal surgery in our unit. Forty-two patients were finally included, treated for acute mesh infection using NPWT-Vivano®. The demographic data of patients were noticed. Seventy-eight percent of them had successful salvage of the infected abdominal wall without requiring explanation of the mesh.

**Conclusion:** In case of early abdominal mesh infection, the use of NPWT, with a safe removal of exudates, provides an opportunity to save the mesh because simultaneously acts as detersion device and reduce the wound healing time.

**Clinical relevance:** Acute abdominal mesh infections imply a high socio-economic impact for patients. The use of NPWT should be considered for each case for single-stage conservative management.

**Conflict of Interest:** Authors declare no conflict of interest

## References:

- Berrevoet F et al. Infected large pore meshes may be salvaged by topical negative pressure therapy. *Hernia*. 2013 Feb;17(1):67-73.
- Leber GE et al. Long-term complications associated with prosthetic repair of incisional hernias. *Arch Surg* 1998;133:378-82.
- Delikoukos S et al. Late-onset deep mesh infection after inguinal hernia repair. *Hernia*. 2007;11:15-7.
- Amid PK. Classification of biomaterials and their related complications in abdominal wall hernia surgery. *Hernia* 1997;1:15-21
- Alaedeen DI et al. The single-staged ap-proach to the surgical management of abdominal wall hernias in contaminated fields *Hernia* 2007;11:41-5.
- Gillion JF, Palot JP. Eventrations. Prothèses infectées: traitement et prévention. *Journal de Chirurgie Viscérale* 2012;149S:521-532.
- Bueno Lledo J et al. Prosthetic infection after hernioplasty. Five years experience. *Cir Esp* 2009; 85:158-64

# The efficiency and safety of negative pressure wound therapy in open abdomen. A hungarian multicentric, prospective, observational study.

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**Aim:** The negative pressure wound therapy (NPWT) is more and more often used in open abdomen treatment. There are few experiments with this approach in Hungary. The aim of this study was to evaluate the efficiency and safety of NPWT in open abdomen therapy.

**Methods:** The inclusion criterias for this multicentric, prospective observational study (ethical permission: 096531/OTIG) was the prevention or treatment of abdominal compartment syndrome (26.2%), impossible abdominal wall closure due to septic complications or trauma (71.4%) and damage control surgery (2.4%). Exclusion criteria was active bleeding, tumour growth in the wound, undiagnosed enteral fistule and the absence of patient's permission. The causative disease of the 42 patients (mean age: 65.2±14.4 years, male/female rate: 54.8:45.2%, mean BMI: 17.5±7.0) was malignancy in 30.1%, untreatable consecutive paralytic ileus in 26.2%, acute pancreatitis in 16.7% and others in 27%. The visits were performed at the beginning, on the 15th day and at the end of the NPWT.

**Results:** The decrease of intraabdominal pressure during NPWT was significant between the 2-3 and 1-3 visits. The decrease of the wound size (width, length, depth) was significant in all the three dimensions. The rapidity of wound size decrease was 0.41 cm/day between the 1-2nd visit, 0.128 cm/day between the 2-3rd visit with a mean level of 0.19 cm/day. The efficiency rate of the NPWT was 66.7%. The overall mortality rate was 33.3%. The mean time of the NPWT was 26.4 days.

**Conclusion:** The NPWT was effective to decrease the pressure in cases of abdominal hypertension and compartment syndrome. During the NPWT in open abdomen therapy the size of wound decreased significantly. The rate of successful treatment was 66.6% with a mean mortality rate of 33.3%.

**Clinical relevance:** To introduce a new method for the treatment of open abdomen therapy

**Acknowledgements:** To all the experts contributing on this study

# The role of NPWT in the treatment of severe burns in children

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**Aim:** Severe burns (IIb and III degree, large body surface) are from far one of the most traumatic injury in children. Not only the management of local lesions, but also the treatment of burn shock might pose a high degree of difficulty in the severe burned child. Some particular body regions like face, hand (including fingers), feet and perineum require a special care. While IIa degree burns require only conservative management of the lesions and III degree burns require indubitable surgical treatment, IIb degree burns have a more complex assessment. Our work presents the importance of using NPWT (negative pressure wound treatment) in the treatment of pediatric burn patient. It helps avoiding infection, limits the severity of burn shock, reduces the edema under the burn lesions (space three Randal) promotes graft taken, stimulates healing of IIb degree burns.

**Material and Methods:** We evaluated 9 cases. Our study includes large body surface burns (10 to 40 % BS), IIa, IIb and III degrees. At the admission was made burn shock treatment, burn wounds cleaning followed by NPWT. For III degree burns we made surgical excision of the burned skin followed by skin grafting. Graft intake was assisted with NPWT. For IIb burns only NPWT sufficed for complete healing of the burns. Complete epithelisation was achieved in a period up to 10 days.

**Results:** The evolution was favorable in all patients with complete healing of IIb degree burns, no infections, complete intake of skin grafts for III degree burns, reducing edema under burn lesions, preventing intrinsic hand muscles fibrosis in hand burns, shortening the hospitalization time.

**Conclusions:** NPWT is an excellent tool in addressing pediatric patient with severe burns. It permits complete healing of IIb degree burns, complete intake of skin graft for III degree burns, reduces the frequency of wound dressing, pain, fluid loss as well as the risk of infections. It limits the total hospitalization period and allows a much better functional and aesthetic result in the treatment of pediatric severely burned patient.

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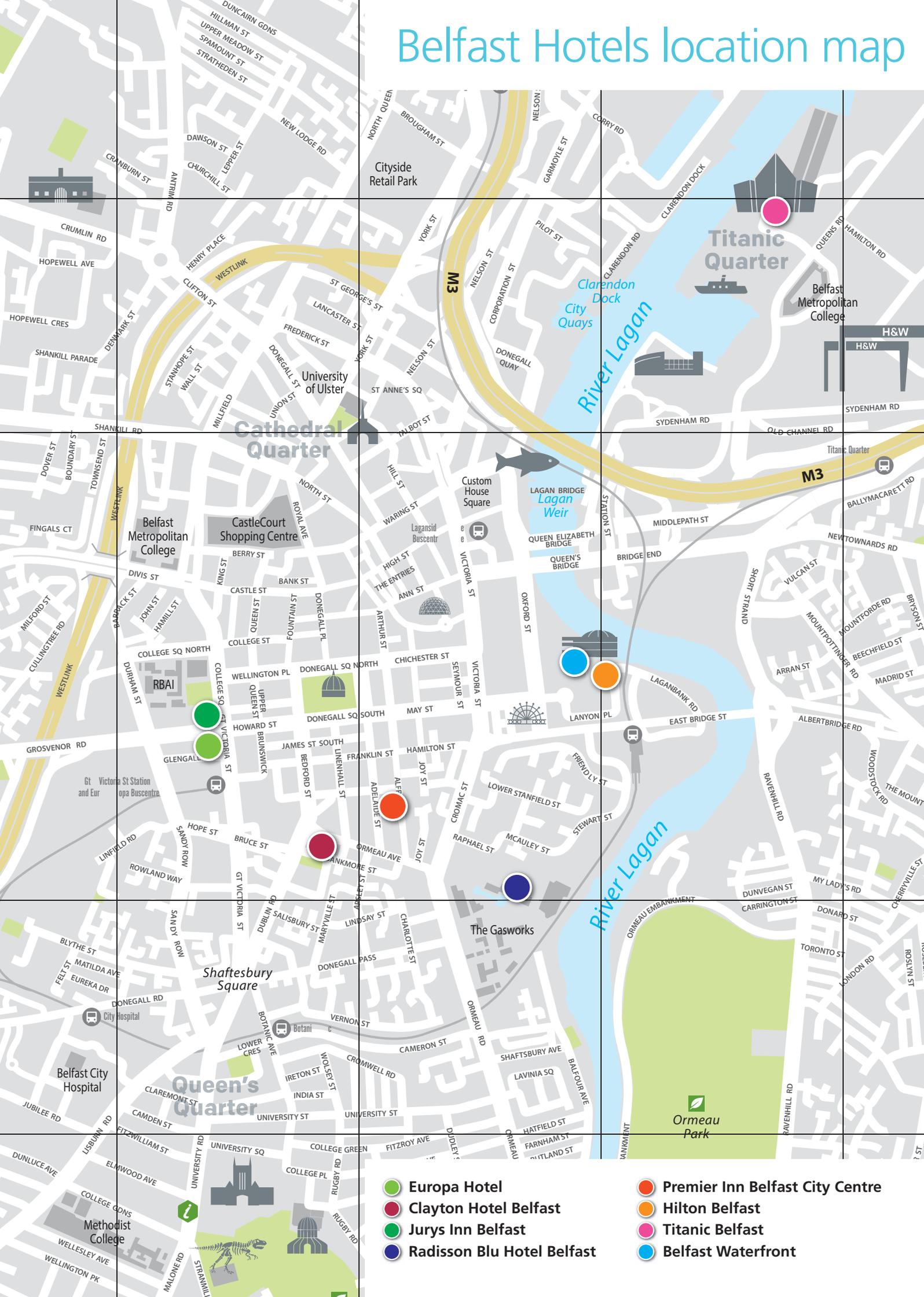
[1] Atkin, L. and Ousey, K. (2016). Wound bed preparation: A novel approach using HydroTherapy. British Journal of Community Nursing 21 (Suppl. 12), pp. S23-S28. [2] Ousey, K. et al. (2016). Hydro-Responsive Wound Dressings simplify T.I.M.E. wound management framework. British Journal of Community Nursing 21 (Suppl. 12), pp. S39-S49. [3] Spruce, P. et al. (2016). Introducing HydroClean® plus for wound-bed preparation: a case series. Wounds International 7(1), pp. 26-32. [4] Ousey, K. et al. (2016). HydroClean® plus: a new perspective to wound cleansing and debridement. Wounds UK 12(1), pp. 94-104. [5] Ousey, K. et al. (2016). HydroTherapy Made Easy. Wounds UK 12(4).

# Poster presentations overview

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- 2 Our early experiences with NPWT after common surgical procedures**, *Gabor Sahin-Toth, Norbert Farkas, Oszkar Racz, Alzubi Ali, Attila Hegedus, Akos Irsai, Hungary*
- 3 Experiences with negative-pressure wound therapy (NPWT) in gram-negative sepsis following Hematopoietic stem cell transplantation**, *László Bor, Ágnes Radványi, Péter Reményi, Ilona Bobek, Ferenc Ender, Hungary*
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# Belfast Hotels location map



- |   |                                   |   |  |
|---|-----------------------------------|---|--|
|  | <b>Europa Hotel</b>               |  | <b>Premier Inn Belfast City Centre</b> |
|  | <b>Clayton Hotel Belfast</b>      |  | <b>Hilton Belfast</b>                  |
|  | <b>Jurys Inn Belfast</b>          |  | <b>Titanic Belfast</b>                 |
|  | <b>Radisson Blu Hotel Belfast</b> |  | <b>Belfast Waterfront</b>              |



