Third International Vivano Conference in Nuremberg: How should the Cost-effectiveness Ratio of Negative Pressure Wound Therapy be Evaluated?

Dr. Daniela Kaspar*, Tanja Maindok

Abstract — Does negative pressure wound therapy (NPWT) result in wound healing more often and more quickly than standard wound therapy? For which indications can NPWT be used? And how should the cost-benefit ratio be evaluated? These were the central questions at the third international Vivano Conference, which customers, wound therapists and experienced speakers were invited to attend in Nuremberg by PAUL HARTMANN AG.

Keywords — Negative pressure therapy, conference report, international congress.

FOLLOWING a common plenum session with respected key notes speakers international speakers at the two-day conference presented their experiences with negative pressure wound therapy in a total of 26 case studies. In these case studies, the therapy was used not only for chronic wounds but also in the case of third- and fourth-degree burns, for complex surgical interventions in the abdominal region, for open fractures and in thoracic and cardiac surgery. Remarkable but no less successful was the endoluminal use of NPWT in the upper gastrointestinal tract. Dr Michael Laukötter (Dr. med.) from university hospital Münster Dr Johan Friso Lock (Dr. med.) from the university hospital in Würzburg presented their studies on this subject.

“Everyone using negative pressure wound therapy shares the same problem internationally,” said Associate Professor Lenka Veverková (MD, PhD), explaining the paradox of any young form of therapy. “There is no evidence-based data.” Together with colleagues and supported by PAUL HARTMANN AG, Veverková founded the international Vivano Competence Network in order to improve knowledge and promote research. The lack of evidence-based data on economic benefit of NPWT is still one of the reasons why there do not yet exist financial models for reimbursement of NPWT in most of the European countries. Peter Schuck pointed out the value of transparency in treatment cost calculation on institutional or department level in order to prove whether NPWT is providing a higher cost efficiency for the institution in addition to the higher medical outcome. The common goal should be a dedicated budget for NPWT treatment on department level and direct reimbursement in form of a dedicated treatment code in order to support medical professionals to base their decision regarding the most optimal treatment for their patients without being forced to make compromises. In his presentation Tomasz Banasiewicz demonstrated the clinical as well as the economic benefit of negative pressure compared to standard treatment in patients with open abdomen. In addition to the reduction of wound complexity he reported a reduction in mortality by over 50% for NPWT (18%) compared to standard treatment (45 %) which was associated with a cost saving of over 5000 € per patient. Of no less importance was the gain in patients’ quality of life. For future regards he stressed the necessity of more

*Correspondence to Dr. Daniela Kaspar, PAUL HARTMANN AG, Heidenheim, 89522 Germany
randomized control trials as well as the recognition of personal experience in order to strengthen the body of evidence for NPWT and thereby made the transition to the following case presentations.

**National Study Project Evaluates Negative Pressure Wound Therapy**

In Germany, too, a pilot project is currently being carried out to evaluate the effectiveness, the safety and the cost-benefit ratio of NPWT both on an individual sector basis and across all sectors. Dörthe Seidel of the IFOM (Institut für Forschung in der Operativen Medizin – Institute for Research in Surgical Medicine) reported on the national research project led by her, which should yield study results by the end of 2014. The Gemeinsame Bundesausschuss (G-BA) – the German Joint Federal Committee, a body governing German health services and providers – will then use these and possibly other studies to assess whether NPWT can be included in standard ambulant care covered by statutory health insurance funds. Irrespective of the outcome of the pilot project, negative pressure wound therapy has proved itself to be an internationally cost-effective method which, depending on the indication, helps to improve people's lives and quality of life more often and more quickly than standard wound therapy. NPWT has therefore become an indispensable part of patient care in Europe's hospitals and clinics.

**NPWT as “Salvage Technique” in Open Abdomen**

Sergey Shlyapnikov (Russia) pointed out the key role of the Open Abdomen during “relaparotomy stage” with NPWT as one of the most promising techniques among different ways for temporary closing. He presented two cases of patients for temporary closing of abdominal wounds due to anastomotic dehiscence with leakage after surgery, one of them due to multiple intestinal ruptures and a hemoperitoneum. Sergey Shlyapnikov emphasized the effectiveness of NPWT for temporary abdominal closure as the patients could be discharged within a relatively short time with complete closure of skin and fascia. The economic benefit in terms of treatment duration was confirmed by Vladimir Obolenskiy (Russia) in the case of a patient with peritonitis and biliary fistula. After one day of NPWT the patient could be transferred from the intensive care unit to the surgery ward, six days later there were no signs of peritonitis and the wound could be closed with no recurrence at the six months follow-up. Martin Hutan (Slovakia) used a combination of bi-faced poppypropylene net together with NPWT for reconstruction of giant abdominal wall defects caused by trauma, abdominal wall tumors, necrotizing infection and complications of previous abdominal surgeries. He described the use of NPWT as a „salvage technique“ when standard use of prosthetic material is not feasible because of infection as it minimizes complications resulting from the absence of abdominal wall: NPWT suppresses biofilm formation and accelerates granulation tissue formation over bradytrophic tissue.

**NPWT in the Management of Fistula**

“Despite advances in Open Abdomen Management enterotransmashosfistula are new and vicious adverse events to surgeons and needs a multidisciplinary approach.” Radovan Škuta (Slovakia) presented the case of a patient with severe purulent peritonitis after two years of multiple surgical approaches. The patient underwent evacuation of the abscess, hemicolecotomy, ileostomy, and developed several fistula. The secretion of these enterotransmashosfistulae could be reduced within a short time by isolation with NPWT. After two parts of the small intestine had been resected the OA could be closed and skin cover reconstructed.

**NPWT in the Gastrointestinal Tract**

Dan Sabau (Romania) reported a case of a patient who had undergone a reinsertion of an esophageal stent. After surgery the patient suffered an evisceration and his health status worsened dramatically. The use of NPWT improved the wound status and thus the general health status of the patient and within one month the wound could be closed. Dan Sabau emphasized the „minimal invasivity concept“ which specifically addresses patients with an inoperable neoplastic stenosis. A highly sophisticated method was presented by Michael Laukötter (Germany) who developed an adaptation of the negative pressure wound therapy in cases of anastomotic leakages and wall defects in the upper gastrointestinal (GI) tract. In 32 patients with major leakages or perforation in the upper GI-tract this new method of endoscopic negative pressure therapy comprises efficient closure and drainage of the defects without failure. Thus it has been shown to be applicable for nearly all possible leakages of the upper GI-tract. Johan Friso Lock (Germany) pointed out the advantages of NPWT for the use in the upper GI tract, in particular, the handling such as the simple connection of endoscopic sponge to the container and the optimal removal of biliary secretion. He concluded with an overview of potential new indications for endoscopic negative pressure wound therapy such as transgastral necrosectomy of pancreatitis and perforated gastric ulcer.
NPWT AFTER MAXILLOFACIAL SURGERY

Iwona Niedzielska (Poland) emphasized on the need for reports on NPWT application in patients for maxillofacial surgery the major difficulties being associated with port fixation. She reported six cases of patients who suffered impeded wound healing after oncological procedures or osteradionecrosis with untypical course of inflammatory processes and demonstrated the importance of individual treatment algorithms that take into account the port fixation near the oral cavity as well as the intensity of the applied negative pressure. Opposed to the traditional therapeutic methods a reduced treatment time could be observed by the use of NPWT.

NPWT AS A BRIDGE FROM THE SEPTIC WOUND TO PLASTIC SURGERY

In the European Union approximately 2 Mio of patients suffer nosocomial or hospital acquired infections annually of which more than the half are drug resistant. Lenka Veverkova (Czech Republic) addressed her presentation to the question whether NPWT should be used in order to reduce bacterial load and whether this reduction is necessary for the ongoing healing process. Even though the question could not be fully answered by her prospective observational approach all infected wounds of 70 patients decreased bacterial load during NPWT and healed without exception. Rolf Becker (Germany) reported a high incidence of joint replacement infections. In particular, after prosthetic implantations infection rates may achieve up to 10% depending on the anatomic site. In addition to strict measures in preparation of the implantation he pointed out the importance of NPWT for infection prevention. According to his own observations Zsolt Szentereszy (Hungary) described the negative pressure therapy as a “bridging therapy from septic wound to plastic surgery”. He reported the management of three different highly complex situations in thorax surgery: thoracic empyema, deep infected sternal wound and chest wall infection where NPWT reduced severity until surgical reconstruction was possible. He emphasized the cost effectiveness due to the reduction of the hospital stay, antibiotic therapy and outpatient therapy. Pavel Zacek (Czech Republic) pointed out the need for immediate opening of infected wounds and NPWT application together with an aggressive surgical approach of necrectomy in order to save patients’ time. He reported his experiences with NPWT in 52 patients with infected sternal wounds after cardiac surgery which finally obtained full regeneration of skin integrity without failure.

NPWT TO DOWNSCALE COMPLEX WOUNDS

Early wound coverage is crucial in order to decrease the risk of infection, osteomyelitis, nonunion and further tissue loss. Particularly, in case of exposed bones, tendons and neurovascular structures advanced reconstructive procedures are needed such as flap surgery requiring technically demanding, costly, and time consuming operations with high complication rates, donor site morbidity and failure rates. NPWT may be used when previous flap failure or if flap is not available due to patient condition as well as to go downstairs the reconstructive ladder from a complex wound which needs a complex surgical procedure to a smaller and simpler wound which requires only simple procedures. Noditi Gheorghe (Romania) presented the use of NPWT as a temporary cover for infection control in the management of an open fracture type Gustillo Anderson IIIB which had initially been supplied with an external fixation and left open for infection control. After microbial culture had been negative and granulation tissue covered exposed structures the tibial defect could be closed with a skin graft. Mazen Ali (France) focused on the treatment of high energy traumata, in particular wounds with exposed structures where reconstruction failed after flap surgery and which could be successfully treated with NPWT and subsequent skin grafting. Csaba Halmy (Hungary) combined different modalities in order to reconstruct complex chronic and acute wounds. He presented an impressive “salvage procedure” of a patient with a third degree open fracture at the lower leg that had failed to heal after flap surgery. In a second attempt the surgeon covered the large wound partly with a muscular and partly with a cutaneous flap while on the rest of the wound a skin grafts were applied. Flaps and grafts were bolstered by NPWT until the grafts took.

The failure of a complex flap reconstruction was also the reason for a young patient to undergo reconstructive surgery at his lower leg. Alexandru Ulici (Romania) demonstrated in the case of a young patient who had suffered high voltage electrical burns how NPWT downscaled the complexity of a large excised wound within six weeks of treatment until secondary closure with a skin graft was possible.

Exposed structures are subjected to drying, infection or the risk of amputation unless reconstructive procedures will be performed, in particular, in large excision wounds. Darko Jurišić (Croatia) reviewed reconstructive techniques such as local and distant flaps or free tissue transfer used to cover wounds large excised burn wounds. He presented the case of a patient with fourth degree burns of the fingers, the dorsum of the hand and the forearm that were successfully managed with NPWT to prevent structures from desiccation and from infection.
NPWT TO SUPPORT SKIN GRAFT UPTAKE

The support of a grafting procedure is a common use of NPWT in large and deep burns. Bolstering the graft to the wound bed by negative pressure provides close contact between graft and wound bed and minimizes seroma formation beneath the graft. Since 1997 this method has been applied by Eric Dantzer (France) after surgical treatment of large and deep burns, necrotizing fasciitis, and large trauma. The wound bed with exposed muscles and tendons is grafted with an artificial dermis. The rapid healing process and functional recovery due to NPWT comes along with a reduction of hospital stay.

NPWT IF MORBIDITY CAUSES HEALING DISORDERS IN THE WOUND BED

Chronic ulcerations represent a globally increasing medical and economic problem. Prevalence numbers range from 1% in the adult population to 3.5% in the population over 65 years. The causes of leg ulcers are diverse. In addition to the most frequently occurring vascular ulcers there is an increase of risk factors for atherosclerosis like smoking, obesity, and diabetes. Sergey Shapovalov (Russia) summarized his experiences with fifteen patients with soft tissue defects of whom nine patients suffered chronic wounds. He pointed out the positive stimulation of graft uptake even in those patient with serious trophic wound bed disorders caused by atherosclerosis and ischemia. Vyacheslav Zavatskiy (Russia) emphasized on the short time within which NPWT prepares the wound to plastic closure. He presented two cases of patients with peripheral arterial disease and large purulent necrotizing ulcers at the lower leg that first received surgery for revascularization and were then treated with NPWT until secondary closure with grafts. Piotr Trzeciak (Poland) stated a reduction of time of hospitalization and treatment cost by NPWT. He presented a severe case of multimorbidity in a patient with pressure sores on the buttocks. Sergey Goryunov (Russia) observed a reduction in time of wound bed preparation until plastic surgery was possible. From his experience with 103 patients suffering chronic wounds he presented an impressive case of a patient with pyoderma gangrenosum that caused a progressive circular leg ulcer which has lasted for up to three years. After 15 days of NPWT autodermoplasty was performed and the patient could be released from hospital 6 days later. An accordant case was reported by Wlodzimierz Klonowski (Poland), from a patient suffering insulin-dependent diabetes and a gangrenous purulent ulcer at the foot. Following 18 days of NPWT the wound showed good granulation and skin grafting was performed with ongoing NPWT. After 66 days the patient was discharged with the completely healed wound.

The treatment aim of a diabetic foot ulcer is the preservation and functional restoration of the foot. Thus only limited amputation of a toe or part of the foot may be undertaken to eliminate infection, minimize further loss of tissue and maximize the preserved function. Csaba Toth (Hungary) presented three patients with diabetic foot syndrome, two of them with foot sore amputations which were going to be treated with NPWT. After a total of eight days with NPWT wounds could be closed secondarily with a skin graft or primary closure with a suture, respectively.

NPWT REDUCES TREATMENT TIME AND COST

Economically venous leg ulcers represent a major cost factor for health care systems. Data from France and Belgium estimate the cost to be about 2% of the total health-care budget. The major cost driver were hospitalisation and nursing cost in the outpatient sector. Vladimir Oboleniuk (Russia) assessed the economic benefit of NPWT versus traditional treatment of venous trophic ulcers. He demonstrated that the improvement of treatment outcomes was associated with a reduction in treatment duration and a remarkable reduction in treatment cost.

REFERENCES