APPLYING THE NEGATIVE PRESSURE WOUND THERAPY PRINCIPLES IN NECROTIZING FASCIITIS FOLLOWING ABDOMINOPLASTY FOR MORBID OBESITY

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INTRODUCTION

The term of necrotizing fasciitis has been used for the first time in 1952 by Wilson, to describe the necrotic infection of the subcutaneous tissue and fascia, with relative sparing of the underlying muscle but with rapid progression towards septic shock and death if not promptly recognized and treated.1

Initial symptoms are unspecific, with local discreet signs, edema and inflammation, modification of the skin color; in cases of late diagnostic there are bullosa skin necrosis, subcutaneous gas crepitus and a general clinical aspect of severe sepsis and septic shock.

Diagnosing this condition requires a high rate of suspicion; therefore Wong and al published a laboratory score of diagnosis, allowing early recognition and differential diagnosis with non necrotic infections of the soft tissues.2

Although necrotic infections are usually caused by species of Streptococcus and Staphylococcus, a wide range of bacteria can also be involved: Gram-negative - E. Coli, Pseudomonas Aeruginosa, species of Proteus or Serratia, and anaerobic species – Bacteroides, Clostridium and Peptostreptococcus.3 This complication can affect any anatomical region (abdomen, perineum, extremities), its etiology can be multifactorial and many times without an identifying cause. Most of the patients that develop necrotizing fasciitis also have preexisting comorbidities that make them more vulnerable to
infection, such as immunosuppression, diabetes mellitus, chronic diseases, malnutrition, age>60 years, obesity, peripheral vascular disease, renal failure, cancer, steroids administration; common triggering factors are surgery, trauma, soft tissue infections, administration of intravenous drugs, burns, child birth.\(^3\)

Local and systemic bacterial and toxins invasion determines destruction of skin, fat and muscle, and a systemic inflammatory response syndrome evolving towards sepsis, septic shock and multiple organ dysfunction syndrome. Morbidity and mortality have significant rates. A study by McHenry and al reports a 33% mortality rate in cases of necrotizing fasciitis of the extremities, while other authors report mortality rates up to 80% in cases with comorbidities and complications (acute renal failure, septic respiratory distress syndrome, multiple organ dysfunction syndrome).\(^2,4,5\)

The management of this genuine emergency condition consists of extensive surgical debridment to remove the necrotic infected tissue, along with systemic antibiotherapy and intensive support of vital functions.

CASE PRESENTATION

A 43 years old female patient, height 1.67 m, weight 137 kg, BMI 46 (morbid obesity) addressed our clinic in March 2009, to undergo the surgical removal of a gigantic abdominal skin and fat excess. Associated diagnostics were postoperative abdominal eventration after an umbilical hernia surgically treated in 2002, bilateral congenital hip dysplasia. From the patient’s personal history we record that she underwent a progressive, accelerated postpartum weight gain – caesarian section in 1995 at 90 kg weight; this, associated with the lack of mobility due to the congenital hip dysplasia, led to a weight of 140 kg in the next 10 years. In 2005 she was the victim of a domestic accident with left coxofemural joint dislocation; orthopedic joint replacement surgery was postponed due to excessive weight and a particularly large adipose layer around the articulation. Although she followed a medically controlled diet and psychological counseling to improve the alimentary habits, the lack of mobilization, the depression syndrome and the algic syndrome only aggravated the patient’s condition; she reached 160 kg weight in 2008. The same year she was included in the gastric balloon program and lost 23 kg, but the abdominal skin and fat excess required surgical removal. (Fig. 1) The patient was under discontinuous Ketoprofen administration for episodes of hip pain and Tianeptine for the depressive syndrome.

Preoperative evaluation of the patient followed the protocol of our clinic, including medical history and biological investigations:
- Complete blood workup and lipidic profile – within normal range;
- Cardiologic examination - HR 100/min, BP 110/70 mmHg, ECG low voltage, without acute ischemia signs;
- Chest X-ray – elevation of right hemidiaphragm, heart and lung aspect age accordingly;
- Spirometry – no respiratory dysfunction;
- Doppler examination of carotid arteries and lower limb veins – no morphological or functional modifications;
- Abdominal ecography – no pathological findings.

All investigations were done with the patient admitted, because of extreme difficulty in patient mobilization (pathological standing posture of extreme anteflexion and support from an orthopedic frame), and also under prophylactic administration of single daily dose of Enoxaparine 0.5mg/kg sc.

The thromboembolic score was appreciated as high, the ASA score was III and the surgical risk was medium; informed consent was signed. The surgical intervention proceeded under general anesthesia: surgical cure of the eventration with polypropylene mesh covered by suturing the rectus abdominis muscles and abdominal dermolipectomy with excision of a 10 kg flap. The intervention lasted for 4 hours, and the antibacterial prophylaxis has been done according to local protocols with Cefuroxime 2g 1 hour before surgery, repeated after 4 hours.

The postoperative evolution was initially favorable, but 6 days after intervention the patient presented local redness at the incision site along approximately 5 cm, with moderate local pain; after another 48 hours there were cutaneous pallor and clinical signs of skin and fat necrosis, which imposed surgical debridment.
Antimicrobial de-escalation was initiated with Tygecicline. Tissue culture revealed E. Coli and the Tygecicline treatment has been continued according to the antibiogram. Local wound care was done twice a day, but the patient's condition was getting worse; at day 13 there were clinical and paraclinical signs of sepsis, with local extended necrosis of the dermal fat flap and altered general status, digestive intolerance, hypotension (BP 95/60 mmHg), HR 110/min, rectal temperature 38.5°C, anemia (Hb 8.4 g/dL, Ht 28%), leucocytosis (11.6 x 10^6/µL), lymphopenia and monocytopenia, progressive elevation of protein C levels.

![Figure 2. Abdominal wall skin and fat defect after serial debridment](image1)

Despite all the measures taken and an improvement of the general status, the local evolution was towards extensive flap necrosis, with important skin loss that required the applying of negative pressure wound therapy (NPWT) principles. (Fig. 2)

As we do not dispose of VAC® or other commercially available standard devices, we have applied gauze wet with saline and Betadine impregnated sponges, while aspiration was made through a drainage tube under an Ioban™ foil (self-adhesive, impermeable, transparent, Betadine impregnated, 120/60 cm, from 3M™) applied as equally as possible on the surface of the lesion. (Fig. 3) The drainage tube was connected to the existent wall suction device, using continuous pressure of -75 -100 mmHg, adjusted on clinical bases according to the level of exudate. Dressing changes were spaced at 2-4 days.

![Figure 3. Application of negative pressure wound therapy](image2)

Microbiological monitoring of the wound has been done every 4-5 days, with the adjustment of the antibiotic treatment according to germ sensibilities.

The Doppler examination, in a context of prolonged immobilization, vicious position of the left coxofemoral articulation and systemic sepsis, revealed another complication in day 30 – partial thrombosis of the left femoral vein, with extension into the left external iliac vein, without any clinical signs of deep venous thrombosis. Continuous Heparin therapy was initiated on automatic syringe, maintaining the APTT value at double of normal range. After 8 days another ecography revealed the resorbtion of the thrombus; treatment was continued with Enoxaparine 2x120 mg/day. The patient was monitored with venous Doppler at 2 weeks distance, switching the therapy to oral anticoagulants when surgical debridment was no longer necessary.

All this time the patient has been under intensive care of fluid, electrolytes and metabolic balance, received blood transfusions to redress the anemia, correction of the low albumin levels, oral and parenteral nutrition, intensive specific nursing. The difficulties in the medical care and the slow improvement of the patient’s condition had a major emotional impact which led to a decompensation of the depressive syndrome and therefore to an adjustment in the psychotropic therapy.

RESULTS

The slow favorable progression of the wound due to the efficient drainage system during 65 days of negative pressure wound therapy and to the metabolic support by intensive care measures allowed surgical approach at 3-4 days distance, obtaining a clean wound fit for secondary suture in day 95. (Fig 4)
The patient was discharged after 110 days of treatment, with complete restoration of the abdominal wall (discharge weight: 108 kg) and permanent counseling regarding the diet and home care, with independent mobility by help of orthopedic mobile frame, subsequently addressing to an orthopedics clinic for left hip joint implant.

DISCUSSIONS

The case presented is one of a subacute necrotizing fasciitis; the literature also reports a growth in the number of cases of the subacute model. The difficulty in establishing a clinical diagnosis and in differentiating it from the postoperative cellulites represented the main cause of delay of extensive debridment. The aggressive surgical approach and antibiotic treatment are the basis of the treatment and the key to patients’ survival.

Extensive debridment leads to a large skin and subcutaneous tissue defect, which has to be subsequently closed. Management options in soft tissue defects of such magnitude have evolved during the past decade, a widely accepted additional technique being that of negative pressure wound therapy. This method consists of applying subatmospheric pressure under a special system of sponges and impermeable foil, which drains the secretions, decreases the edema and inflammation, promotes circumferential wound contraction and maintains the surrounding skin intact. The negative pressure determines a high blood flow in the wound bed, favoring tissue growth and increased influx of cellular factors (leukocytes, fibroblasts); the number of microorganisms per gram of contaminated tissue is inversely proportional with the blood flow. The effective drainage of secretions also has direct consequences upon the degree of bacterial contamination and the absolute decrease in the number of bacteria per gram of tissue, healing of the wound being closely correlated to a bacterial load of under $10^5$/gram of tissue.

The technique of negative wound pressure has been used since mid-90’s. A report of Morykwas and Argenta in 1997 presents a retrospective analysis of their clinical experience in 175 chronic, 94 subacute and 31 acute wounds, observing the positive effects of vacuum-therapy upon several difficult local conditions (soft tissue avulsions, contaminated wounds, hematomas). Another series of studies have demonstrated the benefits of vacuum therapy in enhancing infected wounds closure, with superior effectiveness compared to the traditional wound dressings.

Previous to applying the negative pressure wound therapy the patient underwent marginal debridments of the abdominal wall and classical dressings changed twice per day, with subsequent surgical stress, maintaining SIRS and high risk of septic complications, while the NPWT system allowed a few days between the procedures, increasing patient comfort and diminishing the pressure upon hospital resources (operating room time, work load, materials). Average closure time with VAC® technique reported in literature for similar abdominal defects is of 60 days; in our case NPWT was applied for 75 days, followed by secondary suture.

Microbiological surveillance of the wound showed a significant improvement after initiating the NPWT, with significant diminishment of contamination level; clinically, the decrease of the necrosis, but also SIRS and hypercatabolic syndrome remission were obvious.

Morbid obesity is a serious condition, in itself a risk factor for complications of surgery. Abdominal and systemic sepsis management necessitated close monitoring of biological and microbiological samples, effective communication with the central laboratory, strict isolation and aseptic conditions and priority to the operating room. Losing the integrity of the abdominal wall escalated patient’s morbid condition; the local and systemic sepsis and the temporary immobilization led to thrombotic complications and increased mortality risk. Also the frequent surgical procedures, the repeated catheterization maneuvers, and the difficulties occurred during nursing care had a substantial neuropsychological impact upon the patient, with sustained psychological support needed. Along the entire period of hospitalization the patient benefited of intensive specific nursing care, permanent monitoring and a dedicated team formed of surgeon, anesthesiologist, nursing staff, and kynetotherapist.

CONCLUSIONS

1. Surgical treatment, sustained intensive care and the implementation of the negative pressure wound therapy principles in the medical management of this
serious complication have contributed to survival and therapeutic success.

2. Morbid obesity is an independent risk factor for postoperative infectious complications; early clinical diagnosis is essential and necessitates the implementation of risk scores in the laboratory diagnosis.

3. Doppler monitoring applied to the patient according to our department protocol and correlated to the calculated thromboembolic risk made evident the major thrombotic complication in absence of any clinical signs, allowing the adequate treatment of this potentially lethal complication.

4. The price of patient’s survival included high financial costs (approximately 160,000 RON), significant human resources and work load, and tremendous organizational effort in the rather tough hospital environment under the existing sanitary policy. Up-to-date treatment of this condition with a high mortality risk imposes granting of adequate resources, towards an alignment to the international therapeutic standards and applying of the modern techniques for high risk surgical wound care.

REFERENCES