

Role of plastic surgery on the treatment complex wounds

Atuação da cirurgia plástica no tratamento de feridas complexas

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A B S T R A C T

Objective: To report the performance of plastic surgery in the treatment of complex wounds in a tertiary hospital, analyzing its characteristics, types of injuries and approaches adopted, with emphasis on surgical treatment. **Methods:** Was conducted a retrospective analysis of patients with complex wounds treated by plastic surgery in a tertiary hospital in a period of five years (2006 to 2010). Data collection was obtained from visits made, serial assessments and records of the medical charts. **Results:** There were 1927 patients treated (32 queries / month), mean age 46.3 years, predominantly male (62%). The surgical specialties requested 1076 consultations (56%), and the clinical, 851 (44%). The distribution by type of wound showed predominance of pressure ulcers (635/33%), traumatic wounds (570/30%), complicated surgical wounds (305/16%) and necrotizing wounds (196/10%), with the remainder represented by vasculitis (83 / 4%), venous ulcers (79 / 4%), diabetes (41 / 2%) and post-radiation (18 / 1%). The treatment was surgical in 1382 patients (72%) and non-operative in 545 cases (28%). There were 3029 operations, predominantly debridement (1988/65%) and skin grafting (619/21%) associated or not with negative pressure therapy (vacuum), followed by pedicle flaps (237 / 8 %), digital reimplantation (81 / 3%), microsurgical flaps (66 / 2%) and other (38 / 1%). **Conclusion:** The plastic surgeon played an important role in the treatment of complex wounds by adopting early surgical treatment, contributing to the effective healing of cases.

Key words: Patients. Wounds and injuries. Surgical procedures, operative. Surgery, plastic. Skin transplantation.

INTRODUCTION

The treatment of wounds is probably one of the oldest areas of medicine. Archaeological evidence indicates that even in prehistoric times extracts of plants, fruits, mud, water and ice were applied to wounds. The ancient Egyptians used cloth strips to keep the borders of the lesion together, as they believed that a closed wound healed more quickly than an open one.

In the IV b.C. Hippocrates advised the treatment of wounds, "*Melt the fat an old pig and a mix it with resin and bitumen, spread on a piece of old clothing, heat it in the fire, apply it as a bandage*"^{1,2}. Ambroise Pare, in the sixteenth century, introduced the need for debridement, approximation of the edges and dressings. Lister, in the nineteenth century, developed the concept of antisepsis of the skin and surgical supplies, contributing to the healing of wounds^{1,2}.

Wound is defined as the loss of skin coverage, not just the skin but also subcutaneous tissues, muscles and bones. Wounds can be conceptualized as "breaks of the solution continuity of the structures of the body" or as a "disruption of normal structure and function of tissues."

They can be caused by trauma that originate inside or outside the affected tissue and vary from an acute and controlled injury to a generalized aggression³.

With increased life expectancy of the population, there is increasing incidence of diseases that accompany aging (heart disease, cancer, diabetes mellitus, hypertension). Such conditions increase the prevalence and complexity of the wounds and delay its healing⁴. Trauma is today the leading cause of preventable death and affects primarily the economically active adults, with great social impact. This also contributes to the emergence of serious wounds, with complicated and prolonged treatment.

The increasing longevity and prevalence of trauma victims in hospitals, raising the frequency of so-called "difficult" wounds, has attracted the attention not only of doctors and nurses, but also health care administrators, concerned about the impact of costs of treating these conditions. At the hospital, the care of these patients is generally associated with prolonged hospitalization time, use of expensive antibiotics and need for daily dressings, with mobilization of a large team of specialized professionals^{4,5}.

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Traumatic wounds are caused by severe trauma, resulting in lesions with extensive skin loss and damage to the tissue viability, as detaching injuries in lower limbs, amputation of limbs and fingers, as well as bruises, lacerations and large crushes, with exposition of noble tissue⁶⁻⁹. The most extensive and deep burns can be considered complex wounds, but traditionally they are separated and treated in specialized centers.

Surgical wounds are complicated due to the dehiscence of previous surgery incisions, usually associated with infection or tissue ischemia, and aggravated by the patients' clinical status⁴⁻⁶. The necrotizing wounds present with aggressive infection of the tissues, with spread to the deep layers and tissue necrosis, as in severe cellulitis and Fournier syndrome, found mainly in patients with immunosuppression or chronic disease^{10,11}.

Among the chronic wounds, there are the pressure ulcers, which develop due to prolonged tissue ischemia caused by sustained pressure of the soft tissues between a bony prominence and a hard surface. They occur in patients bedridden for long periods, paraplegics and quadriplegics^{12,13}. Lower limb venous ulcers represent a complication of chronic venous insufficiency^{14,15}. Diabetic wounds occur most commonly in the lower extremities and are due to neuropathy and macro- and microangiopathy that diabetes causes, associated with the defective healing process^{16,17}.

Wounds associated with vasculitis arise with the onset of inflammation of blood vessels or immunosuppression, occurring in various diseases such as rheumatoid arthritis, lupus, scleroderma, dermatomyositis and sickle cell anemia^{18,19}. Post-radiation wounds manifest as radiodermatitis or necrosis and are sequelae of radiation therapy for the treatment of cancer^{20,21}.

The objective of this study is to report the performance of plastic surgery in the treatment of complex wounds in a tertiary hospital, analyzing its characteristics, types of injuries and approaches adopted, with emphasis on surgical treatment.

METHODS

Was performed a retrospective analysis of patients with complex wounds treated by the Plastic Surgery HCFMUSP through consultations requested by all the clinics of this hospital and the emergency room in a five-year period, between January 2006 and December 2010. As inclusion criteria, the patient had to be admitted to a ward or the emergency room. Was excluded patients treated in outpatient clinics.

The study was approved by the Ethics Committee for Analysis of Research Projects of the Hospital of the Medical School of USP (HCFMUSP), registered under number 0719/08.

The principles governing the conduct of research involving humans have been properly followed, according to the Resolution of the National Health Council 196/96.

Was consider a wound complex when it was difficult to solve and it was associated with one or more of the following: extensive skin loss, aggressive infection, impaired tissue viability (presence of ischemia and / or necrosis) and association with systemic diseases that affect the normal processes of healing (diabetes, vascular disorders, vasculitis)^{4,5}. Based on these criteria, in 2006, Ferreira *et al.* proposed a second classification of complex wounds etiology, dividing them in⁴: traumatic wounds (including burns); complicated surgical wounds; necrotizing wounds; pressure ulcers; venous ulcers; diabetic wounds; vasculitis wounds; and post-radiation wounds.

The first three are generally seen in the acute phase, and the rest are considered chronic for not spontaneously healing in a period of three weeks. In this study, we adopted the aforementioned classification for complex wounds.

Data collection was obtained from the team of Plastic Surgery, through the care provided, the serial assessments in a specific form and also by analyzing medical records.

The studied data of each patient were age, sex, specialty that originated the request for consultation and the clinic where the patient was hospitalized. Data of complex wounds included their classification, the adopted strategy and operations performed.

As for the origin of the request for consultation, patients were distributed among those of medical and surgical specialties. The clinic of origin refers to where the patient was at the time of the first evaluation of Plastic Surgery, being in a ward, emergency room or intensive care unit (ICU).

With regard to the adopted strategy, the complex wounds were divided into those undergoing conservative or surgical treatment. A conservative approach was adopted in patients without clinical conditions to undergo surgery, in small and superficial wounds and in those in early stages of development. Conservative therapy included the use of dressings (activated carbon, hydrocolloid, silver sulfadiazine), topical debriding (papain, collagenase, calcium alginate, hydrogel), emollients and socio-educational measures (cleaning the wound site and change in lifestyle).

Surgical treatment was indicated for extensive and / or deep wounds, with an exposition of noble tissue, related to support bone surfaces, associated with severe systemic diseases or infections and in cases of digital amputation. Surgical procedures were grouped into surgical debridement and skin grafts, isolated or associated with negative pressure therapy (vacuum system), pedicle flaps or microsurgical flaps, and digital reimplantation.

RESULTS

Within five years of this study (2006-2010), 1927 patients were treated with complex wounds. The average attendance for the period was 32 appointments a months, more than one per day. The average patient age was 46.3 years, ranging from two days to 103 years. There was predominance of the group aged between 40 and 59 years. The age distribution of patients is shown in table 1.

As for gender, there was male predominance (1187 patients - 62%) over females (740 patients - 38%); 1076 patients came from surgical specialties (56%) and 851 from clinical ones (44%), as seen in table 2. The locations of the first evaluation of Plastic Surgery are shown in table 3.

The distribution of the type of complex wound of the 1927 patients is shown in table 4. There was predominance of surgical treatment (1382 patients - 72%) when compared to conservative one (545 patients - 28%).

In 1382 patients undergoing surgical treatment, 3,029 surgeries were performed, with an average of 2.2 surgeries per patient, distributed as seen in table 5. Both surgical debridement and skin grafts were associated with the use of negative pressure therapy, which was applied in 907 patients, i.e., 47% of the patients used the vacuum system at some time during treatment.

Among the pedicled flaps, the most used were the local advancement, rotation, and transposition flaps and rhomboid, muscle flaps (rectus abdominis, latissimus dorsi, pectoralis major, gluteus maximus, tensor fascia lata, gastrocnemius, soleus, gracilis and trapezius), fasciocutaneous flaps (groin, posterior thigh, front, scalp) and perforating flaps. With regard to microsurgical flaps, the most accomplished were the anterolateral thigh, rectus abdominis, latissimus dorsi, lateral arm and omentum.

Postoperatively, patients were followed for an average period of 122 days, either during hospitalization or in outpatient care. In the 1382 operated patients there were 128 greater post-surgical complications (7%), listed in table 6. Due to the severity of patients, there were 119 deaths (6%) during the study period.

DISCUSSION

The analysis of 1927 patients admitted to the HCFMUSP with the diagnosis of complex wounds and attended by the Department of Plastic Surgery in the period from 2006 to 2010 demonstrated the high prevalence and extent of the wounds in this referral hospital.

Most patients were in age group of the economically active population (55% of them were aged between 20 and 59 years). Besides causing a significant social impact, the presence of wounds directly affects productive capacity, as these individuals were away from their work activities for their treatment. Many of them

Table 1 - Age distribution of the 1927 patients.

Age (years)	Patients (#)	Percentage
0-19	223	12%
20-39	445	23%
40-59	615	32%
60-79	488	25%
> 80	156	8%

Table 2 - Distribution of the 1927 patients regarding clinic of origin at the time of the first plastic surgery visit.

Specialty	Patients (#)	Percentage
The Surgical):	1076	56%
-General Surgery and Trauma	598	31%
-Cardiac Surgery	123	6%
-Orthopedics	91	5%
-Vascular Surgery	81	4%
-Neurosurgery	44	2%
-Digestive surgery	38	2%
-Urology	33	2%
-Other surgical specialties	68	4%
B) Clinics:	851	44%
-Internal Medicine	244	12%
-Cardiology	186	9%
-Pediatrics	70	4%
-Infectious Diseases	58	3%
-Rheumatology	51	3%
-Neurology	42	2%
-Oncology	39	2%
-Geriatrics	37	2%
-Other clinical specialties	124	6%

Table 3 - Distribution of the 1927 patients regarding the location of the plastic surgery visit.

Location	Patients (#)	Percentage
Surgical Ward	454	24%
Clinical Ward	529	27%
Surgical Emergency Room	437	23%
Clinical Emergency Room	126	6%
Surgical ICU	196	10%
Clinical ICU	185	10%

progressed to chronic sequelae, with functional limitation, temporarily or permanently preventing the return to work^{22,23}.

There was a predominance of complex wounds in male patients (62%), which can be explained by the

Table 4 - Distribution of the 1927 patients regarding complex wound type.

Complex wound type	Patients (#)	Percentage
Traumatic wounds	570	30%
Complicated surgical wounds	305	16%
Necrotizing wounds	196	10%
Pressure ulcers	635	33%
Venous ulcers	79	4%
Diabetic wounds	41	2%
Vasculitis wounds	83	4%
Post-radiation wounds	18	1%

Table 5 - Distribution of the 3029 surgeries performed.

Surgery	Patients (#)	Percentage
Surgical Debridements	894	29%
Surgical Debridements + vacuum therapy	1094	36%
Skin grafts	323	11%
Skin grafts + vacuum therapy	296	10%
Pedicle flaps	237	8%
Microsurgical flaps	66	2%
Digital reimplantations	81	3%
Other	38	1%

Table 6 - Distribution of the 128 greater post-operative complications displayed by the 1382 patients undergoing operative treatment.

Post-operative complications	Patients (n°)
Wound dehiscence	34
Surgical wound infection	28
Thromboembolic events	23
Complete necrosis of flap	12
Total loss of skin graft	10
Other clinical complications	21

higher incidence of trauma in men and higher health care traditionally given to women.

Regarding the medical specialty that requested the evaluation, was noted that almost all of them - medical and surgical - were represented, demonstrating knowledge of the care provided by the Plastic Surgery and the advantages of this treatment, such as greater healing. It was a surprise verifying the embrace of wounds in beds of those various specialties. In addition, the treatment of wounds, especially surgical, is not a traditional part of the

therapeutic armamentarium of most specialties.

In 2006, Ferreira *et al.* proposed the definition and classification of complex wounds based mainly on the etiology⁴. According to this classification, the distribution of complex wounds in the present study revealed the prevalence of four types: pressure ulcers (33%), traumatic wounds (30%), complicated surgical wounds (16%) and necrotizing wounds (10%), reflecting the severity of patients seen at HCFMUSP, a tertiary care hospital, reference for severe cases and trauma.

In smaller numbers, other types of complex wounds, such as venous ulcers (4%), injured by vasculitis (4%), diabetic wounds (2%) and post-radiation injuries (1%), were seen. Although quite common in the population, venous and diabetic ulcers of the lower limbs had lower contribution, since they are usually treated on an outpatient basis, excluded from this study. Nevertheless, they have benefited from the latest surgical procedures^{4,17,24}. Post-radiation wounds decreased with improvements in radiotherapy equipment and its indications, but they still occur. In HCFMUSP, they have been treated separately in oncology centers, and currently the Instituto do Câncer do Estado de São Paulo (ICESP), linked to FMUSP.

The prevalence of surgical treatment (72%) resulted from the introduction by the Department of Plastic Surgery of the pioneer idea proposing surgery, especially earlier than usual, in the treatment of wounds^{4,13,17,24}. With the combination of earlier and aggressive surgical debridement, the use of negative pressure therapy (vacuum system) in many cases (907 patients - 47%) and plastic surgery procedures such as skin grafts and flaps, we accomplished the effective healing of wounds. As a consequence, a reduction of treatment costs, which is very interesting for managers of health facilities and hospital administrators^{4,22-24}.

In the 1382 patients undergoing surgical treatment, there were 3029 surgeries. In most of them (86%), the procedures were of medium complexity, represented by surgical debridement (65%) and skin grafts (21%), associated or not with negative pressure therapy. These operations must be performed by plastic surgeons. Pedicle flaps accounted for 8% of the operations and may be considered more complex and, in smaller numbers, it took highly complex procedures (5%), which require prior training in microsurgery, microsurgical flaps (2%) and digital replantation (3%).

The data obtained in this study bring us a current overview of the demographics of patients with complex wounds in a tertiary hospital, their characteristics, types of injuries and procedures adopted. Importantly, many of these patients had no serious illnesses or needed intensive care and could be treated with plastic surgery procedures available to hospitals at a secondary level.

In order to better study the patients with wounds, to offer a specialized, multidisciplinary treatment and to evaluate the benefits of surgical treatment, the Wounds

Group was instituted in 2003, initially at the Central Institute, and then extending to the whole complex the HCFMUSP, coordinated by the Department of Plastic Surgery. This group has acted in order to know the prevalence of complex wounds, to study the therapeutic options to treat them, the types of dressings, surgical procedures and technologies currently available, such as negative pressure therapy (vacuum system)^{4,25,26}.

We have proven that the most complex wounds should be treated with surgical procedures, because if taken care of only clinically or conservatively, their healing will take months. In addition, surgical debridement, skin grafts and flaps should be given earlier than it has been usually done in order to increase and accelerate the healing. The plastic surgeon should be involved in groups that treat these wounds from the beginning, be they medical or nursing groups. The authors believe that the rapid healing of complex wounds reduces hospital stay and therefore treatment costs^{4,22,24,27,28}.

Currently, we can see some difficulties in relation to the treatment of wounds. Besides the little integration between the various specialties that treat these conditions, another difficulty is related to the lack of government regulation, since there are no public policies that set targets

for their control, prevention or to guide treatment as indicated. Due to its high prevalence in hospitals and clinics in general, wounds can be considered a serious public health problem.

There are numerous treatment methods that lack scientific evidence. Many behaviors are based on empiricism or in small clinical series. There are no parameters for most appropriate evaluation of the results and possible comparisons between therapies. In this work we only showed that the early surgical treatment was effective for the healing of wounds. We did, however, no comparative studies.

The HCFMUSP Complex Wound Group can serve as a model for creating other similar groups, coordinated by plastic surgeons, in secondary and tertiary levels hospitals. In Europe and the United States there are already centers independent and specialized in treating wounds, more effective in achieving prevention, treatment and rehabilitation of patients. These centers would have a multidisciplinary approach and could be deployed both in developed and in developing countries^{29,30}.

In conclusion, the plastic surgeon demonstrated to play an important role in the treatment of complex wounds by adopting early surgical treatment, contributing to the effective healing of cases.

R E S U M O

Objetivo: Relatar a atuação da Cirurgia Plástica no tratamento das feridas complexas em hospital terciário, analisando suas características, tipos de lesões e condutas adotadas, com ênfase no tratamento cirúrgico. **Métodos:** Análise retrospectiva dos pacientes com feridas complexas atendidos pela Cirurgia Plástica em hospital terciário, através dos pedidos de consulta, em um período de cinco anos (2006 a 2010). A coleta dos dados foi obtida a partir de atendimentos realizados, avaliações seriadas e registros do prontuário médico. **Resultados:** Foram atendidos 1927 pacientes (32 consultas/mês), com média de idade de 46,3 anos, predominando o sexo masculino (62%). As especialidades cirúrgicas solicitaram 1076 consultas (56%) e as clínicas, 851 (44%). A distribuição por tipo de ferida demonstrou predomínio das úlceras por pressão (635/33%), das feridas traumáticas (570/30%), cirúrgicas complicadas (305/16%) e necrotizantes (196/10%), sendo o restante representado por vasculite (83/4%), úlceras venosas (79/4%), diabéticas (41/2%) e pós-irradiação (18/1%). O tratamento foi operatório em 1382 pacientes (72%) e não-operatório em 545 casos (28%). Nos pacientes operados, realizaram-se 3029 operações, predominando os desbridamentos (1988/65%) e enxertias de pele (619/21%) associadas ou não com a terapia por pressão negativa (vácuo), seguido pelos retalhos pediculados (237/8%), replantes digitais (81/3%), retalhos microcirúrgicos (66/2%) e outros procedimentos (38/1%). **Conclusão:** O cirurgião plástico demonstrou ter importante atuação no tratamento das feridas complexas por adotar o tratamento cirúrgico mais precocemente, colaborando para a efetiva resolução dos casos.

Descritores: Pacientes. Ferimentos e lesões. Procedimentos cirúrgicos operatórios. Cirurgia plástica. Transplante de pele.

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- Received on 27/01/2011
Accepted for publication 30/03/2011
Conflict of interest: none
Source of funding: none
- How to cite this article:**
Coltro PS, Ferreira MC, Batista BPSN, Nakamoto HA, Milcheski DA, Tuma Júnior P. Role of plastic surgery on the treatment of complex wounds. *Rev Col Bras Cir.* [periódico na Internet] 2011; 38(6). Disponível em URL: <http://www.scielo.br/rcbc>
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