ARTIGO DE OPINIÃO

THE STAPLES OF PLASTIC SURGERY: CREATIVITY, INNOVATION, COLLABORATION

OS PONTOS CHAVE DA CIRURGIA PLÁSTICA: CRIATIVIDADE, INOVAÇÃO, COLABORAÇÃO

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The field of plastic surgery did not spontaneously materialize in the mid-twentieth century as if by miracle. Part of its arsenal consists of old surgical techniques which were rediscovered, further developed, and applied to new situations. Pushing the limits of anatomy and physiology through disruptive creativity and innovation have long been the hallmarks of our relatively young specialty. Intricate collaboration with other areas of medicine is an integral part of our practice. This is what I will try to illustrate over the following paragraphs, with reference to a few surgeons who were innovators in the field and ending with some clinical cases which are representative of the collaborative nature of our specialty.

"MY GOD, THERE IS A NOSE!"

Nose reconstruction had been practiced in India for millennia, nose amputation being a common punishment for adulterers, thieves, and other criminals (the Hindu word, 'nacta' means having the nose cut off as a punishment[1]). During the sixth century BCE, a priestly class of northern

FIGURE 1: **Indian nasal reconstruction with a forehead flap. (Reproduced from BL. Letter to the editor. Gentleman's Magazine 1794;64:891––892.)**

India, the Koomas, developed techniques of nose reconstruction with forehead tissues, described in the Sushruta Samhita[2]. in October 1794, the Gentleman's Magazine of London published a letter to the editor, signed BL, describing the case of Cowasjee, a bullock driver whose nose had been amputated by insurgents in retaliation for working for the British army. A detailed description of the nasal reconstruction with the traditional Indian method is given, together with illustrations.

This letter came under the attention of the English surgeon Joseph Constantine Carpue (1764-1846), who, after careful consideration and extensive consultation with colleagues, decided to put the method into practice. Following many years of cadaveric dissections, he applied it in 1814 on two British military officers who had lost their noses due to the toxic effects of mercury inhalation in one case, and through mutilation by a sword in the other. At the end of the operation, which lasted 35 minutes and was performed without anaesthesia, one of the patients famously exclaimed: "my God, there is a nose!".

His illustrated monograph "An Account of Two Successful Operations for Restoring a Lost Nose from the Integuments of the Forehead"[3] is justly considered to have marked the rebirth of plastic surgery in Europe. In it, he also set the standards for future observational studies by trying to standardize objective follow-up metrics of outcome.

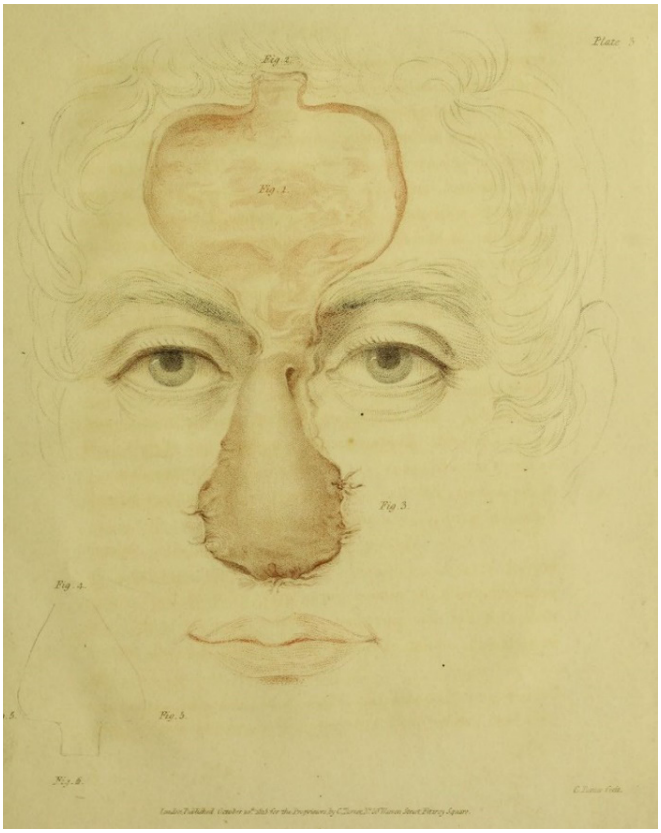

FIGURE 2: **Nasal reconstruction with a forehead flap. Reproduced from Carpue J.C. An Account of two Successful Operations for Restoring a Lost Nose from the Integuments of the Forehead, in the Case of two Officers of his Majesty's Army. London: Longman, Hurst, 1816.**

WAR AND PEACE

Modern plastic surgery was born during the first world war, significantly through the efforts of Sir Harold Gillies (1882-1960), a surgeon born in New Zealand and trained in the UK, at Aldershot and at the Queen's Hospital in Sidcup, Kent. Before the war, most battle injuries were caused by small arms or swords, causing little disfigurement, but the advent of heavy artillery and the use of shotguns in close-quarters trench warfare changed the picture dramatically. Suddenly, great numbers of servicemen with horrendous facial injuries had to be treated. Gillies rose to the task and developed ingenious innovative techniques, based on skin grafting and new tubed flap designs with delay procedures that helped to restore many mutilated young men. His 1957 book "The Principles and Art of Plastic Surgery", co-authored by Ralph Millard, is considered the first textbook on modern plastic surgery.

THE TOWN THAT DOESN'T STARE

During the Second World War Sir Archibald McIndoe (1900-1960) (Gillies' cousin), head of the Plastic Surgery Unit at the Queen Victoria Hospital

in East Grinstead, UK, specialized in the treatment of airmen with severe burn injuries. McIndoe's patients formed a club known as the *Guinea Pig club*[4]. Its members were injured airmen and the surgeons and anaesthesiologists who treated them (patients had to have gone through a minimum of 10 surgical procedures to be eligible for membership). McIndoe's goal was to foster the social reintegration of the injured soldiers, and he managed to have some of the families in East Grinstead to accept his patients as guests and other residents to treat them as normally as possible, which was very innovative. East Grinstead became known as "the town that doesn't stare."

THE HERRICK TWINS

When one thinks of kidney transplantation, plastic surgery does not immediately spring to mind. And yet, the first successful such procedure in humans was carried out by Doctor Joseph Murray (1919--2012), a plastic surgeon by training, in 1954, at the Peter Bent Brigham Hospital in Boston[5]. Having dealt extensively with skin grafts for the treatment of injured servicemen from WWII, he became interested in the factors underlying the success and failure of tissue and organ grafting and started investigating the feasibility of kidney transplantation in a dog model. After careful consideration and after consulting widely on the ethics of using a living human donor, his work culminated in the first successful kidney transplantation in humans, between the identical twins Ronald and Richard Herrick, on 23 December 1954. He went on to perform the first unrelated human renal allograft using azathioprine as an immunosuppressant, and to share the Nobel Prize in Medicine and Physiology in 1990 for his pioneering efforts in organ transplantation.

Doctor Murray ended his career as a practicing plastic surgeon and he participated in the development of the highly specialized and collaborative field of craniofacial surgery, fully embodying the hallmarks of modern-day plastic surgery: creativity, innovation and collaboration.

POURQUOI PAS?

Paul Tessier (1917-2008) is the undisputed father of the field of craniofacial surgery. His greatest contributions were the development of a combined intracranial and extracranial approach to the craniofacial skeleton, through coronal and facial incisions, in strict coordination between plastic surgeons and neurosurgeons, for the correction of orbital hypertelorism and other major craniofacial disorders, such as craniosynostoses and craniofacial dysostosis syndromes (Crouzon, Apert).

Gillies had attempted to surgically advance the face of a young Portuguese woman with Crouzon's syndrome in the early 1940s. The procedure was followed by complete relapse and he concluded that this was too difficult and dangerous an operation and so it should be discouraged.

Tessier, who travelled to Great Britain in 1946 to visit and work with Gillies and McIndoe, took the challenge of treating a patient with Crouzon syndrome that presented in 1957. After thoroughly researching the literature, he worked on dried skulls and conferred with colleagues. Applying his newly developed principles (combined intra cranial and extracranial approaches by a team of plastic surgeons and neurosurgeons, wide exposure of the skeleton, primary bone grafting of the osteotomy gaps) he performed a series of successful operations on several patients with craniofacial deformities and his early results are still considered the gold standard for the field[6-8].

His work also paved the way to the treatment of previously unresectable tumours of the skull base, both by providing the trans-facial approach with wide exposure and by allowing the resulting defects to be reconstructed with adequate tissues, transferred in the form of pedicled or free flaps.

It is said that, when preparing for the endeavour, he asked his neurosurgical friend Guiot if he thought it could be done. The reply was 'pourquoi pas?' (why not?). This expression has become the logo of the International society of Craniofacial Surgery, of which Tessier was the first president.

THE RUSSIAN CONNECTION

Bone distraction, a technique popularized by the Russian surgeon Ilizarov for the treatment of long bones[9], was first applied to the craniofacial skeleton by Joseph McCarthy at New York University's Institute of Reconstructive Plastic Surgery[10]. An example of innovation resulting from the adaptation of an old technique to a different anatomical area, bone distraction has changed the practice of craniofacial surgery, by allowing certain conditions to be treated with less extensive surgical aggression and improving treatment outcomes.

FLAP FREEDOM

Vascularized tissue transfer in the shape of pedicled flaps has for long been a mainstay of plastic surgery. Improvements in the anatomic knowledge of vascular territories have allowed progressively larger amounts of tissue to be transferred for the reconstruction of defects resulting from trauma or tumour resection, in the form of axial pattern fasciocutaneous or myocutaneous flaps.

But it was the advent of microvascular surgery, performing anastomoses between vessels which are 3 mm or less in diameter, in conjunction with specially designed instrumentation and sutures aided by optical magnification, that released the flaps from the constraints of their arcs of rotation. It is now routinely used in many centres to reconstruct complex defects using copious amounts of specialized tissues transferred from distant anatomic locations. The first clinical application of microvascular surgery was in replantation[11]. The first free flaps were reported in 1972 (omentum)[12] and 1973 (groin flap)[13].

During the 1980s, rapid progress in microvascular surgery allowed it to become a routine technique, with high degrees of success and low complication rates. During the 1990's, allotransplantation became a clinical reality with the first hand transplant in 1998 and the first partial face transplant in 2005. Both procedures fall well within the reach of current microvascular technique and are only limited by considerations related to the need for immune suppression.

COLLABORATION, COLLABORATION, COLLABORATION

Many are the areas of interface between plastic surgeons and other specialists in everyday clinical life. A few illustrative clinical examples, by no means exhaustive, are to follow.

Plastic surgeons and paediatric *neurosurgeons* often work together in the treatment of craniofacial deformities, such as craniosynostoses, craniofacial dysostosis syndromes (Crouzon, Apert, Pfeiffer, Saethre-Chotzen) (Fig. 3), craniofacial clefts and orbital hypertelorism (Fig. 4). Plastic surgeons are also frequently involved in the treatment of tumours of the cranial base, both for providing trans facial access and for reconstruction of the surgical defect. The treatment of certain sequelae, such as facial paralysis and upper limb paralysis, also falls under the scope of plastic surgery techniques.

Otolaryngology and head & neck surgery are frequent fields of collaboration for the reconstruction of complex defects after tumour resection (maxillectomy, mandibulectomy), often requiring the microvascular transfer of tissues (Fig. 5).

Several collaborative interfaces with *general surgery* exist, as are the cases of microvascular tissue transfers for oesophageal reconstruction, several

FIGURE 3: **Four-year-old girl with Crouzon syndrome showing exophtalmus and severe obstructive apnoea due to midface hypoplasia. Treated by the author and a team of neurosurgeons at Centro Hospitalar Universitário Lisboa Norte. Treatment consisted of a Le Fort III craniofacial disjunction assisted by distraction osteogenesis. a,b: preoperative views. c: intraoperative view with distractor in place. d: early postoperative at the ICU during distractor activation by the paediatricians. e, f: Six-months postoperative views immediately after removal of the distractors.**

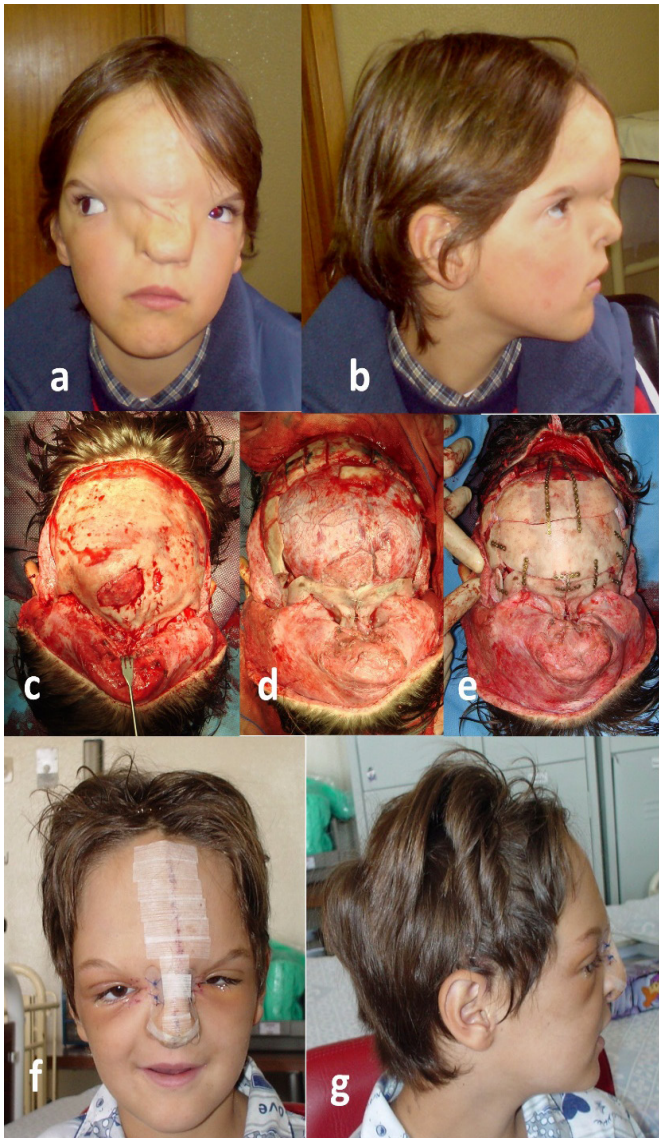

FIGURE 4: **Seven-year-old boy with severe orbital hypertelorism. Treated by the author and a team of neurosurgeons at Centro Hospitalar Universitário Lisboa Norte. Treatment consisted of cranioplasty and total orbital osteotomies for medialization. a, b: preoperative views. c, d, e: intraoperative views. f, g: Postoperative views at 15 days.**

kinds of procedures for breast reconstruction (Fig. 6), thoracic wall reconstruction and abdominal wall reconstruction, including the perineum.

Plastic surgeons collaborate frequently with *orthopaedic surgeons* in the closure of open fractures, coverage of implant material, the treatment of osteomyelitis (Fig. 7) and the management of certain sequelae like peripheral nerve damage (Fig. 8).

RETURN ON INVESTMENT

Plastic and reconstructive surgery has developed as a distinct specialty during the mid-twentieth century, driven by necessity and the creative power and innovative entrepreneurship of its pioneers, who drew and improved on existing techniques from many different surgical areas. It has reached

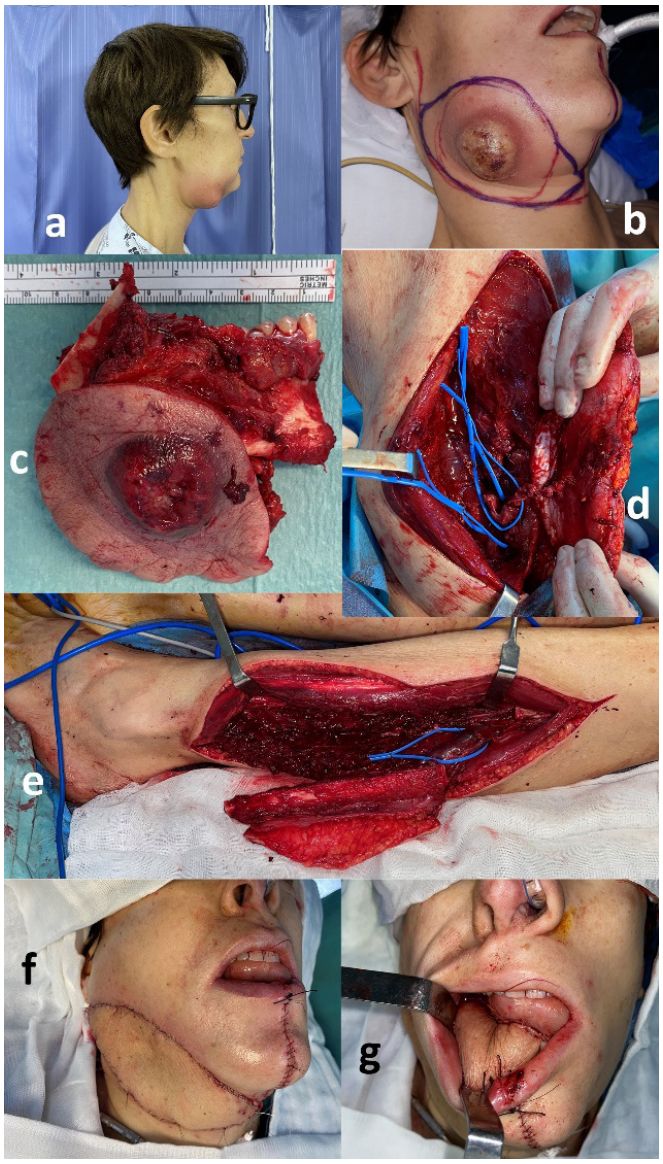

Figure 5: **Forty-six-year-old patient with squamous-cell carcinoma of the oral mucosa with invasion of the mandible and skin. Treated by Doctor Carlos Pinheiro and a team of ENT surgeons at Centro Hospitalar Universitário Lisboa Norte. Treatment consisted of wide resection and reconstruction with two free flaps anastomosed sequentially. a, b: preoperative views. c: Resected specimen, including a segment of mandible from the right angle to the symphysis d: dissection of an anterolateral thigh flap e: dissection of an osteo-cutaneous fibular flap. f, g: Postoperative views with both flaps transferred to the surgical defect after microsurgical anastomosis to the facial artery and external jugular vein.**

maturity and developed an extensive and highly differentiated tool set that allows it to intervene in most anatomic areas and to collaborate with many different surgical specialties in a coordinated,

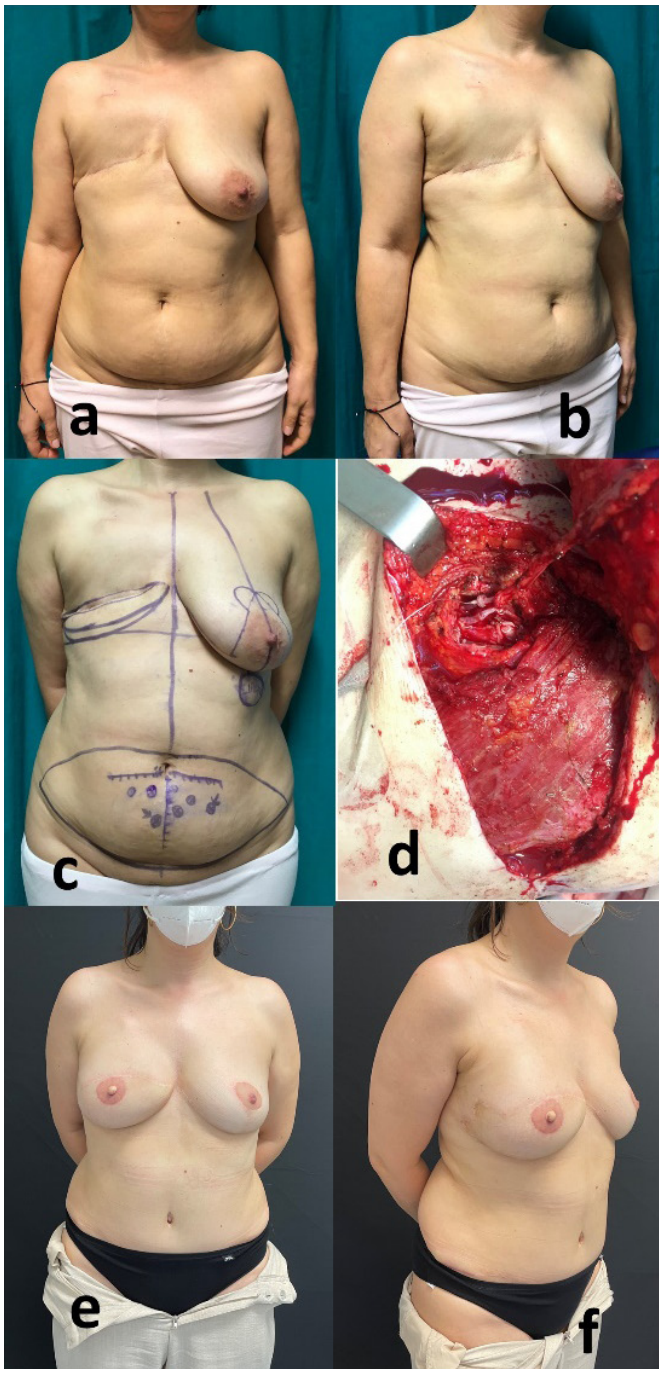

Figure 6: **Fifty-two-year-old patient following right mastectomy for breast cancer. Treated by Doctor Carlos Pinheiro and a team of general surgeons at Centro Hospitalar Universitário Lisboa Norte. Treatment consisted of reconstruction with a deep inferior epigastric artery perforator (DIEAP) free flap, nipple-areolar reconstruction with a star-flap and dermo pigmentation, and contra-lateral breast reduction and pexy. a, b: preoperative views. c: Preoperative markings d: microvascular anastomosis of the DIEAP flap to the internal mammary vessels at the 2nd right intercostal space e, f: Postoperative views.**

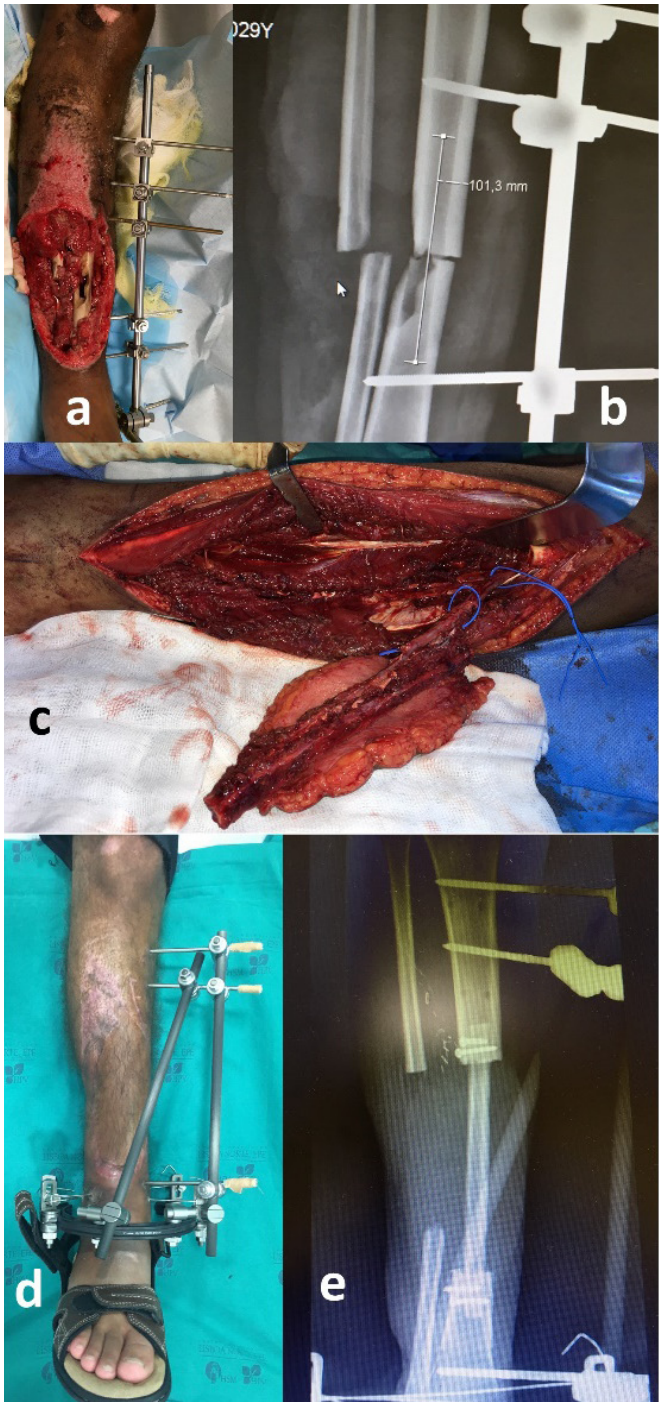

Figure 7: **Twenty-six-year-old patient with ulcerated osteomyelitis of the right tibia and fibula. Treated by Doctor Carlos Pinheiro and a team of orthopaedic surgeons at Centro Hospitalar Universitário Lisboa Norte. Treatment consisted of wide resection of infected bone and soft tissues, and reconstruction with a contra lateral free flap. a, b: preoperative view and X-ray. c: dissection of a contralateral osteo-septo-cutaneous fibular flap for microvascular transfer: d, e: Postoperative view and X-ray**

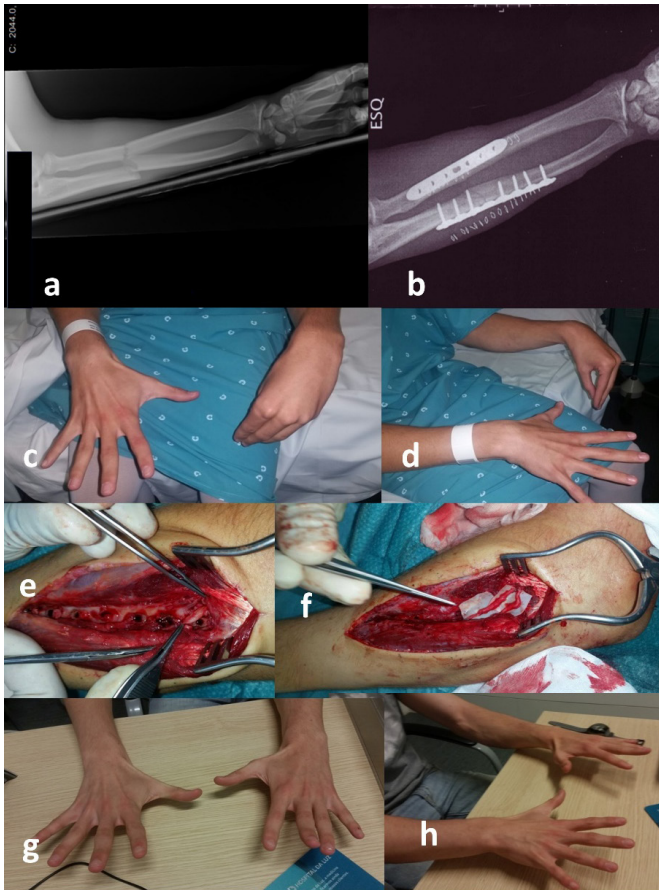

Figure 8: **Seventeen-year-old boy with iatrogenic paralysis of the left radial nerve following osteosynthesis of a fracture of the radius, treated by the author at Hospital da Luz Lisboa. Treatment consisted of implant removal, neural release, and microsurgical reconstruction with two cables of sural nerve. a, b: Preoperative X-rays c, d: Preoperative views showing complete paralysis of the left radial nerve e: intraoperative view with the lower forceps marking the proximal stump of the deep branch of the radial nerve, after removal of the osteosynthesis plate and screws f: reconstruction with two cables of sural nerve g, h: Postoperative views show complete functional recovery at six months.**

synergistic fashion. Presently, the department of plastic surgery should play a pivotal role in any major general hospital, developing closely knit interactions with most surgical specialties and many medical ones, in a patient-centred, problem-solving attitude of full cooperation.

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