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Nomadic plastic surgery: from healthcare huts to war-zones. Our experience over 30 years

Chirurgie plastique nomade. De la case de santé aux conflits armés: notre expérience sur 30 années

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ABSTRACT

We present 30 years' experience of "nomadic" plastic surgery missions carried out by a small non-governmental organization, specialized in reconstructive surgery in challenging conditions in developing countries. Here, we provide a record of missions carried out between 1993 and 2023. The study shows how surgical missions are conducted and the methodology used. We carried out 70 missions, with more than 8,000 consultations, and operated on 3,780 patients. A quarter of operations concerned clefts, a quarter tumors, a quarter burns and a quarter various diseases such as Noma and, recently, traumatic lesions secondary to armed conflict. We show some adaptations such as autonomy during missions, adjustment of indications to this new environment and the integration of local traditions in our therapeutic action. We offer practical ideas about surgery and some reflections on the social concerns.

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R E S U M E

Nous présentons le bilan de 30 années (1993 à 2023) de missions de chirurgie plastique nomade effectuées par une petite organisation non gouvernementale spécialisée dans la chirurgie réparatrice en situation précaire dans les pays en voie de développement. Cet article décrit le déroulement des missions et la méthodologie employée. Nous avons réalisé plus de 70 missions, fait plus de 8 000 consultations et réalisé 3780 interventions chirurgicales. Les interventions se sont réparties en ¼ de fentes labio-palatines, ¼ de tumeurs, ¼ de séquelles de brûlure et ¼ de pathologies diverses comme le Noma et, plus récemment, des lésions secondaires aux conflits armés. Nous montrons quelques adaptations comme l'autonomie en mission, l'ajustement des indications par rapport à ce nouvel environnement et l'intégration des traditions locales dans notre action thérapeutique. Nous proposons des notions pratiques sur le plan chirurgical et certaines réflexions sur le plan sociétal.

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Introduction

France has a long tradition of cooperation with developing countries. Non-governmental organizations (NGOs) have greatly specialized in this medical field in recent years. There is confirmed demand for plastic surgery. Some large NGOs are associating

plastic surgeons in their medical programs or running missions on a specific pathology such as cleft or noma (cancerum oris).

Our own little NGO specializes in plastic surgery in developing countries, dealing with all pathologies that require surgical repair. We came to concentrate on plastic surgery in challenging conditions. With increasing demand, notably from rural areas, we soon focused on "nomadic" plastic surgery.

The present study includes a photographic record of 30 years of plastic surgery missions in developing countries, with the

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development of nomadic plastic surgery and also recent undertakings in war-zones.

Missions

The non-governmental organization

Our NGO has the legal form of a non-profit association governed by the French Act of 1901, aiming to intervene in countries in which plastic surgery is non-existent. This year, we are celebrating our 30th anniversary. On average, we intervene 3 or 4 times a year in India, Senegal, Togo, Benin, Nigeria, Ghana Niger, Armenia, Madagascar, Cameroon, the West Bank, Chad, Türkiye, etc. We

always try to associate mission and training, in full collaboration with our local partners and with full respect for local traditions.

Nomadic plastic surgery missions

80% of the demand for plastic surgery is in rural areas, and we decided to work as close as possible to those in the greatest need: i.e., in villages and dispensaries [1].

Missions are regular, averaging 3 a year and lasting about 10 days each, with 3 members per mission (dressings nurse, anesthetist, surgeon) plus a dentist in 80% of missions. The mission is generally conducted in a dispensary or a health center (Fig. 1). Teams travel by local transport (taxi, pirogue, bush aircraft), with an average 200 kg of equipment (Fig. 2). We use special reinforced



Fig. 1. Surgery in a health hut in Benin.



Fig. 2. Bush air transport in Madagascar.



Fig. 3. Luggage for nomadic mission in Niger.

cases for fragile material and waterproof bags for more resistant goods. We aim at autonomy, taking with us all we could possibly need so as to operate quite independently (Fig. 3).

There are, however, 3 essential local inputs for a rural mission:

- Water: we try to be close to a well;
- Electricity: by generator or solar panels;
- Compressed oxygen tanks: in isolated situations, we compress the oxygen ourselves, but the flowrate is slow, averaging 5 l/min.

Practically and schematically, missions often proceed as follows

- Written invitation and authorization from a local health authority.
- Organization several months in advance of the mission: information on location, number of patients, age, gender and pathologies, local conditions, etc.
- Preparation: constituting the team, air tickets, vaccinations, administrative formalities, preparation of equipment, etc.
- Arrival in the village: presentations and greetings with local and health authorities, essential meeting with village chief and traditional healers [2], meeting explaining mission objectives, etc.



Fig. 4. Consultation in a village in Togo.



Fig. 5. Operating theater in a dispensary in Senegal.

- Installation in the dispensary with the help of the local health agent: cleaning the premises, setting up a nomadic surgery unit and unpacking the surgery and anesthesia equipment, checking the oxygen and starting up the generator.
- Consulting patients and drawing up the surgery schedule (Fig. 4).
- Beginning surgery as of day 1, starting with simple operations, to test the equipment.
- Daily surgery with no interruption throughout the stay, sometimes with two tables (Fig. 5).
- For sterilization, we first clean each instrument with a surgical brush, steep everything in classical disinfectant or else in bleach, then sterilize the surgery boxes in a Poupinel dry-heat sterilizer at 200 ° for 120 min. We travel with our 17-liter sterilizer, that we connect up to the generator.
- Frequent consultations between surgeries.
- End of mission: final consultation reviewing (and photographing) all patients; dressings renewed; consumables given to each patient; advice for follow-up. Generally, there is a meeting between the dispensary health staff, mission organizers and our own team, for final assessment, comments on how the mission went, and identifying points for future improvement.

Results

Missions

Between 1993 and 2003, we ran a dozen missions in the hospitals of the main capital cities of West Africa (e.g., in Togo, Benin, Nigeria) and in Asia (e.g., India and Myanmar).

Between 2003 and 2023, we ran more than 60 missions in these countries. Two-thirds were in health huts and health centers, and one-third in a general hospital – but with dreadful sanitary conditions

The nomadic plastic surgery missions were fully autonomous: i.e., with no outside medical help. We took advantage only of nearby wells, compressed oxygen tanks and generators.

Consultations

We performed more than 8,000 consultations – probably more than 10,000. On the ground, those involved know that there are many secondary consultations throughout the mission: between surgeries, or even in rest areas. Consultations mainly concern general plastic surgery. The pathologies concerned are either classical, but at advanced stages, or less common, such as noma [3], Buruli ulcer [4], elephantiasis or unusual congenital malformations. However, selection varies greatly between missions.

Anesthesia

Before defining the surgical indications, the anesthetist's experience has to be taken into account; this is often the common denominator of good medical management in these very precarious conditions [5].

The minimum requirement for acceptable anesthetic security is to have a source of oxygen (tank or concentrator), a mechanical or electrical aspiration system, and at least one check on oxygen saturation. Local and locoregional anesthesia is preferable but general anesthesia may be unavoidable, in which case spontaneous ventilation under ketamine and midazolam is to be preferred. If curarization proves indispensable, we prefer vecuronium, as it degrades less in the heat.

Surgery

We performed 3,780 surgeries in the 30 years, not counting time-consuming complex dressings under sedation. Surgeries comprised 25% cleft, 25% tumor, 25% burns and 25% other.

- Two-thirds of the clefts were labial (80% unilateral) and one-third labiopalatine. There was a large incidence in adults, whereas in France clefts are treated in childhood (Fig. 6). Most labial clefts were treated by J. Delaire's primary functional cheilorhinoplasty [6]. The suture failure rate was <1%. We used classic bony palate closure by mucoperiosteal flap and the usual techniques for soft-palate closure. We never needed bone graft for palatine cleft.



Fig. 6. Labial cleft, Ghana; before and after.

- Two-thirds of tumors were large disabling lipomas. Local anesthesia was generally use, with “cushioning” to avoid secondary drainage. The other third were various maxillomandibular and soft-tissue tumors (Fig. 7). Pathology examination is rarely feasible. In case of clearly poor prognosis, we did not perform surgery in such an inauspicious context.
- Burn sequelae were of 3 sorts: cervical straps, thoracic burns and upper-limb straps (Fig. 8). Many upper-limb burns implicate lifestyle, with traditional open hearths. Children were most often the victims. Surgery tends to be long, averaging 2h30, in the hand, when several digits are stuck together, requiring long delicate debridement and painstaking total skin graft. In axillary



Fig. 7. Macrodactyly of the foot, Cameroon; before and after.



Fig. 8. Perineal burns sequelae, Chad; before and after.

and elbow burns, treatment is quicker, with local or locoregional skin plasty. Cervical straps are treated either by local flap or total skin graft. Exceptionally, latissimus dorsi flap was used [7].

- Miscellaneous surgeries comprised the whole range of plastic surgeries, but most often for very advanced pathology: retractile skin bands, joint retraction, post-traumatic sequelae, infection

sequelae, various tissue defects. We also extended operations to emergencies such as C-section, peritonitis and open fracture, and tropical diseases such as noma (Fig. 9) [8] and Buruli ulcer.

During this period, the dental surgeon performed 650 operations, 20 of which were under general anesthesia. One-third were



Fig. 9. Noma, Nigeria; before and after.



Fig. 10. Multiple shrapnel wounds, Nagorno-Karabakh, 2020.

for infection sequelae, one-third for large bone cyst with extraction, and one-third were combined surgeries with a maxillary step such as for noma.

A separate issue is recent interventions in war-zones, with a moderate number of cases (Fig. 10). We would distinguish emergency surgery (wound-care, amputation, revascularization, nerve suture, flaps) and secondary reconstruction such as orthoplastic limb surgery [9].

Postoperative course

In villages, apart from septic pathologies, we minimized dressing, with one large solid hermetic dressing that could be left untouched for 8–10 days. At end of mission, all dressings were made with the local team present, providing material and advice. The postoperative infection rate was less than 3%. We always appointed a local correspondent in case of complications.

Discussion

We soon decided to operate on patients in their home country rather than having them come to France, for several reasons: a growing number of cases, considerations of cost, being able to treat the patient in the home environment, and associating training.

Since 2003, we developed the concept of “plastic surgery in challenging conditions” for the missions [10,11]. We then went further, with a concept of “nomadic plastic surgery”, meaning mobile surgery. Like many NGOs, we worked at first in hospital centers, but quickly came to see that the demand was coming from rural areas. We therefore decided to work close to the actual patients, for whom the health system was inaccessible. We had to be mobile. More recently, modern armed conflicts have led to a new demand for plastic surgery. Armed with our experience of surgery in precarious settings and nomadic surgery, we adapted to treat the war-wounded. This required being mobile and fast.

These 30 years' experience and constant adaptation to prevailing conditions, with constant reviewing of our practice, led us to consider 3 concepts; eco-surgery, chrono-surgery, and ethno-surgery.

Eco-surgery

An ecosystem comprises an environment (biotope) and the species living there. By analogy, eco-surgery is defined by the

environment in which it is practiced: surgery according to the environment and the people. Adapting the surgery to the setting.

Eco-surgery aims to adapt. In a village, for example, we try whenever possible to hold consultations along with a traditional healer, who has the cultural references to explain the treatment option and surgery. A well-explained option is better accepted.

Eco-surgery also adapts the technique to the setting. For example, in an emergency in a precarious environment, we still favor covering open fracture with a reliable local muscle flap that is quick to perform; on the other hand, in case of multiple revision for complex fractures, as in war-zones, a fasciocutaneous flap is preferable, maintaining trophicity over time [12].

Overall, there was a low rate of postoperative infection (<3%) in villages. This was partly thanks to the lesson learned from one of our illustrious masters of plastic surgery, Dr Raymond Vilain, who showed that “microbes don't jump”. We learned that the prime factor in the prevention of infection is simple lavage with soap and water, and we applied this in the bush. We insisted on the preoperative shower, with soap and well-water. We implemented the usual cleansing rules. We learned to limit surgery so as to avoid technical error: isolating the operative zone, working alone, with few procedures and few instruments, and above all going fast, being precise, ensuring good hemostasis, closing without external suture (buried intradermal running suture), and finishing with a large hermetic dressing left in place until the end of the mission. In the village, dressings have a hard life and they need to be large, hermetic and robust, renewed as seldom as possible, as dressing care in these environments always incurs a risk of contamination. Thus, we had to change our habits for hand dressings, especially in children, from “ASAP” (as small as possible) to “LHR” (large, hermetic and robust).

To sum up adaptation in a single word: “autonomy”. This was our leitmotif: financial autonomy, equipment autonomy, consumables autonomy, surgical autonomy. Surgical autonomy is the final goal. The training offered in each mission should enable local agents to manage their patients autonomously.

Chrono-surgery

Chrono-surgery involves thinking about the representation of time in plastic surgery missions in precarious situations.

There is the time of the mission, the time given over to the mission in our working lives, and the time to prepare the mission.

There is also time-management during the mission, and social time. The question at end of mission is always: how many surgeries? We all know that, in 1 day, one can perform 10 small or 3 more complex operations. Thus, we prefer to talk in terms of “surgical time” – the time actually spent operating – rather the number of operations. Unfortunately, it is still the number that is the take-away symbol for the image of the mission and the local health authorities.

Chrono-surgery above all focuses on the choice of surgery according to mission duration and frequency and the possibility of extending a complex reconstruction over time. For example, the calendar is essential in perineal reconstruction after the kind of sexual mutilation encountered in South Kivu with Dr Denis Mukwege or in reconstruction of complex noma. In the latter, technique differs depending on whether you have just one surgical slot in just one mission or can come back every 3 months for successive steps.

In war-zones, the chronology of care for the wounded is also particular, as the activity of physicians in civil society does not always match the progress of the war, while it is they who are actively involved nowadays, as in Nagorno-Karabakh (Artsakh) in 2020 and Ukraine in 2022. In these armed conflicts, we were able to intervene, but with a different agenda. For secondary limb reconstruction, for example, the army drew up a precise sequence: 6 h, 7 days, 8 weeks, and 9 months [13]. This is an excellent schedule, proposed by Dr Sylvain Rigal, but we were unable to adhere to it: as civilians, we cannot go straight to the front, and we cannot pursue a mission for several months for a long reconstruction. Time is thus an important factor in managing complex reconstruction.

Ethno-surgery

We quickly came to value the anthropological and cultural aspect of our work. We explored the interface between contemporary biomedicine in our own practice and the cultural diversity found in local therapeutic traditions. We sought to develop a concept of ethno-surgery resulting from the meeting of the two. Patient management was soon implemented in collaboration with traditional healers in joint consultations. We dealt with the visible aspect of the disease, and they with its invisible aspect. Above all, the traditional healers explained to the people what we were doing. We also learned that “influence can cure” [14].

Ethno-surgery is not the same thing as the anthropology of surgery. It is a research field with objects and methods in common between surgery and anthropology, but above all seeks to understand the patient’s interpretation or experience of the surgical procedure in terms of his or her environment and of the cultural systems of interpreting and managing disease. Ethno-surgery led us to conceive original means of multidisciplinary management. It consists in treating the whole patient, with sophisticated techniques but respecting the patient’s origins, beliefs, ethnic group and local therapeutic traditions.

Above all, we wanted to give a primordial role to the patient’s view of the medicine we were importing. Ethnology observes the other: ethno-surgery looks at how the other sees us. It is “reverse ethnology”, and seemed essential to us because a treatment is not going to be accepted if it is not understood. We therefore try to understand how our surgery is understood. Understanding leads to greater confidence and thus efficacy. We can illustrate this with an anecdote: resection of a large deep lipoma of the left thigh in an elderly patient in the village of Bello-Tounga in northern Benin, in 2008. I resected the tumor under painstaking local anesthesia and closed the skin with a buried intradermal running suture, to leave a nice-looking scar and, especially, no stitches that would have to be removed. The patient had a long talk with the nurse, in Dendi, the

local language, which I didn’t understand; but I supposed he was talking about the operation, with a certain satisfaction, as the result seemed very satisfactory to me. A few days later, in a discussion in the village, I found out that the patient was a bit worried, as he had not felt any pain during the operation and moreover could not see any scar or sutures on the skin. In northern Benin (like in much of Africa), surgery is associated with an idea of pain, and the scar, which actualizes the surgery, is expected to be *visible*. The patient was in fact wondering whether I had actually removed everything and how I had managed to reach the “thing”; I had to give a better explanation, with the help of the local go-between: why there had been no pain, and why the scar was scarcely visible.

Rather than contrasting different therapeutic procedures, we think it is better to associate them, depending on the individual patient. Rather than trying to adapt the patient to the treatment, we advocate letting the patient choose.

Personal reflections

After 25 years in the field and more than 65 surgical missions, may I be allowed a few personal thoughts?

“02” MOBILITY

I am convinced that mobility is essential these days with the worldwide demand for plastic surgery, to come close to rural populations in developing countries, and also now to meet demand in war-zones. We demonstrated this in the conflict in Nagorno-Karabakh in 2020 and again today in Ukraine, where, with the NGO Actions Santé Femmes, we set up mobile clinics on the Romanian border to face up to the surge of displaced Ukrainians. Recent events, with the Turkish earthquakes of February 6, 2023, further bore out the idea that we need to move quickly to deal with trauma sequelae. Plastic surgeons may not be fundamental in situations of extreme urgency, in which damage control is the watchword, but they quickly become important for reconstruction of sequelae [15].

“02” SECURITY

Security issues in humanitarian missions are heightening and becoming an obstacle to our projects in some countries. I am not



Fig. 11. Leprosy sequelae with 1st commissure amyotrophy.



Fig. 12. 1st commissure lipofilling; before and after.

talking here about war-zone missions, where the risk is obviously real. What is new is that non-military physicians are increasingly involved in areas of conflict. We saw this in the West Bank in 2015, UD Congo in 2019, Armenia in 2020 and Ukraine in 2022. As a reminder, in the terrorist attacks on the Bataclan nightclub in Paris in 2015, it was civilian doctors who treated the wounds caused by assault weapons; it was thanks to our experience abroad that we were straightforwardly able to deal with these injuries in Paris.

Geopolitical developments today, notably in West African countries, are leading to increasing hostility toward Westerners. Uncontrollable armed groups are spreading in these regions, as is large-scale banditry, with mission personnel taken as hostages.

"02" TEACHING

In 2004, in Paris, we set up an interuniversity diploma course in plastic surgery in precarious situations, to share our experience. Seeing the success of the course, we decided in 2008 to extend it to Madagascar, where it has been included in the basic surgery diploma course. We also set up a basic surgery school in southern Chad, with the NGO Handicap Santé, to provide basic plastic surgery residents training. And, as part of our many missions, we have provided practical training for our local colleagues on an apprenticeship basis.

There is today some doubt as to the effectiveness of all these educational efforts, as real results are hard to assess. Individually, the techniques being taught are obviously essential, but the impact on health systems is less clear. Effective teaching of a surgical specialty ought, in our opinion, to be organized at the local level, with local teachers and adaptation to the local environment. Our role should just be to meet a demand for specialized teaching in a specific area of expertise.

"02" HUMANITARIAN COSMETIC SURGERY

Esthetics was found to be an important aspect of patients' expectations, even in the poorest regions. We quickly learned the local cultural interpretations of disease and the "sick body". The esthetic demand can be understood in terms of the fundamental importance, here more than elsewhere, of belonging to the group: to be part of the group, you have to look like part of the group. This does not involve a stereotypic "resemblance", but rather a "non-difference": i.e., any modification of the body, such as a large lipoma or a noma, counts as stigma. A non-normal presentation (and yet, what is the norm? [16]) makes the subject distinct, or a bearer of "evil". In some parts of Africa, a new-born with a labial

cleft may be drowned at birth. At delivery, a baby born with a tooth or a lot of hair or who simply moves "oddly" is liable to be labeled a "witch child" by some matronly lady. Here the esthetic dimension comes into its own. What is at stake is not whether cosmetic surgery makes therapeutic sense, but whether it can be life-saving! In Asia, for example, the prime demand in surgical treatment of leprosy is to correct first commissure atrophy (Fig. 11). Obviously, we are mainly focused on screening, medical treatment, nerve release and tendon transfer for sequelae; but first commissure atrophy is the sign of the disease, stigmatizing the patient in daily life, and we well know how important the dorsal side of the hand can be in society. The atrophy shows that the subject has the disease. The demand is thus straightforward: to correct the amyotrophy esthetically so as to circumvent exclusion socially. For this, we now use lipofilling (Fig. 12). The demand is cosmetic, and we use a cosmetic surgery technique. In the case illustrated here, cosmetic surgery was therapeutic, in that it treated the "esthetic function" highlighted by Raymond Vilain's school in the Boucicaud hospital [17] – and thus treated the patient! We developed the concept of "humanitarian cosmetic surgery" [18,19], repairing the esthetic function of the injured body, and we learned that cosmetic surgery is therapeutic in these far-off lands. It can even save lives.

Conclusion

There is great demand for plastic surgery in developing countries, and 80% of this demand is in rural areas. We therefore concentrated our missions in dispensaries, and the "nomadic" version allowed a perfect response to the demand. This surgical adventure has changed how we work these last 30 years. We adapted our techniques to the environment, while respecting local traditions.

Today, modern armed conflicts are leading to new demands in plastic surgery. We find multi-tissue wounds following bombardments and burns by white phosphorus bombs, requiring specific management. We also encounter dreadful genital mutilations in the eastern part of the RDC, where sexual violence and rape are real weapons of mass destruction.

Our experience of surgery in precarious settings, and its mobile or "nomadic" version, enabled us better to respond to these new surgical needs. We have moved from dispensaries to war-zones.

Plastic surgery in challenging conditions should be taught in all hospital centers in developing countries. Nomadic plastic surgery now provides a good response to the strong demand in rural areas and war-zones.

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