Original article

French surgical experience in the Role 3 Medical Treatment Facility of KalA (Kabul International Airport, Afghanistan): The place of the orthopedic surgery

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\textbf{A B S T R A C T}

\textit{Introduction:} In 2009, the French took command of the Medical Hospital (MH) or Role 3 Hospital at KalA (Kabul International Airport) within the framework of its role in the military mission Operation Pamir in Afghanistan. The goal of this study was to analyze the volume of orthopedic surgical activity for the last four years, to identify its specificities and to improve training of military orthopedic surgeons.

\textit{Hypothesis:} Orthopedic surgery is the most important activity in the field and surgeons must adapt to situations and injuries that are different from those encountered in France.

\textit{Patients and methods:} All patients operated on between July 2009 and June 2013 were prospectively included in an electronic database. The analysis included the number of surgical acts and patients, the types of injuries and the surgical procedures.

\textit{Results:} Forty-three percent (n=1875) of 4318 procedures involved orthopedic surgery. Half of these were emergencies. French military personnel represented 17% of the patients, local civilians 47% and children 17%. Half of the procedures involved the soft tissues, 20% were for bone fixation and 10% for surgery of the hand. The rate of amputation was 6%. The diversity of the surgical acts was high ranging from emergency surgery to surgical reconstruction.

\textit{Discussion:} The activity of this Role 3 facility is comparable to that of other Role 3 facilities in Afghanistan, with an important percentage of acts involving medical assistance to the local population and scheduled surgeries as well as primary and/or secondary management of the wounded. The diversity of surgical acts confirms the challenge of training military orthopedic surgeons within the context of the hyperspecialization of the civilian sector. Specific training has been organized in France by the École du Val de Grâce.

Specific continuing education is also necessary.

\textit{Level of evidence:} IV (retrospective review).

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1. Introduction

The wars in Afghanistan and Iraq have seen a new type of so-called asymmetric war between traditional armies and rebel or terrorist forces in which combat, peacekeeping, and humanitarian operations occur side by side [1,2]. Army Medical Services have had to redefine their policy for the management of war casualties, which is now structured according to a time and space based organization with front line combat surgical units called Role 2 and medical hospitals or Role 3 facilities with complete diagnostic and therapeutic services [2] (Fig. 1).

In July 2009, NATO gave France command of the Medical Hospital (MH) at the Kabul International Airport (KalA). A hundred or so military personnel work there, one third from French military hospitals (doctors and paramedics), one third from the 1st Medical Regiment of Valbonne (medical auxiliaries and first aid specialists and stretcher-bearers) and one third from other countries (German, Czech Republic, Bulgaria…). There are three operating rooms, one emergency room, an outpatient clinic, an intensive care unit (4–6 beds) and a hospital unit (32 beds). Its mission is to manage coalition soldiers including military personnel from the National Afghan Army (NAA), collateral civilian war casualties and
finally other civilians depending on operational and logistic constraints and within the framework of medical aid to the population (MAP). For this, three surgical teams rotate with a general surgeon, (abdominal, chest or vascular surgery) and an orthopedic surgeon as well as an ophthalmologist, a neurosurgeon and an ENT or maxillofacial surgeon.

We reviewed the orthopedic surgery activity at the Kāī A MH for the past four years. The goal of this study was to compare our experience with those of other Role 3 facilities deployed in Afghanistan or Iraq and to use these data to train French military orthopedic surgeons.

Our hypothesis was that orthopedic surgery represented a major part of the activity in the field, with situations and injuries that were different from those encountered in France and that training military orthopedic surgeons should respond to these specific needs.

2. Methods

We reviewed the data from patients operated on at the Kāī A MH from July 2009 to June 2013. The surgical reports were prospectively entered into an electronic database, FileMaker Pro (File Maker Inc., Santa Clara, CA, USA).

All surgical procedures were entered and then the orthopedic surgery activity (surgery of the limbs and soft tissue) was extracted.

The overall surgical activity of the MH was reported as the total number of procedures per specialty. Patients were classified into four categories according to their status: French military personnel, foreign military personnel, MAP and others (contractual workers, from embassies or non government organizations [NGO]).

The activity of orthopedic surgeons was analyzed in relation to patients’ demographic data (age, gender) and the type of surgical procedure according to the level of urgency, the mechanism of injury (road accident, bullet wound, work-related accident, knife wound, shrapnel) and the indications. Each surgical procedure was counted in patients who underwent several separate procedures. In case of one operation including several orthopedic procedures on different limbs in the same patient, each procedure was counted separately. When several procedures were performed during the same operation on the same segment of a limb, only the main procedure was counted. For example, both procedures were counted separately in a patient with an open leg fracture who underwent external fixation and a secondary flap cover. In a bone fracture treated by debridement wide excision and external fixation, only the external fixation was counted. The goal was to prevent overestimating or underestimating the number of surgical procedures.

3. Results

3.1. Overall activity

A total of 4318 surgical procedures were performed in 3215 patients or 1.34 procedures per patient. Forty-seven percent of the procedures were emergencies. Orthopedic surgery represented 43% of the total activity (1875 procedures) (Fig. 2).

3.2. Orthopedic activity

A total of 1319 patients were managed in the orthopedic surgery unit or a mean 1.4 operations per patient. Patients were a mean 30.9 years old (range = 1–78); 17% were children (<15 years old) (Fig. 3) and 89% were men. Forty-seven percent of patients were Afghan civilians and 17% were French military personnel (Fig. 4). The typology of operated patients is shown in Table 1. Approximately two out of three interventions were emergencies (Table 1).
Eighteen percent of the emergency operations were performed in patients with non-war related injuries (MAP, road traffic accidents, accidents related to sports or daily activities). War related injuries (bullet wounds, shrapnel, burns from explosions, armored military vehicles) involved 37% of patients and 47% of interventions.

Table 2 summarizes the surgical procedures performed by orthopedic surgeons. There were numerous indications and they involved all anatomical regions. Half of the interventions involved the soft tissues (debridement, wide excision of soft tissue, skin grafts, dressing under general anesthesia with or without the use of vacuum-assisted wound closure therapy). Bone fixation was performed in 18.3% of the procedures, and hand surgery in 9.6%. Most internal fixation was performed on long bones, the hand and the ankle. Most external fixation involved the lower limbs. (Fig. 5).

4. Discussion

4.1. Overall activity

The overall surgical activity in the Role 3 KalA facility is comparable to that in other series in the literature in terms of volume of surgeries, patients and injuries [2-7]. Because of asymmetric warfare, both military (NATO and Afghan National Army [ANA]) and civilian patients were managed. MAP and scheduled surgeries represented more than half of Role 3 facility [2-8] activity, which is specific to these structures, unlike Role 2 facilities which manage military and civilian Afghan patients in two out of three cases [4] with 70% of emergency procedures, providing emergency surgical management of the wounded before they are evacuated to Role 3 facilities. They are mobile, close to combat zones and their goal is to stabilize the wounded based on the principles of damage control surgery by controlling hemorrhage, which is the primary cause of death in combat, and infection [9-11]. Role 3 facilities are better equipped, allowing primary and secondary management of the wounded, as well as planned surgeries and MAP. The percentage of women who undergo surgery is low because very few are involved in combat. On the other hand, children represent approximately 20% of the cases because they are often victims of explosions of improvised explosive devices that they pick up, resulting in severe injuries such as burns or penetrating traumas, with a high rate of mortality [4].

4.2. The role of orthopedic surgery

In Role 3 hospitals, orthopedic surgeries are the most frequent type of surgery representing between 40 and 77% of the total surgical activity [4-8,12,13]. In asymmetric warfare, the incidence of musculoskeletal injuries is 3.06/1000 deployed military personnel/year [13], because of the improvement in ballistic protection against fatal wounds. Moreover, there are fewer immediate losses in combat thanks to improved medical management on the front lines (use of tactical tourniquet, principles of damage control) and the capacity for rapid evacuation [7,14]. Thus, surgeons are faced with survivors with severely mutilated limbs and extremely challenging surgical cases [15]. However, only 38% of the patients have specific war-related injuries, even though these injuries represent more than half the surgical procedures, showing the extreme severity of these wounds (explosions, bullet wounds) and the important role of burns, which require several operations. Thus, nearly 50% of the surgical acts involve the soft tissues (wound debridement, bandaging, skin grafts). Vacuum-assisted wound
therapy is extensively used to promote drainage and healing of wounds [12,16]. There are many diverse procedures, from emergency surgery to reconstruction and management of sequellae (grafts, skin flaps, reconstruction...) [17] as well as conventional scheduled surgery [15,16]. Hand surgery plays an important role [18]. Fractures and internal fixation only represent 20% of the procedures and involve all limb segments [14]. External fixation is justified during combat surgery because it allows stabilization of fractures before evacuation of military personnel to France, while respecting the principles of damage control orthopedics so that later internal fixation procedures and skin flaps are not compromised by [9]. In MAP, the fracture can be immobilized with a minimal risk of infection [19,20]. Internal fixation is used for closed fractures. The rate of amputations in our series is low (3.4%) like in the literature [13,21]. However, Krueger et al. [22] reports a series of amputations in Afghanistan from 2010–2011 in which 10% were performed more than 90 days after the injury. We did not evaluate our rate of secondary amputation, but that study is a reminder of how difficult it is to initially evaluate the severity of injuries [23,24]. The study by Doukas et al. in 2013 shows that amputation of the limbs is better than long, difficult salvage procedures for the patient’s social, family and professional reintegration, as well as from a psychiatric point of view [25]. These late stage amputations should be avoided if the situation is obviously hopeless [8,23].

### 4.3. Training of military orthopedic surgeons

Because of the diversity and the highly technical nature of the surgical procedures, the many different contexts of surgery and the typologies of injuries, orthopedists must be highly qualified and have experience in complex traumas and surgery. Orthopedic surgeons may also be obliged to perform neurosurgery, general and/or vascular surgery in the field, especially in Role 2 facilities. As early as 1995, Becker and Grabarek [26] showed how complicated it is to train German military surgeons within the context of the hyper-specialization in the civilian sector. He insists on the importance of general surgical training, and observes that long periods of training are necessary to reach these goals [27].

In France in 2007, École du Val de Grâce (EVDG) began offering advanced surgical training course for overseas operations (CACHIRMEX) [8,23] to provide all military surgeons with the tools to manage severe hemorrhaging and to treat and evacuate these patients to France under the best possible conditions based on damage control surgery. This training includes five modules of

### Table 2

Interventions by orthopedic surgeons.

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture fixation</td>
<td>218</td>
<td>11.1</td>
</tr>
<tr>
<td>Internal fixation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External fixation</td>
<td>141</td>
<td>7.2</td>
</tr>
<tr>
<td>Skin flap cover</td>
<td>37</td>
<td>1.9</td>
</tr>
<tr>
<td>Surgery of the soft tissues (except the hand)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debridement/soft tissue excision</td>
<td>356</td>
<td>18.2</td>
</tr>
<tr>
<td>Skin graft</td>
<td>63</td>
<td>3.2</td>
</tr>
<tr>
<td>VACT</td>
<td>450</td>
<td>23.0</td>
</tr>
<tr>
<td>Abscess/arthritis</td>
<td>74</td>
<td>3.8</td>
</tr>
<tr>
<td>Hand injuries</td>
<td>187</td>
<td>9.6</td>
</tr>
<tr>
<td>Treatment of nonunion (septic and aseptic)</td>
<td>78</td>
<td>4.0</td>
</tr>
<tr>
<td>Fasciotomy for compartment syndrome</td>
<td>14</td>
<td>0.7</td>
</tr>
<tr>
<td>Amputation (including hand)</td>
<td>67</td>
<td>3.4</td>
</tr>
<tr>
<td>Treatment of osteitis</td>
<td>14</td>
<td>0.7</td>
</tr>
<tr>
<td>Removal of fixation material</td>
<td>104</td>
<td>5.3</td>
</tr>
<tr>
<td>Surgery for sequellae (skin plasty, krükenberg procedure, tendon transfer, muscle release, arthrolysis, nerve graft...)</td>
<td>52</td>
<td>2.7</td>
</tr>
<tr>
<td>Conventional surgery (civilian traumas, shoulder stabilization, neurolysis, tenorraphy...)</td>
<td>101</td>
<td>5.2</td>
</tr>
<tr>
<td>Total</td>
<td>1956</td>
<td>100.0</td>
</tr>
</tbody>
</table>

VACT: vacuum-assisted closure therapy.

![Fig. 5. Number of bone fixations in relation to the anatomical zone.](image-url)
understanding and necessary training are also two specialties.

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**Disclosure of interest**

The authors declare that they have no conflicts of interest concerning this article.

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**References**


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**Theoretical classes and practical workshops on cadavers or animal models. It also includes three semesters outside one’s specialization (chest and abdominal surgery, vascular surgery and neurosurgery) and a 2-month internship in a Role 2 facility working with an experienced surgeon. Eardley et al. [24,28] shows that this practical training is necessary to bridge the gap between good theoretical understanding and limited surgical experience. For Brooks et al. [29] this type of experience is essential because the experience of two months of field work is equivalent to the entire training program in France.

Moreover, our study shows that military orthopedic surgeons are regularly confronted with highly specialized surgery such as hand surgery, microsurgery, flap covers, osteoarticular infections and multiple traumas. These elements must be included in the future training of orthopedic surgeons [20]. Pediatric orthopedics is also an important part of this activity, and a semester of pediatric orthopedics is already an obligatory part of the training course [4].

Finally, occasional continuous medical education courses before leaving for the field, as well as teamwork to update and test knowledge based on theoretical and practical case studies seems to be necessary and effective [30–33]. Keeping up to date by doing hospital duty in multiple trauma units, participating in multidisciplinary meetings on osteoarticular infections in reference centers, developing telemedicine connections with pediatric orthopedic units...are possible projects to optimize the training of military orthopedics specialists and ensure high quality support for French military personnel throughout the world.