Rural Surgery in Niger: A Multicentric Study in 21 District Hospitals

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Abstract The purpose of the study was to evaluate the qualitative aspect and global impact of surgery in a district hospital (DH) since the launching of the surgery at the district level. Surgical care was provided by general practitioners (GP) who received 12-month training in surgery, certified by a “Capacity of District Surgery” (CDS) diploma. It was a prospective study during 4 years from 2007 to 2010. Of the 34 DHs, only 21 were functional and included in this study. Most of the DHs had two or more CDS ($n=15$). The majority of the DHs had one nurse surgical aid ($n=16$) and one nurse anesthetist ($n=17$). The total number of surgical operations was 18,441 cases; emergency cases represented 51.8 % and elective surgery 48.2 %. Regarding emergency surgery, cesarean sections revealed the most common surgical procedure (37.21 %), followed by wound debridement (19.42 %). In elective surgery, hernia repair and hydrocelectomy were the most common surgical procedures (69.60 %), followed by gynecologic procedures in 12.74 % of the cases. The global complication rate was 4.34 %. The global mortality rate was 1.04 % ($n=192$), 102 deaths following cesarean section (2.87 %). No death was encountered in elective surgery. Nine hundred and fifty-five patients (5.17 %) were transferred to a higher-level facility of whom 598 patients (62.61 %) were admitted for fracture treatment. The concept of district surgery has proven to be an effective tool to counter skilled medical manpower shortage to perform emergency and elective basic surgery at the rural level and could be adopted by developing countries facing similar health challenges.

Keywords Rural surgery · District hospital · Rural health care · Rural Niger

Introduction

The problem of medically skilled human resources is the common denominator across all developing countries. The number of surgeons in the developing countries is significantly low. Some authors report that general practitioners (GP) handle 75 % of all surgical procedures in rural area; these nonspecialists, GP, and sometimes senior nurses received a special training to perform these specific tasks [1–4]. Niger, a low-income country, needs an alternative to solve this manpower issue. Mobile surgical camps were initiated since 1974; however, this policy was abandoned because of its high cost [2]. In 2004, the Ministry of Health (MOH) became involved in the regional development of district surgeons, in order to strengthen health systems and increase access to surgery in rural area. In consultation with the Faculty of Health Sciences of the University of Niamey, the MOH in 2005 developed a program to train GP in surgery, funded by a number of partners (Belgian Technical Cooperation, Italian Cooperation, the World Health Organization, and the World Bank). The certificate called “Capacity of District Surgery” (CDS) was created for students who were government physicians who finished 12 months of training. From 2006 to 2009, 67 district surgeons were formed and dispatched in the DHs. The aim of this study is to evaluate the global impact of surgery at the DHs and to include data such as the name and type of intervention; morbidity and mortality after these physicians were deployed at the end of their training in 21 functional DHs.

History of Rural Surgery in Niger

Surgery in the rural areas in Niger was launched in 1974 in order to respond to the high prevalence of hernias and

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hydroceles in the rural population. Before this period, surgery was only offered at the Niamey National Hospital and a few regional hospitals. Hernia and hydrocele represented over 40 % of cases of the patients requiring surgery in these structures [5], and approximately 80 % of patients were from rural areas [5, 6]. More than 72 % of the population lives in rural areas. In order to respond to the surgical needs of the population, the MOH instituted mobile surgical units led by surgeons and trained operating room nurses. Such traveling surgical camps have existed more than 25 years ever since their debut in 1974. Politically, the program of surgery in rural area received a great support from the state and created 34 DHs with operating rooms. During 1994 and 1995, a new initiative began to train 31 GP to become trained in emergency surgery. Of the 31 trained physicians, however, only six were able to carry out surgical activities in their DHs. Evaluation of this program concluded that several barriers contributed to this failure of more widespread surgical activities: (1) training was too short (3 months), (2) a lack of motivation on the part of the physicians, (3) lack of proper equipment in the DHs, and (4) the noninvolvement of faculty of medicine and technical partners. In 1998, under the direction of the MOH, the University of Niamey created two diplomas: the specialist diploma of general surgery, and the obstetrics and gynecology diploma. The diplomas are obtained only at the end of 5 years of study. The first graduation occurred in 2003 with three surgeons and four gynecologist-obstetricians. All of these practitioners, however, stayed in national and regional hospitals. Recognizing that a rate of 3 to 5 graduates per year would not be able to meet the needs of the 8 regional hospitals and 34 DHs, in addition to the question of whether graduates would accept a rural posting. In 2005, the MOH and the Faculty of Medicine developed a program to train GP in surgery. Based on lessons from the failure of the 1995 program, the Faculty of Medicine agreed to increase the number of trainees and to improve teaching methods. The certificate called “Capacity of District Surgery” was created for students who were government physicians who finished 12 months of training [2]. The diploma of district surgery also provided a bonus on their annual salary as additional incentive.

Patients and Methods

It was a prospective descriptive study during 4 years from 2007 to 2010. The inclusion criteria were all the DHs with a functional theatre room, an active surgical team with GP CDS, nurse anesthetist (NA) and nurse surgical aides (NSA), and practicing surgical activities. Exclusion criteria were DHs not equipped with a theatre room and those not having district surgeons. The survey concerned 21 functional DHs during supervisor visit. A questionnaire was administered directly to the operating team; analysis of the theater report book and the

direct observation were done. The data studied were the following:

- Functional theater rooms
- Surgical activities
- Supervision and difficulties encountered
- Direction of maternal health and reproduction (MOH) for global rate of maternal and neonatal mortality

Results

Among 34 DHs, only 21 were functional and included in this study. The number of CDS varied from 1 to 3. Most of DH had two or more CDS ($n=15$). The majority of the DHs had one NSA ($n=16$), one NA ($n=17$), and the number of midwives varied from 2 to 7 (Table 1). For emergency surgeries, cesarean sections were the most common surgical procedure and accounted for 37.21 %, followed by wound debridement in 19.42 % and 12.45 % for orthopedic treatment. Out of the 394 cases of uterine rupture, 16 hysterectomies were performed. Many traumatic lesions were associated with road traffic

Table 1 Human resources by DHs

Districts	CDS	NSA	NA	Midwives	Nurses
Aguié	2	1	1	3	1
Dakoro	2	1	1	3	3
Doutchi	3	2	2	3	6
Gaya	2	1	1	6	3
Gouré	2	1	1	4	2
Guidan Rounджи	2	2	1	3	2
Konni	1	2	2	7	2
Loga	2	1	1	3	1
Madaoua	1	1	1	4	2
Madarounfa	2	1	1	3	0
Magaria	2	2	1	6	5
Mainé-Soroa	2	1	1	3	1
Matameye	1	1	1	4	0
Mayahi	1	1	1	2	5
Mirriah	1	1	1	4	1
Ouallam	2	2	2	6	5
Say	2	1	1	6	6
Tanout	2	1	1	3	0
Tera	2	1	2	5	5
Tessaoua	1	1	1	4	3
Tillabéri	3	1	1	4	4
Total	38	26	24	86	57

NA nurse anesthetist

NSA nurse surgical aides

accidents and other causes (falling in a well or from a tree): fracture ($n=1098$), wound debridement ($n=1854$), splenic fracture ($n=15$), tendon rupture ($n=64/84$), and thoracic trauma ($n=11$). Globally, 3,042 lesions (31.86 %) were due to RTA (Table 2). In the orthopedic treatment group ($n=1098$), 598 (54.46 %) were transferred in high-level facilities for specialized treatment. In planned surgery, hernia repair and hydrocelectomy represented the most of surgical procedure (69.60 %), and 12.74 % for gynecologic procedure (ovarian cyst, uterine fibroma, and prolapses) (Table 3). In total, emergency represented 51.8 % ($n=9,548$) and elective surgery 48.2 % ($n=8,893$). The global complication rate was 4.34 % ($n=802$): parietal suppuration ($n=508$). The global mortality rate was 1.04 % ($n=192$). According to the pathologies, we noticed 102 deaths in cesarean section (2.87 %) and 65 deaths in peritonitis (8.55 %). No death was encountered in elective surgery.

There were 955 patients (5.17 %) transferred to a high-level facility of whom 598 patients (62.61 %) for fracture after a first management (plaster). One of the main causes of transfer was the absence of members of surgical team: CDS in 148 cases (15.49 %) and anesthetist in 100 cases (10.47 %). Equipment malfunction is also another cause (rupture of an oxygen tank or shortage of anesthetic drugs precluding further surgery) in 28 cases (2.93 %) and high-risk patients who would require specialized operative treatment in 81 cases

(8.48 %). The repartition of transferred patients: 436 cases (45.65 %) in 2007, 121 cases (12.67 %) in 2008, 319 cases (33.40 %) in 2009, and 79 cases (8.27 %) in 2010. In total, 96 supervisions were performed in the 21 DHs. The main difficulties encountered were insufficiency of formative supervision, no response about referred patient to regional hospital, and human resources repartition. Imaging, such as ultrasound, was not available; the only imaging modality was X-ray. The result of the infant mortality in rural area was 198 per 1,000 live births in 2005 and 114 in 2010. The maternal mortality rate was 882 deaths per 100,000 live births in 2005 and 590 in 2010 (information from MOH of Niger).

Commentary-Discussion

1. Human Resources

This human resource crisis, especially in surgical needs, prompted the MOH of Niger, in association with the faculty of medicine and the financial partners, to find a rapid and efficient solution. The main sections of this program were formation and equipping of the DHs. Skilled manpower for health care is a serious problem in developing countries. World Health Organization (WHO) reported that Africa contributes about 25 % of the world's burden of disease but possessed only 1.3 % of qualified health professional [1, 2]. The lack of human resources to perform surgery in sub-Saharan Africa is due to the brain drain to Europe and a shortage of teaching and training facilities adapted to the emergency surgery needs [3]. In Niger, basic emergency surgery is performed by physicians but other African countries have chosen to train non physicians to perform some emergency procedures like cesarean section and laparotomies (assistant medical officers) [7–9]. In Ethiopia, the program consists of training general practitioner in surgical skills for a period of 6 months [2, 10]. During this analysis, a problem of repartition of human resources was observed as two thirds of the DHs have two to three CDSs at one's disposal, number which permits to conveniently perform programmed surgical activities, but in other DHs only one CDS is available; in such circumstances, surgery will totally stop in case of its nonavailability. The deleterious effect of a lack of recuperation opportunity after guard duty is not considered. As a result, this situation should adamantly convince the authorities to enhance their support to this kind of training in order to obtain at least two CDSs per HD as well as a reinforcement of the surgical team in all the 34 DHs.

2. Surgical Activities

Emergency surgery was effective and included obstetrics, general surgery, and traumatology. Globally, emergency surgery represented 51.8 % and elective surgery

Table 2 Profile of the surgical emergencies treated in the 21 district hospitals

Profile	2007	2008	2009	2010	Total	%
Dystocia/cesarean sections	230	995	1,599	729	3,553	37.21%
Wound/debridement	479	540	664	171	1,854	19.42%
Orthopedic treatment for fracture (plaster)	155	338	469	136	1,098	11.50%
Uterine rupture (suture or hysterectomy)	44	110	169	71	394	4.13%
Ectopic pregnancy/cure	6	13	16	8	43	0.45%
Forceps	8	31	33	18	90	0.94%
Strangulate hernia/cure	59	107	168	31	365	3.82%
Peritonitis/laparotomy	82	271	310	173	836	8.75%
Bowel obstruction/laparotomy	16	30	48	11	105	1.10%
Splenic fracture/splenectomy	3	8	2	2	15	0.16%
Appendicitis/appendectomy	19	48	84	30	181	1.90%
Abscess debridement	110	242	362	134	848	8.88%
Tendon rupture/cure	5	34	41	4	84	0.88%
Others (skin abscess, vaginal trauma, and management of thoracic trauma)	5	26	43	8	82	0.86%
Total	1,221	2,793	4,008	1,526	9,548	100.00 %

Table 3 Type of pathologies of planned surgery in the 21 district hospitals

Pathologies	2007	2008	2009	2010	Total	%
Hydrocele	85	317	396	322	1,120	12.60 %
Inguinal and crural hernia	570	1,346	1,837	825	4,578	51.47 %
Umbilical hernia	18	147	243	83	491	5.52 %
Bladder stone	24	73	120	63	280	3.16 %
Lipoma	97	221	246	175	739	8.31 %
Ovarian cyst	117	229	269	159	774	8.70 %
Uterine fibroma	25	38	54	47	164	1.84 %
Uterine prolapsus	22	59	96	19	196	2.20 %
Others (ectopic testicle, circumcision...)	84	236	132	99	551	6.20 %
Total	1,042	2,666	3,393	1,792	8,893	100 %

48.2 %. In Denmark, Tottrup [11] found 26.84 % cases of emergency against 73.16 % of cases in elective surgery. Humber et al., in Canada, found respectively split of 81 % in elective and 19 % in emergency [12], but in Mozambique, the ratio was 70 % for emergency [9]. The higher percentage of emergent cases in Niger and in Mozambique suggests that the needs for these types of programs are even greater in sub-Saharan Africa. Obstetrical operations (cesarean section, treatment of uterine rupture, forceps) constitute the main surgical emergencies in 42.28 %, followed by wound debridement with 19.42 %, immobilization with plaster for fracture in 11.50 %, and laparotomy for peritonitis in 8.75 %. In a previous study [2], we reported that cesarean section with 70 % is first, seconded by peritonitis 9.2 %. Of note, in order to encourage access to basic surgical care, the government of Niger decreed that cesarean sections would be free (2005–316/PRN/MSP/LCE of November 2005). In Mozambique, where surgical interventions were performed by middle-level health workers, Vaz et al. [9] have reported curettage (26 %) as the most frequent procedure, followed by fractures immobilization, skin abscess drainage, and cesarean section. The outcome of cesarean section done by GP was compared to that of specialist, and this study noticed a similar low morbidity rate for both groups [13]; these GP have only 4 months training after their graduation. Some studies comparing clinical officers and doctors show minimal differences in outcomes to patients; use of substitute health workers is clearly another essential option for African countries [14]. Nearly one third of emergency were associated with trauma. However, no orthopedic operation but immobilization was recorded in this study. The CDS benefitted of the orthopedic training during the formation like external fixer for serious open fracture.

Elective surgery saw an exponential progress; it increased from 1,042 cases in 2007 to 3,393 cases in 2009. The most important components of this elective surgery were hernia

repair 57 % and hydrocele 12.60 %. In Niger, hernia repair is the most common gastrointestinal surgery; we previously reported hernia topping (80.8 %) and followed by hydrocele (13.3 %) in elective surgery in Niger [2,6]. Likewise in Mozambique, 32.19 % of the cases of hernia were found, followed by hydrocele with 14.56 %. All these results showed the important frequency of hernia and hydrocele in African rural area. In terms of morbidity and mortality in our study, we recorded 4.34 % of complications and 1.04 % of all operations carried. Vaz and al. [9] have found 3.67 % of complications ($n=377$) with 0.4 % of deceased ($n=31$). When comparing the outcome of patients operated for hernia in a DH and those operated in the teaching hospitals, no difference is noted, however, a lower cost was observed in the district. Patient operated in the DHs may not have to pay for transport to reach urban centers [15]. We found a progressive decreasing number of referral in our study, of which 45.65 % in 2007 to 8.27 % in 2010. The referrals to the regional hospital were mainly due to orthopedic in 62.61 % for fracture after a first management. Although these generalists are trained in the basic treatment and management of orthopedic fractures, the majority of these cases were referred to the regional hospital simply because of a lack of materials (external fixator, orthopedic bed for traction). During the analysis of the launching of rural surgery, it has been observed that trauma cases in particular were automatically referred to a higher level of treatment structure without any first care measure. The results of this first study have been submitted to the MOH which readily have started to deliver the required supplies to the DHs in order to treat fractures (the cases of immobilization by plaster were recorded in this study). Globally, we found the same problem in all 21 DHs. A best repartition of human resource and the maintenance of equipment are recommended because the other main causes of transfer were absent members of surgical team and equipment malfunction. In term of global impact, the development of rural surgery is one of the factors in reduction of maternal and infant mortality rate which drastically decreased from 2005 to 2010.

Conclusion

The proved efficacy of this program is mainly due to the involvement of the MOH, the financial and technical partners, and the faculty of medicine of Niamey. A similar framework could be replicated in other African countries which are similarly confronted with a shortage of staff. Most of the surgical procedures performed are basic operations. The progressive availability of orthopedic material has allowed some essential fracture treatment. What still has to be done is to render the other DHs functional, to improve the distribution of human resources by means of incentives, and to encourage this kind of training at university level.

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