

PAEDIATRIC SURGERY AND INTERNATIONAL COOPERATION: CASE STUDY AT MALINDI SUBCOUNTY HOSPITAL, KENYA

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Abstract

The present study analyses the characteristics and needs of surgical practice in the paediatric population of Malindi Subcounty Hospital, Kenya. The non-interventional observational retrospective study was conducted on 1019 patients from 0 to 18 years (including 29 new-borns) hospitalized from 1/3/2017 to 24/5/2019. The distribution of surgical diagnoses, the incidence of septic surgery (14.5%), the use of anesthesia (general 56%, spinal 28%, local / sedation 16%), the length of hospital stays (10.2 days on average, range 1-121 days), mortality (1.27%) and its causes were analysed. The study was integrated with a perspective narrative part carried out through interviews with the hospital staff regarding the referring system, the availability of surgical instruments, the hygienic conditions, the costs incurred by the patients, the hypothetical improvements. Our data highlight a profound connection between paediatric surgery and society, as many surgical indications are the earliest signs of poverty and bad habits. In addition, many accesses to the operating room are due to septic surgery. Too high a number of caesarean sections still emerge in adolescents, denouncing unwanted pregnancies and obsolete obstetric practices. The staff, in the interviews, demonstrates a good understanding of possible solutions. Africa needs sustainable development strategies: the health of children, including those suffering from surgical diseases, is one of the essential keys.

Il presente studio analizza le caratteristiche e le necessità della pratica chirurgica nella popolazione pediatrica del Malindi Subcounty Hospital, in Kenya. Lo studio, retrospettivo osservazionale non interventistico, è stato condotto su 1019 pazienti da 0 a 18 anni (di cui 29 neonati) ricoverati dal 1/3/2017 al 24/5/2019. Sono state analizzate la distribuzione delle diagnosi chirurgiche, l'incidenza di chirurgia settica (14,5%), l'utilizzo dell'anestesia (generale 56%, spinale 28%, locale/sedazione 16%), la durata delle degenze (10,2 giorni in media, range 1-121 giorni), la mortalità (1,27%) e le sue cause. Lo studio è stato integrato con una parte narrativa prospettica realizzata mediante interviste con lo staff dell'ospedale in merito al sistema di riferimento, alla disponibilità di strumentazione chirurgica, alle condizioni igieniche, ai costi sostenuti dai pazienti, ai miglioramenti ipotizzabili. I dati evidenziano una profonda connessione tra la chirurgia pediatrica e la società, in quanto molte indicazioni chirurgiche sono i primissimi segnali di povertà e di scorrette abitudini. In più, tanti accessi in sala operatoria sono dovuti a chirurgia settica. Emerge ancora un numero troppo alto di tagli cesarei in adolescenti, che denuncia gravidanze indesiderate e pratiche ostetriche obsolete. Lo staff, nelle interviste, dimostra una buona comprensione delle possibili soluzioni. L'Africa necessita di strategie di sviluppo sostenibili: la salute dei bambini anche di quelli affetti da patologie chirurgiche ne è una delle chiavi essenziali.

Keywords

Paediatric Surgery, Kenya, Students' cooperation, International cooperation

Introduction

Africa has a large burden of unmet surgical needs in children (Lawal 2019); Eastern Africa counts on only one paediatric surgeon every 7.000.000 inhabitants (Derbew 2019), 39% of them < 14 years of age (World Factbook Website), entailing a ratio of 1 paediatric surgeon every 2.700.000 children, while in Europe there is 1 paediatric surgeon every 26.000 children < 14 years of age (Parigi 2018), a density more than a hundred times higher. Demographic and epidemiological studies on paediatric surgical needs in Africa are awfully scanty as well: out of the 33.602 quotes in Medline of the keyword “paediatric surgery”, just 354 (0,01 %) are linked also with the keyword “Africa” (Medline website).

There is therefore a strong need to fill this unbearable gap, also with epidemiological studies within limited reach: this observation prompted us to carry on an analysis of the paediatric surgical activities at the Malindi Subcounty Hospital (Msh), in Kenya. *Primary endpoint* of the study will therefore be a detailed quantification of the pediatric surgical pathologies observed, together with treatment adopted and results achieved; *secondary endpoint* the analysis of some ancillary aspects in the description of pediatric surgical problems in Malindi and the formulation of a set of recommendations for the planning of future cooperation projects in this field.

Materials and methods

Msh is located in the former Coast province of Kenya, today in Kilifi county, having an area of 12.245 Km² and a population of 1.453.787 inhabitants (website), 567.000 of them (39%) below 14 years of age. Its catchment area includes the communities of Malindi, Watamu, Marereni, Balala, Chakama, Garsen, Marafa, Kijanaheri, Langobaya, Sabaki. The hospital has 230 beds, of which 44 + 8 cots in the Paediatric Ward (PW). Hospital employees are 300 in total, of whom 9 are specialised doctors and 16 general medical doctors.

Primary endpoint was studied through a retrospective cross-sectional non-interventional study on pediatric surgical activities at Msh from 1/3/2017 to 24/5/2019. Enrolled in the study were all patients admitted in PW (≤ 12 years of age) with a surgical diagnosis – both those undergoing surgery and those treated conservatively - and all patients 13 to 18 years of age undergoing surgery. Data were collected from clinical reports from Operating room (OR) and PW; they included sex, age, diagnosis, emergency/cold case, date of the operation, procedure performed, category (major/minor), specialty surgery group (general surgery, Ear Nose and Throat –Ent –, Obstetrics and Gynaecology – O&G -, etc.), type of anesthesia, incidence of postoperative sepsis, length of stay (Los), postoperative conditions, final outcome. Due to the lack of a uniform method of

diagnosis codification and registration, all diverse ways adopted to formulate diagnoses were standardized according to the ICD-10-CM classification, 2016 version.

Secondary endpoint was analysed through interviews with the hospital staff on actual status and possible improvements about: 1) How the referring system works and which pathologies cannot be treated in Malindi; 2) Availability of surgical instruments and hygiene conditions in the OR; 3) Anesthesia issues; 4) Costs to be paid by surgical patients.

Due to the typical qualitative value of the narrative prospective study devoted to the secondary endpoint, not attributable to numerical or tabular evaluations, what gathered from the interviews will be summarized directly in the Discussion.

Results

In total 1019 patients were enrolled: 859 from the PW (≤ 12 years), 231 operated upon (26,9%) and 628 treated conservatively (73,1%), and 160 from the OR (13 to 18 years), all of them by definition undergoing surgery. Age range went therefore from birth to 18 years, with an average of 6,3 years

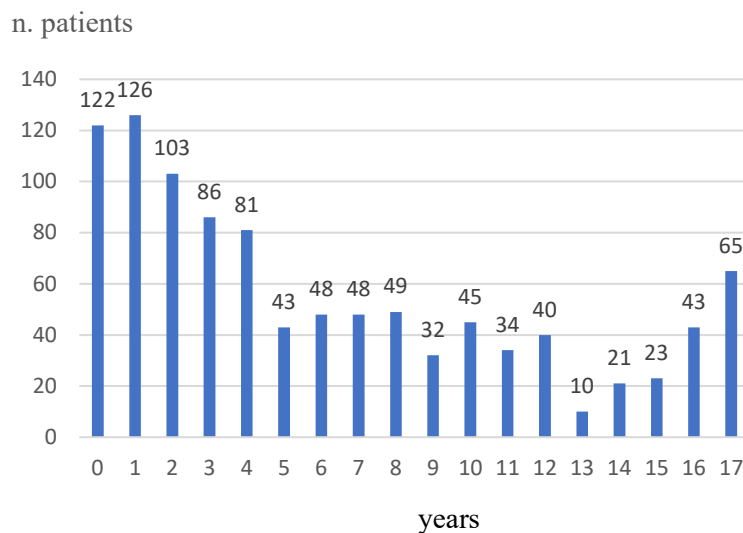


Fig. 1. Study population age distribution

(5,1 M; 7,6 F); out of the 122 patients below 1 year of age, 29 were neonates. Age distribution of the study population is presented in fig. 1.

In the age group ≤ 12 years M:F ratio is 2:1, while in the age group 13 to 18 years M:F ratio is 1:4,6. This difference can be easily explained with the high number of O&G procedures needed in female age group (tab. 1).

| Age | M | F | not registered | Total |
|-------------------|------------|------------|----------------|-------------|
| 0 days to 1 month | 13 | 16 | | 29 |
| 1 month to 1 year | 60 | 32 | 1 | 93 |
| 1 to 12 years | 488 | 246 | 3 | 737 |
| 13 to 18 years | 37 | 123 | | 160 |
| Total | 598 | 417 | 4 | 1019 |

Tab. 1. Study population sex stratified by age

13 out of the 1019 patients died (see later); 13 (1,3%) were discharged upon request during treatment; 27 (2,6%) were referred to other hospitals; 799 (78,4%) had a successful recovery, while for the remainder no data are recorded.

Indications for surgery

231 children ≤ 12 years underwent surgery (157 M, 74 F), the 6,7% of the 3.440 operations performed in total during the studied period. Of these, 143 were major procedures (61,9%), 88 minor (38,1%); 126 cold cases (54,5%), 105 emergency cases (45,5%); breakdown of surgical procedures performed is presented in tab. 2. Under “miscellaneous” are listed, among others: Injury of urinary and pelvic organs, Urethral stricture, Child abuse, Fistulae involving female genital tract, Myositis, Pilonidal cyst and sinus, Polyps of female genital tract; of particular interest are the bleeding problems secondary to traditional uvulectomy, especially in children < 3 years. 7 of the 231 patients were infants from 2 to 11 months of age, operated for abscess drainage (4 cases), post uvulectomy bleeding, phimosis and inguinal hernia. No intraoperative deaths were recorded.

| Operation type | # |
|---|----|
| Adenotonsillectomy | 38 |
| Traumatic cut wound suture | 30 |
| Herniotomy and hydrocelectomy | 29 |
| Ingested foreign bodies removal | 20 |
| Fracture surgical fixation | 19 |
| Abscess incision and drainage | 16 |
| Orchidopexis | 10 |
| Thoracic drainage (pleural effusion and pneumothorax) | 10 |

| | |
|---|------------|
| Circumcision | 9 |
| Pyogenic arthritis drainage | 8 |
| Appendectomy | 6 |
| Neoplasms (benign and malignant) biopsy/removal | 6 |
| Hypospadias correction | 4 |
| Explorative laparotomy for intestinal obstruction | 3 |
| miscellaneous | 23 |
| TOTAL | 231 |

Tab. 2. Surgical indications in patients ≤ 12 years

628 children ≤ 12 years of age admitted in the PW with a surgical diagnosis were treated conservatively, either because no slot available in the OR, or because of too many patients or no surgeon available or too long waiting list; conservative treatment was also adopted as a temporary measure while waiting for a referral in a third level centre for particularly complex surgical pathologies (27 cases). Breakdown of surgical specialty groups treated conservatively is presented in fig. 2.

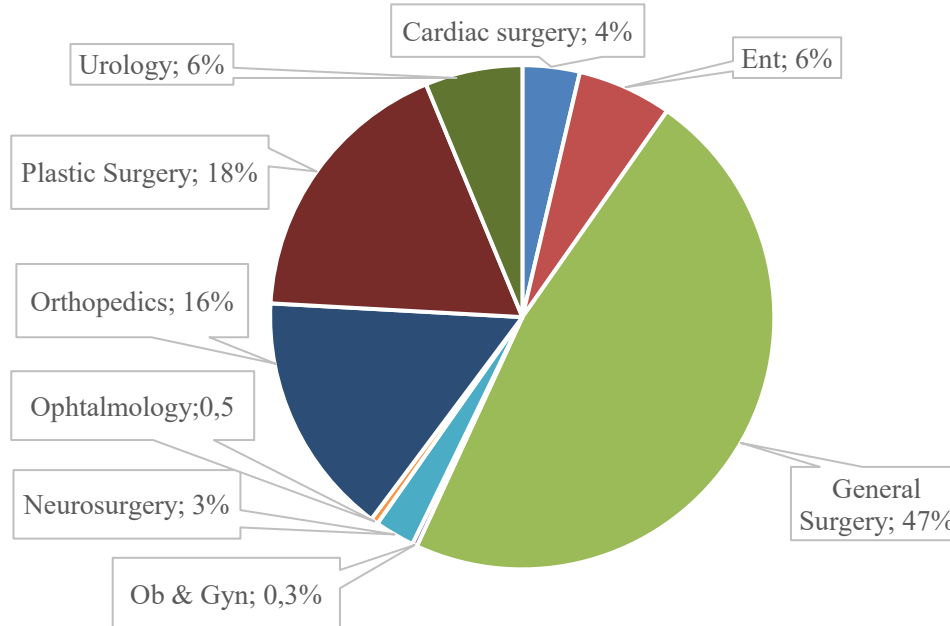


Fig. 2. Conservative treatment in patients ≤ 12 years of age per specialty group

“General Surgery” group includes, in decreasing frequency order: abscesses, other local infections of skin and subcutaneous tissue, hydrocele, inguinal hernia, injury of unspecified body region, paralytic ileus and intestinal obstruction without hernia, superficial injury of head, toxic effect of contact with venomous animals.

“Plastic surgery” group refers exclusively to burns, an accident related to the presence of an open fire in every hut, usually in the middle of it.

“Cardiac surgery” group applies to children with non-specified cardiac pathologies, usually admitted to the PW with a congestive heart failure, diagnosed through chest X-Ray or simple clinical evaluation, treated in acute condition but afterwards suggested to refer to Nairobi to get proper surgery, not having Msh a paediatric cardiologist, let alone a cardiac surgeon. Unfortunately, this suggestion is usually disregarded due to the unbearable involved costs.

Other specialties involved in the daily routine of conservative treatment are: orthopaedics (fracture of femur, pyogenic arthritis); urology (undescended testis); Ent (stomatitis and related lesions, foreign body in alimentary tract, chronic diseases of tonsils and adenoids); ophthalmology (chalazion, anophtalmos, disorders of the globe).

In the 160 patients 13-18 years of age operated upon (37 M, 123 F), emergency operations are by far more common than cold cases (134 vs 26; 83,7% vs 16,3%), as well as Major vs Minor operations (118 vs 42; 73,7% vs 26,3%). Actually, in this age group the most represented operation is caesarean section (C-section - 77 cases equal to 62,6% of the total). More in detail, 5 of these girls were 14 years old, 8 of 15, 21 of 16 and 43 of 17. One girl aged 15 died during the procedure. Out of the 123 female patients, 106 (86,2%) entered OR with an O&G indication (fig. 3).

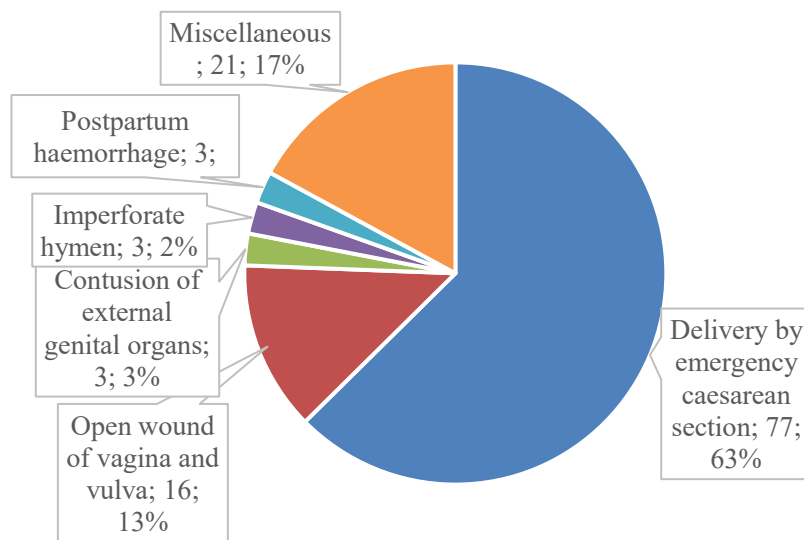


Fig. 3. Female patients 13-18 years: indications for surgery

Summing up all data related to the 391 children 0-18 years of age operated upon, it becomes possible to quantify the relative need of each surgical specialty, stratifying the differences among patients in terms of age groups and sex.

Operations performed in males from 0 to 18 years belong to General Surgery in more than half of cases (mainly inguinal hernia, hydrocele, acute appendicitis), then to Ent (mainly

adenotonsillectomy and removal of foreign body in the alimentary tract – being kids rarely under supervision, it is rather common to find coins or other objects in their oesophagus), to Urology (undescended testis, disorders of prepuce, hypospadias) and to Orthopaedics (traumatic fractures and pyogenic arthritis).

On the other hand, in females 0 to 18 years old a huge part of surgical indications is represented by O&G issues, mainly emergency C-sections. Another 13% of the surgical indications in this group is due to an open wound of vagina and vulva: it is uncommon to have a specified cause on the clinical chart, but one main option is sexual abuse. General surgery indications do not exceed 17% (abscess incision and drainage) and equal those of Ent (mainly adenotonsillectomy). Orthopaedics issues (pyogenic arthritis and traumatic fractures) are the least common problem; in particular, fractures in females are half of those in males, because girls are encouraged to stay at home helping mums in housework, while boys more commonly go out either to play or to do small jobs. Older boys drive motorbikes with no helmet, no licence and unclear traffic laws. Fig. 4 and 5 emphasise the differences among boys' and girls' surgical indications.

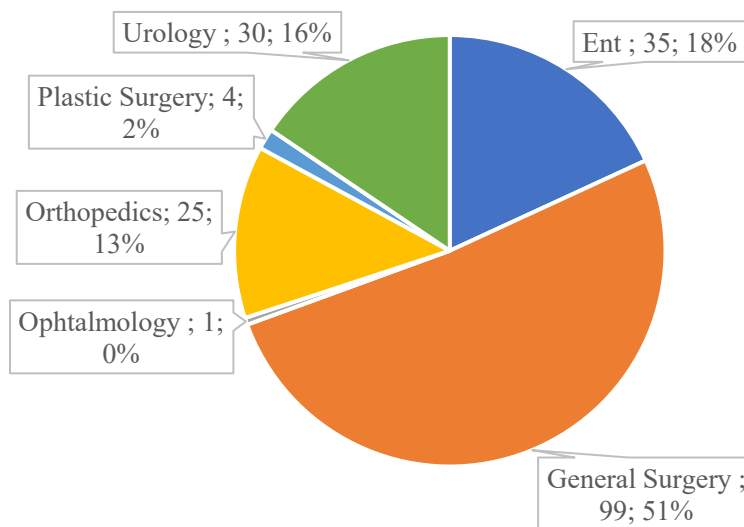


Fig. 4. Male population 0-18 years. Indications per surgical specialty group

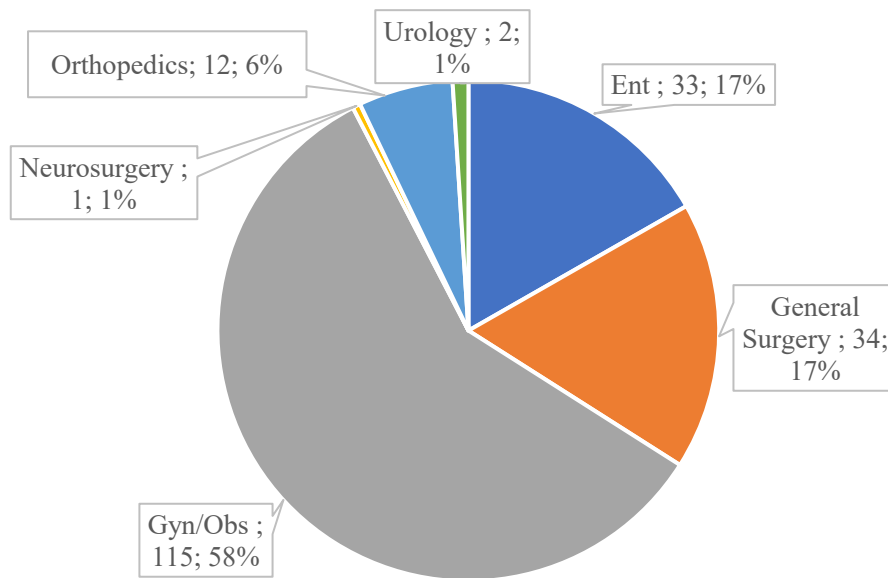


Fig. 5. Female population 0-18 years. Indications per surgical specialty group.

Septic surgery

Out of the 391 operations studied, 57 (14,5%) recognised a septic indication, with a major role of abscess incision and drainage. Other common septic surgery turned out to be preputial strictures following repeated local infections and needing a circumcision; drainage of pleural effusion (not better specified); drainage of pyogenic arthritis.

Anesthesia issues

In Msh available types of anesthesia are: General anesthesia (GA), Epidural and Spinal Anesthesia (SA), Local Anesthesia (LA) and sedation. GA is performed through ketamine, diazepam and muscle relaxation drugs; intubation is indicated for all surgeries above the waist and for all children ≤ 12 . Fig. 6 gives details on the utilisation of the various types of anesthesia.

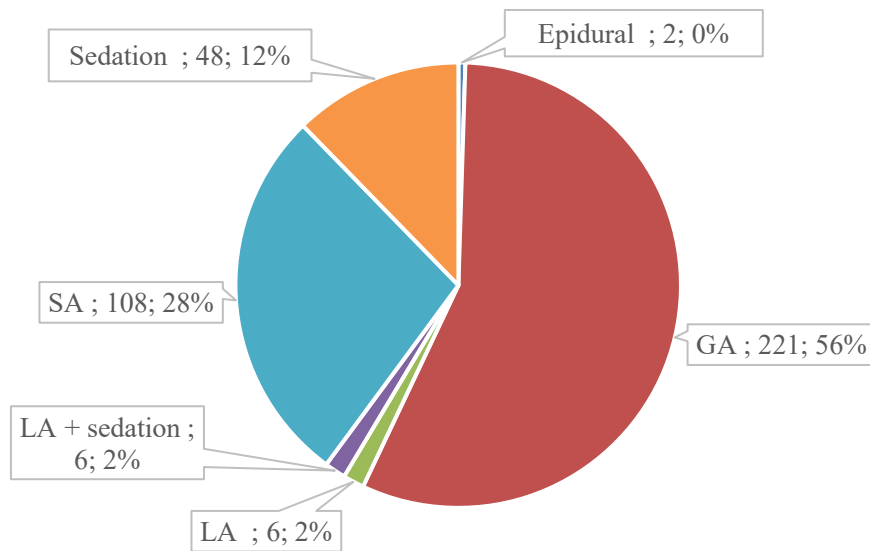


Fig. 6. Types of anesthesia utilized

Fig. 7 gives details on the type of anesthesia utilized according to the surgical intervention (major/minor). On a total of 391 operations, including 263 major and 128 minor procedures, GA is used 221 times, turning out to be the most used type of anesthesia in any kind of surgery. Spinal anesthesia is the second most used anesthesia for major procedures, while sedation is the second most used technique in minor procedures.

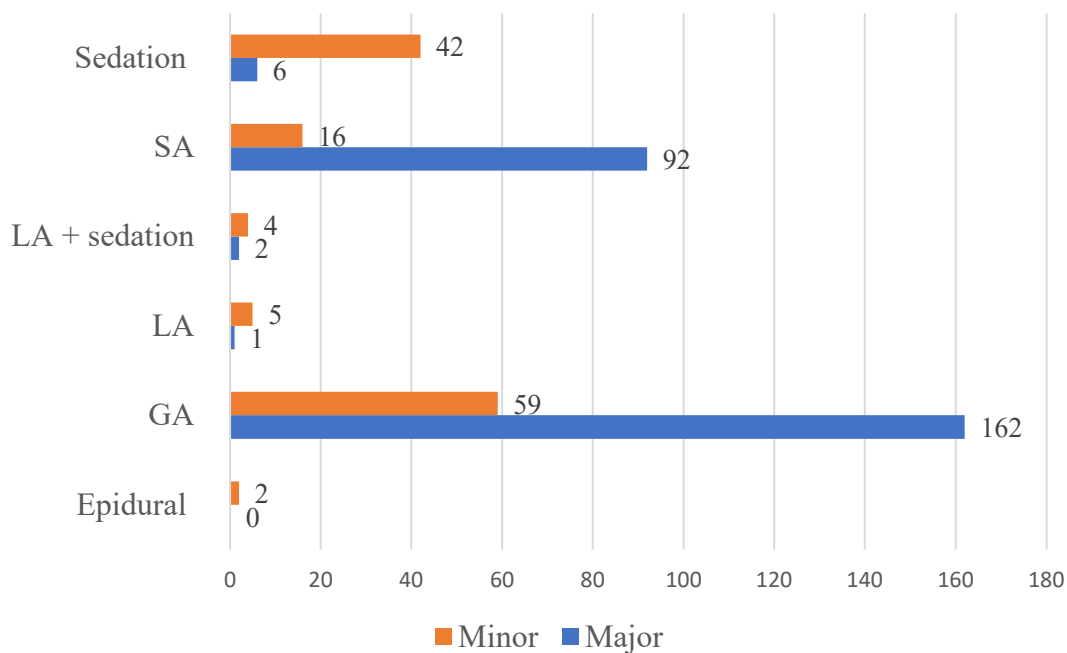


Fig. 7. Types of anesthesia utilised according to the surgical intervention.

On a total of 239 Emergency procedures (60,8% of the total number of operations performed), 145 are targeted as major and 94 as minor. Overall GA is the most applied type of anesthesia, while considering only major emergency procedures the most utilized becomes SA (75 cases), strictly followed by GA (63). Conversely, among the minor emergency procedures, GA is the most used, with a noticeable number of cases managed through sedation.

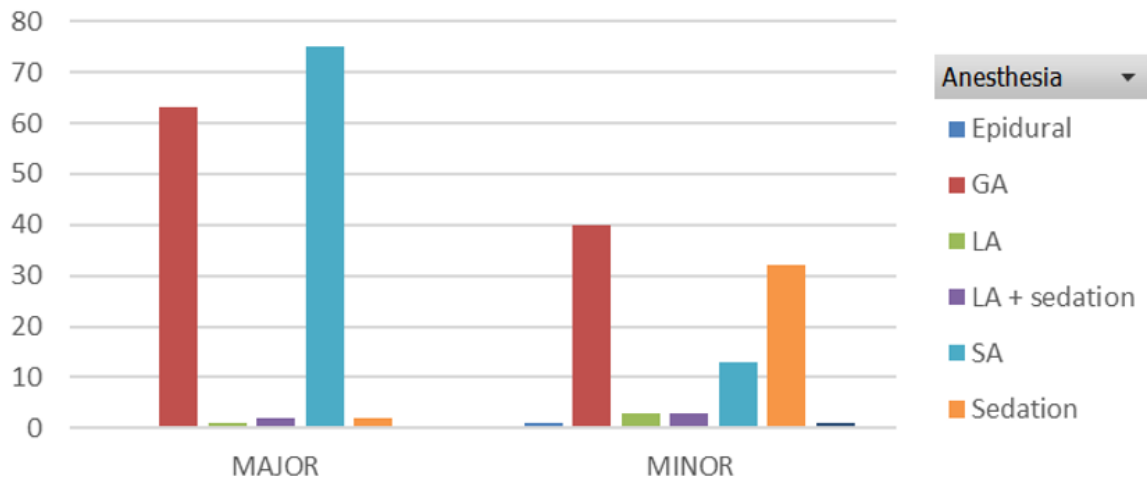


Fig. 8. Types of anesthesia utilised in Emergency procedures

On a total of 145 elective procedures, 115 are targeted as major and 30 as minor; GA is the most used anesthesia in both groups (112 cases - fig. 9).

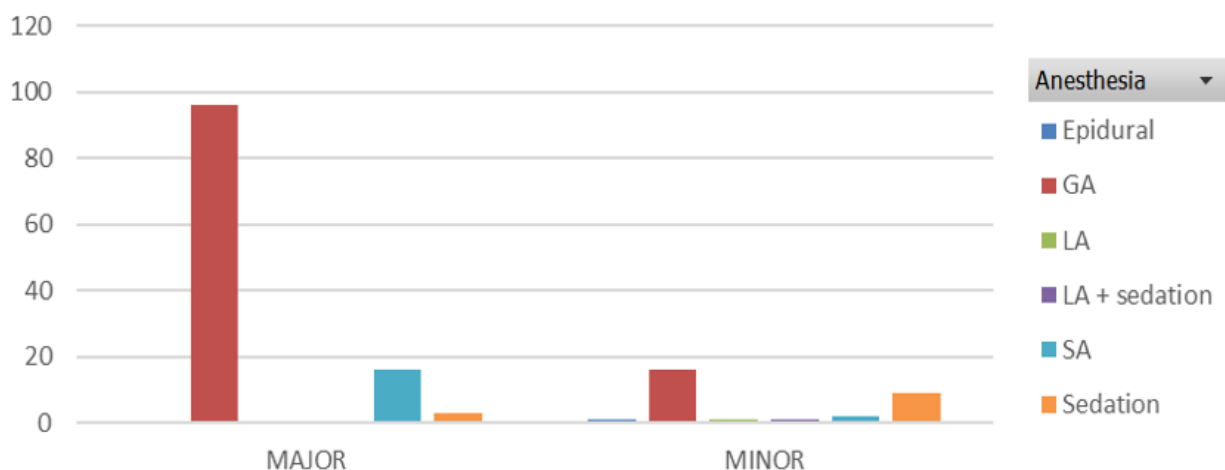


Fig. 9. Types of anesthesia utilised in elective surgery.

Length of hospital stay

The hospitalization length in the study period ranges from a minimum of 1 day to a maximum of 121 days (tab.3). The longest hospital stays are required for patients with severe burns, but also for orthopaedic issues. On top of that, patients often occupy a bed while waiting for the surgery to be done or while doing physiotherapy after it.

| Type of treatment | Ent | General Surgery | O&G | Orthopaedics | Plastic surgery | Urology | Average |
|----------------------------|------------|-----------------|----------|--------------|-----------------|------------|-------------|
| Surgical treatment - Major | 3,6 | 7 | 6 | 16,9 | - | 12,7 | 9,1 |
| Surgical treatment - Minor | 2,2 | 12,7 | 1,5 | 34,3 | 6 | 11,7 | 10,1 |
| Conservative treatment | 6,4 | 6,9 | - | 14,3 | 17,2 | 6,5 | 10,3 |
| Average | 4,5 | 7,4 | 3 | 15,6 | 17,1 | 7,8 | 10,2 |

Tab. 3. Average Length of Stay (Los) expressed in days.

Mortality incidence and causes

13 patients died during the studied period (1,3% of the total study population). Among these, 12 were patients treated conservatively (2 new-borns and 10 ≤12 years); the only death related to surgery is the 15 years old girl died in the OR due to C-section complications.

One of the two new-borns died less than one day after admission with a diagnosis of “Injury of unspecified body region”, while the second one died after 31 days of admission with a diagnosis of “Retention of urine”. There is no clue on the medical chart about whether this patient was taken to the OR or not, but probably not, according to the Msh habit not to anesthetize new-borns.

Among the patients ≤12 years, 4 died one day after admission with the diagnosis of: “Cutaneous abscess, foruncle and carbuncle”, “Open wound of head”, “Paralytic ileus and intestinal obstruction without hernia”, “Undescended and ectopic testicle”. One patient died after 6 days for “Complications and ill-defined descriptions of heart disease”, another one after 17 days for “Heart failure”. Other children passed away with the diagnoses of: “Crush injury and traumatic amputation of abdomen, low back, pelvis, and external genitals”, “Mastoiditis and related conditions”, “Other diseases of biliary tract”. There are no details on the chart about whether surgery was performed or not on these patients.

Discussion

Our study emphasizes once more the “*large burden of unmet surgical needs in African children*” (Lawal 2019): actually, data presented allow to calculate for Msh catchment area one surgical operation performed every 1206 children 0-18 years, while in Europe this ratio is one operation every 111 children 0-14 years (Parigi, 2018), much more than ten times higher considering the difference in age span. While children 0-14 years represent a bit less than 50% of the total Kenyan population, paediatric surgical operations in Msh account for less than 7% of the total, thus sadly supporting the aforementioned statement.

The lack of paediatric surgical services is highlighted also by the high number of children (73,1% of the total) with a surgical diagnosis but not operated upon because of structural restraints, mainly due to overwhelming workload on staff and services. Rather scanty, on the other hand, the number of referrals to third level centres for complex surgical procedures not amenable to be treated at Msh (3,1% of the total).

One of the main problems encountered in the primary endpoint study has been the lack of a uniform codification method for the diagnoses observed and for the surgical procedures performed at Msh, variously defined both in English or Swahili, sometimes with different terms for the same pathology and procedure. Needless to say, this situation hinders any attempt at a quantitative metric evaluation of the performances achieved. Reformulation of diagnoses and procedures according to the ICD-10-CM standard has therefore represented both an obstacle for the study and an opportunity offered to the hospital staff to durably adopt the system.

As far as diagnostic breakdown is concerned, particularly worrying is the far too high number of pregnancies in adolescent girls, often needing a C-section potentially dangerous, raising some hot questions: why in Kenyan society is so widely accepted such an early pregnancy? Why these girls are frequently not even married – so that they are no guaranteed about the new-born’s paternity? How common is sexual abuse inside the family, as denounced by the rather high number of open wounds to vulva and vagina? On the other hand, why is a C-section needed in such young mothers, considering that literature (Entringer 2018) shows a heavy risk increase related to the use of surgery instead of natural delivery?

Going outside the O&G sphere, this study likewise highlights the deep connection between paediatric surgical pathologies and society. Indications that led to surgical treatment are the very first signs of wrong habits, cruel traditions, poverty. This is the case of the high number of burns in children, in average age 2,5 years old, due to the habit of keeping burning an open fire in the middle of each hut (18% out of the 628 patients ≤ 12 years old with a surgical diagnosis treated

conservatively, i.e. 113 cases), or of the high number of septic cases (14,8% of the ≤ 12 years patients), due to the very poor hygienic conditions where children are grown up.

The majority of people in Malindi region have few or wrong ideas about hygiene rules, and some educational campaigns would be needed. Some of the problems relate also to poor access to water or to the presence of contaminated water in many rural regions, some others relate to traditional cultural habits (for example: overcovering children with multiple layers of cloth, even with warm temperatures, putting herbs on open wounds, cutting the skin all around a snake bite). All this explains why, when an injury occurs, the first aid may not be the right one.

The problem of social factors heavily compounding clinical ones is further emphasized by the data recorded about Los, showing a value some five-fold the one recorded in Western hospitals (Papandria, 2018). This difference can be easily justified by the long distances between home and hospital with related transport difficulties and costs, leading often parents to prefer to pay more days of admission than to travel back home and return later; patients' mums sleep in the garden of the hospital. In addition, there are no laparoscopic surgery options, so that everything is done via open surgery, thus increasing the postoperative days needed to recover.

Analysing eventually mortality data, it is encouraging to observe as there is only one case of perioperative death, because of a complication during a C-section. A common feature of many of the remainder mortality cases is the lack of a conclusive diagnosis, just suggesting underlying complex pathologies beyond the diagnostic possibilities of Msh, even more so the possibilities of a therapy.

Discussing now the secondary endpoint of our study, aiming to analyse from a broader perspective the problem of paediatric surgical pathology in Malindi region and to formulate some possible recommendations, we can conclude that Msh staff - facing daily this heavy burden of paediatric surgical cases - shows a clear understanding of the possible solutions, according to the interviews gathered in the framework of this study matched with the factual results recorded.

More specialised surgeons, e.g. paediatric surgeons, are badly needed, since children are operated by general surgeons, while some of the most serious cases must be referred elsewhere. There is a great need for specialised medical education in the whole sub-Saharan Africa: according to Derbew (2019), there are now in Kenya just only 17 paediatric surgeons. Half of Kenyan population being in paediatric age, the lack of paediatric surgeons needs surely to be tackled.

More specialised equipment is needed as well: basic instruments, such as clamps, surgical sutures and abdominal retractors are available, but quality wise there is ample room for improvement. Instrumentation handling is also matter of concern: technical problems are common, for example the ones with electrocautery or suction, often malfunctioning if not fully out of order; air

conditioning failure sometimes forces the surgeons to operate in tropical temperature, and so on. More sophisticated equipment is lacking, and instruments fit for adults cannot be adapted to suit paediatric patients, such e.g. a paediatric cystoscopic instrumentation, unavailable in all hospital of the Kenyan coast. On the other hand, top level equipment such a CT scan is available, but not specialised hospital staff able to use it; the instrument is available only for the patients who can afford to pay out of pocket a doctor and a technician trained in its use.

Neither day surgery nor laparoscopic surgery is provided in Msh, because of lack of proper equipment and appropriate training: this forces the surgeons to perform only open surgery, entailing more prolonged Los as well.

Sterility inside the OR can be much improved, even if there are some good habits. Everything is sterilized in autoclave; sterile cotton fabric is used in order to create the operatory space over the patient. There is no air filter, so that it is very common to find flies in the OR, flying and touching patient and instruments. Contacts between staff outside and inside the sterile area are also frequent. Some basic rules are respected (for example, not to touch anything else except patient and instruments while operating), but they are not enough to guarantee sterility. It would be also a great enhancement to provide functional soap dispensers for the sinks outside the OR: at the moment, surgeons touch with the hands soap bottles while scrubbing, making the scrubbing itself less effective. Moreover, almost once every week there is shortage of water, making all the scrubbing procedures even more difficult.

Surgeons working in Msh regularly complain that anaesthesia issues are totally covered by nurses, who often lack the proper training, resulting in a reduction of technical choices for the patients. In other words, nurses are confident with a limited number of anesthesia techniques: as a consequence, patients can be refused from the OR because the anaesthetist does not know how to deal with them, particularly in the case of new-borns or infants. The extensive use of GA, even in minor procedures, suggests that the complaints of Malindi surgeons are well supported by evidence. In fact, some choice in the possible types of anesthesia should be introduced, especially considering that literature agrees that an extensive use of GA, also for minor operations in which an alternative technique could be adopted, gives no advantages but more risks for the paediatric patient (Serafini 2005).

Last but not least, another heavy obstacle to a proper delivery of paediatric surgical care is the financial burden that families must afford to deal with a pathology affecting their children. Those <5 years old receive free healthcare, while for the others it is not possible to know in advance the overall cost of admission, not even for elective surgery, and this often forces the parents to give up to require an admission to the hospital if not in extreme conditions, when it is possibly too late to receive an effective treatment (6 of the 13 recorded deaths happened within the first day of

admission). A sustainable development strategy in this area is therefore badly needed and may lead to a great impact on economic growth, also in a Country investing just 169 \$ per capita per year in health (WHO website). Children's health is a “collective good”, leading to a healthy society and improving the wellbeing of everyone: it must therefore have the paramount consideration it duly deserves.



During my stage at Msh I spent most of my time in the OR, but I used also to check particular cases in the paediatric ward, to make sure that we were doing the best that we could. That day, while I was visiting a kid with ascites, this woman helped me with the translation swahili-english. Then she asked: «Can you visit also my child?»

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