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ORIGINAL SCIENTIFIC REPORT

The Usefulness of International Cooperation in the Repair of Inguinal Hernias in Sub-Saharan Africa

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Abstract

Introduction The burden of disease and mortality associated with inguinal hernia in Africa, especially in sub-Saharan Africa, is very high. The purpose of this study is to show that International Cooperation work in the field of hernia repair is effective; it minimizes the delay in hernia repairs in the targeted population, and can prevent a large number of disability-adjusted life years (DALYs).

Materials and methods As a part of an International Cooperation program, a total of 990 black patients with inguinal hernias were studied, in whom hernioplasty was performed using polypropylene mesh. The type of hernia and surgical technique were studied. Indicators of scientific and technical quality, indicators of efficiency and of effectiveness were analyzed. The results on the usefulness of interventions were calculated as avoided DALYs.

Results Surgery was performed on 926 patients with a total of 1033 hernia repairs. 87.2 % of the repairs were made with mesh. There was no mortality in the series, complications were minor, and 85.7 % of patients remained less than 24 h in the center. There was a 2.8 % of recurrence, with a follow-up 58.7 % of the patients in the first year. 5014 DALYs were avoided, and the average of the avoided DALYs per patient was of 5.41.

Conclusions Hernia repair with mesh in low development countries is a procedure with low morbidity and high effectiveness that can prevent a large number of DALYs.

Introduction

Although millions of inguinal hernias are repaired annually in the world, little is known about the epidemiology of this common surgical condition in resource-poor environments. In sub-Saharan Africa, there are data indicating a prevalence of between 7.7 and 30 % [1, 2]. The special conditions of work in Africa, mostly with physical exertion, favor the development of this pathology [3, 4].

Moreover, European and African hernias are substantially different. The Plymouth Hernia Service Group has compared the African and European inguinal hernias often highlighting African hernias are large and longstanding, and thus entail associated increased morbidity [5]. Besides, the presentation is also different. The few published studies [6–10] report that a large proportion of adults present with inguinal hernias as

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emergencies, and therefore, a lot more emergency hernia repairs are performed (25–65 %) In Niger, authors have reported a mortality rate of 40 % under these conditions, even in patients with access to surgical care [11].

In the USA, the rate of hernia repair in 2003 was 275 per 100,000 habitants/year [12]. In England and Sweden, these figures are lower [13], 100 and 180, respectively, per 100,000. By comparison, in a sub-Saharan African hospital, only 30 per 100,000 inhabitants/year of inguinal hernias are repaired [14]. Beard states that 683,904 adults suffer from symptomatic inguinal hernia in Tanzania, and each year, 31,197 new cases are presented and that the rate of repair over a period of 10 years will be of about 995,874 hernias [15].

Hernia repair in Africa is not a simple problem. Most African studies indicate that the hernia repair technique most commonly used throughout the continent has been Bassini's and other non-prosthetic techniques [7–9, 16–18]. Although there is sufficient evidence that the Bassini technique does not meet the requirements of satisfactory surgery [19, 20], it remains the standard in Africa [8, 17, 21–23]. However, these hernia repair techniques with prosthetic materials are not available for routine use in Africa [20, 24], because it is considered that they are expensive and therefore unprofitable. Two recent publications by Burkina Faso [24] and Ghana [25] documented using nylon mosquito nets as an alternative to costly commercial mesh. Kingsnorth et al. analyzed hernia repairs in Ghana made with mosquito nets from the perspective of the cost-effectiveness of the procedure [26].

Furthermore, having an inguinal hernia will mean a disability that will result in a loss of health. In a study conducted in Ghana, over 63 % of patients presenting for elective repair reported limitations in professional activity, indicating the extent of the morbidity of inguinal hernia in this population [27]. This loss of health can be quantified calculating the disability-adjusted life years (DALYs). (A DALY represents the loss of the equivalent of 1 year's overall health.) Hernia repair can prevent a large number of DALYs. There are many studies that address hernia repair from this perspective.

The aim of this study is to evaluate the usefulness of international cooperation in the field of hernia repairs in less developed countries and to try to demonstrate that in addition to minimizing the delay in hernia repairs, its inhabitants can avoid a large number of DALY.

Patients and methods

A total of 990 black patients with inguinal hernia were studied as part of an International Collaboration Project for the Spanish NGO (Non-Governmental Organization) called "Solidarity Surgery," between the years 2005 and 2013 in Bengbis (Cameroon) and Kafana (Mali).

The surgical team was made up of skilled healthcare personnel; surgeons (four), anesthetists (two), and nurses (three). Work was performed in a non-hospital setting in units that were specially prepared as operational areas. Drinkable rainwater was used, the supply of power came from two generators, and surgical instruments were chemically sterilized (EZ + T INSTRUNET Perasafe) or by autoclaving (Reverberi. New Matika). The average working temperature was of above 32 °C with a relative humidity of over 90 %.

Preoperative studies included cardiopulmonary auscultation, temperature control, blood pressure, and blood sugar (glucometer). Informed consent was verbally requested through the use of translators.

Of the 990 patients studied, 64 were excluded for the following reasons: children who had acute infectious diseases (12), patients with very small hernias (26), patients affected by an acute outbreak of malaria (25), or those who, due to lack of time or material, could not be included (1).

The classification of the European Hernia Surgery (EHS) [28] was used to classify the type of hernia, and hernia size was assessed based on the Kingsnorth and Sanders classification with Ghanaian modifications [29].

The management of patients included

Preoperative:

- Cardiopulmonary auscultation, temperature control, blood pressure, and blood sugar (glucometer).
- Informed consent.
- Shaving and washing of the operative field with povidone iodine.
- Antibiotic prophylaxis in all patients with amoxicillin–clavulanic 2 g iv.

Intraoperative:

- Prophylaxis of nausea and vomiting with 10 mg of metoclopramide.
- Crystalloid administration (maximum 1000 cc).
- Spinal anesthesia in L2–L3–L4 or L3 using 25G–26G needles filled with 10 mg of bupivacaine hydrochloride, 20 pg of fentanyl, and 0.15 mg of morphine, or local anesthesia using bupivacaine hydrochloride. The exclusion criteria for local or spinal anesthesia were age <5 years, infection of the groin, and/or a malaria outbreak.
- Monitoring of oxygen saturation, blood pressure, and pulse.

Postoperative:

- Perfusion was discontinued at the end of the intervention, and venous access was withdrawn 12–24 h later (in the absence of complications).

- For postoperative IV analgesics, metamizole and paracetamol were used in the first 24 h and then oral metamizole and 600 mg ibuprofen. The evaluation of postoperative pain was performed using a visual analog scale at 4, 6, 12, and 24 h after surgery.
- Discharge was given in the next 12–24 h.

Surgical technique:

- Hernioplasty was performed using a polypropylene mesh, which was limited in some cases by the availability of material. The repair without mesh was mainly performed on children or in cases where there was a lack of prosthetic material.
- In 52.9 % of hernia repairs performed (490 patients), the attendee was a local doctor tutored by a senior surgeon.

Follow-up:

- Patients were given an appointment at discharge, for review in the next campaign.
- Review by the local health workers at 6 and 12 months.
- Follow-up during the first 3 years, by local doctors, health personnel, or by our own surgical team.

A retrospective descriptive study of the results of hernia repair was performed, focusing primarily on the technique used; immediate complications; and early and late follow-ups. Thus, for this group of patients, the following data were obtained:

(a) General information: age, sex, ASA score (American Society of Anesthesiologists), and associated diseases.
(b) Duration and disability caused by the hernias.
(c) The type of hernia and surgical technique.
(d) Indicators of scientific and technical quality: assessment by the anesthetist, use of local anesthesia, antibiotics and prophylaxis of deep vein thrombosis (DVT), use of mesh, surgery by residents, and other surgical techniques.
(e) Efficiency indicators: average hospital stay, discharge certificate.
(f) Effectiveness indicators: mortality, complications (medical, surgical, or anesthetic), monitoring, hernia recurrence. The results of the usefulness of interventions were calculated as they avoided DALYs. The calculation of potential DALYs for treated hernias was performed using the following formula: Potential surgical DALYs = YLL × DW (YLL years of life lost, disability weight DW) [30]. To do this, the equations of The global burden of disease (GBD) [31] study were used; DALYs were calculated according to a discount rate of 3 % without weighting age, to be consistent with the analysis of the control study disease control priorities in developing countries [32]. The average lifespan for each age data was obtained from sex-specific tables from the World Health Organization Model for Mali and Cameroon [33]. The specific values of the age of the YLL correspond to Table 1.1 (GBD study) [30]. In the absence of specific values for the GBD DW for inguinal hernia, the value (0.3) has been used as an approximate midpoint between 0.1 and 0.463 [34–37], being the variations tested by sensitivity analysis. This is the way the DW was calculated in the study by Shillcutt et al. [34] and is based on expert opinion. These results were tested against those obtained using the McCord–Chowdhury [38] method finding similar results. If a patient had multiple hernias, life expectancy was associated with the most severe degree of hernia.

If patients were corrected by surgery, they were classified as (a) avoidable DALYs; (b) potentially avoidable DALYs if surgery could have resolved the problem; and (c) inevitable DALYs if surgery could not have changed the outcome.

Statistical analysis

The results were analyzed using the statistical software program SPSS 20.1.

For continuous variables, we used the mean ± standard deviation. For the qualitative variables, we used the

Table 1 Inguinal hernia

Patients	926
Age	50.6 (49.5–51.8)[a] (0.4–89)[b] years
Sex	Males 746 (80.6 %) (78.1–83.1)[a]
Children	31 (3.3 %) (2.3–4.5)[a]
	6 (4–6.5)[a] (0.3–14)[b] years
BMI	20.62 (20.19–21.04)[a] (13–29)[b]
ASA	
ASA I	241 (26 %)
ASA II	556 (60 %)
ASA III	121 (13 %)
ASA IV	8 (1 %)
Associated illness	
Malaria	96 %
Filariasis	92 %
AIDS	10 %

General data in operated patients

The results have been expressed in percentages and the confidence interval is in brackets

AIDS acquired immune deficiency syndrome, *BMI* body mass index

[a] 95 % confidence interval—CI 95 %

[b] Range

Table 2 Duration and disability caused by the hernia

Duration of the hernia	
>1 year	869 (97 %) (95.8–98.1)
>5 years	246 (26.6 %) (23.6–29.5)
>10 years	155 (17.3 %) (14.8–19.8)
Disability caused by the hernia	
None	122 (13.2 %) (11–15.3)
It limits daily activity	630 (68 %) (65–70.9)
It prevents work	174 (18.8 %) (16.3–21.4)

The results have been expressed in percentages and the confidence interval is in brackets

Table 3 Type of hernia

Type of hernia	EHS[a]	*N*	Percentage IC 95 %
Inguinal hernia $n = 1033$	Lateral	648	62.7 (59.7–65.8)
	Medial	320	31 (28.4–33.7)
	Sliding	34	3.3 (2.2–4.4)
	Femoral	31	3 (2–4.2)
Total		1033	100

[a] European hernia surgery classification

Table 4 Inguinal hernia

	N	Percentage IC 95 %	Definition
H1	165	16 (13.7–18.1)	Reduces spontaneously when patient is lying down
H2	493	48 (44.6–50.7)	Groin only, reduces completely with gentle manual pressure
H3a	160	16 (13.3–17.6)	Inguinoscrotal, reducible with manual manipulation
H3b	65	6 (4.8–7.8)	
H3c	55	5 (4–6.8)	
H4a	61	6 (4.5–7.5)	Irreducible
H4b	20	2 (1.2–2.8)	
H4c	14	1.5 (0.8–2.1)	
Total	1033	100.0	

Size of hernia

Inguinal hernia classification from Kingsnorth [31], with sizes defined in Sanders et al. [9] with Ghanaian modifications (For H3 and H4 hernias)

a = Inguinoscrotal component <10 cm

b = Inguinoscrotal component 10–20 cm

c = Inguinoscrotal component >20 cm

frequencies and their percentages. Student's *t* test and Pearson's χ^2 test were used together with Fisher's test if it were needed.

Table 5 Indicators of effectiveness

Surgical complications	
Mortality	0 %
Hematoma	3.8 % (2.6–5)[a]
Seroma	2.5 % (1.6–3.5)
Wound infection	0.6 % (0.2–1.1)
Infection of prosthesis	0.2 % (0–0.6)
Orchitis	0.2 % (0–0.6)
Anesthetic Complications	
Urinary retention	3.1 % (2.1–4.2)
Cephalalgia	1.9 % (1.2–2.8)
Nausea-Vomiting	2.1 % (0.9–3.3)
Overall Complications	
Overall complications	10.7 % (9–12.6)
Complications with prosthesis	10.3 % (8.3–12.2)
Complications without prosthesis	13.5 % (7.9–19.8)
Follow-up	
Subsequent tracking	58.7 % (55.8–61.8) (31 % by the surgical team)
Recurrence	
Overall recurrence	2.8 % (1.6–4.2)
Recurrence with prosthesis	2.6 % (1.4–3.9)
Recurrence without prosthesis	5.4 % (0–13.3)
DALYs	
DALYs[b] averted (patients repaired) (926)	5013.9 ± 2.7
DALYs potentially avertable (patients not repaired) (64)	475.81 ± 3.02

Complications (%; 95 %CI)

CI confidence interval, *DALYs* disability-adjusted life years

[a] The results have been expressed in percentages and the confidence interval is in brackets. Three hematomas needed a reintervention

[b] One DALY represents the loss of the equivalent of one year of full health

The magnitude of association between the qualitative variables was carried out using the relative risk calculation, whereas for the quantitative variables, it was calculated using Pearson's correlation coefficient.

Results

In the end, 926 patients underwent surgery with a total of 1033 hernia repairs. Data relating to age, sex, anesthetic risk, and related diseases are listed in Table 1. The duration of the hernia and disability caused by the same are shown in Table 2. The incidence of lateral type hernias was above that of the medial type, with no significant differences (Table 3). 12 % (120 hernias) were patients with bilateral hernias, and 10.4 % (104 hernias) were recurrent hernias. Hernia size is shown in Table 4.

Table 6 Potential and category of DALYs

Classification	Surgical care/outcome	*n*	Calculation of potential DALYs			Category of DALYs[d]		
			YLL[a]	DW[b]	Potential DALYs[c]	Averted	Potentially avertable	Unavertable
H1	Repaired	165	3196.6±9.4[f]	0.3	958.9±2.8	958.9±2.8	–	–
	Not repaired	26	646.2±10.5	0.3	193.8±3.1	–	193.8±3.1	–
H2	Repaired	493	7618.5±8.4	0.3	2285.5±2.5	2285.5±2.5	–	–
	Not repaired	17	383.1±9.4	0.3	824.02±2.9	–	824.02±2.9	–
H3a	Repaired	136	2746.7±9.8	0.3	824±2.9	824±2.9	–	–
	Not repaired	16	457.5±10.09	0.3	137.2±3.02	–	137.2±3.02	–
H3b	Repaired	65	978.5±8.6	0.3	293.5±2.5	293.5±2.5	–	–
	Not repaired	2	49.82±2.24	0.3	14.9±0.67	–	14.9±0.67	–
H3c	Repaired	55	752.5±8	0.3	225.7±2.4	225.7±2.4	–	–
	Not repaired	1	20.17±0	0.3	6.05±0	–	6.05±0	–
H4a	Repaired	61	914.6±8.9	0.3	274.4±2.6	274.4±2.6	–	–
	Not repaired	2	29.12±7.9	0.3	8.74±2.3	–	8.74±2.3	–
H4b	Repaired	20	260.9±8.4	0.3	78.2±2.5	78.2±2.5	–	–
	Not repaired	0	0	0.3	–	–	–	–
H4c	Repaired	14	244.6±9	0.3	73.3±2.7	73.3±2.7	–	–
	Not repaired	0	0	0.3	–	–	–	–
Total	Repaired	1033[e]	16713.2±9.03	0.3	5013.9±2.7	5013.9±2.7		
	Not repaired	64	1586,04±10.7	0.3	475.81±3.02		475.81±3.02	

YLL years of life lost, *DW* disability weight

[a] Values are from Table 1.1 in Ref. [32]

[b] See text for how these values were assigned

[c] Potential surgical DALYs = YLL × DW

[d] Category of DALYs assigned by surgical care/outcome

[e] About 926 patients

[f] Mean ± Standard Deviation

The two main techniques for hernia repair using mesh included (87.2 %) (85.8–89.8) the Rutkow–Robbins technique (38 %) (34.7–40.9) and the Lichtenstein technique (33 %) (30–35.9). For non-prosthetic techniques, the Shouldice technique was used the most (8.4 %) (6.7–10.1).

Indicators of scientific and technical quality were analyzed. Spinal anesthesia was used in 80 % of cases (75–85.8), epidural anesthesia in 12.5 % (10.4–14.6), and local anesthesia in 7.2 % (5.7–8.8) of patients. General anesthesia was not used. In none of the cases did further complications arise due to the use of spinal anesthesia (e.g., spinal cord hematoma, paraplegia, visceral lesions, and the like). The use of drains was limited to 3.3 % (2.2–4.4), and 24.2 % (21.6–26.9) of the interventions were made by residents supervised by chief surgeons.

Effectiveness indicators were analyzed. There was no operative mortality. Morbidity, follow-up, recurrence, and avoidable DALYs are all shown in Table 5. Complications were all minor, and three additional interventions were necessary as a result of hematomas. A total of 5014 DALYs have been avoided in 926 operated patients. A further 478 more DALYs could have been prevented if all hernia repairs were performed, and the average number of avoidable DALYs per patient was 5.41 (Table 6).

Efficiency indicators were analyzed. The total time (in hours) of average stay was 19 h 10 min. (18:58–19:63). Most patients (85.7 %) stayed for less than 24 h in the center, and 21.7 % of patients stayed for less than 12 h. Only 15.7 % (13.6–18) of the patients stayed in the center for more than 24 h. All the patients received a discharge certificate.

Over 81 % of patients were free of pain after 24 h. The evaluation of postoperative pain is summarized in Table 7.

Discussion

The inguinal hernia is a very common surgical condition with millions of hernias repaired annually worldwide [39]. In a previous study by our group [40], we demonstrated that in less developed countries with population-associated illnesses, a lack of a health infrastructure, and few instrumental or material means, hernia surgery using mesh can

Table 7 Assessment of postoperative pain (visual analog scale) (VAS) (*n* %)

Pain level	VAS 4 h Frequency	VAS 6 h Frequency	VAS 12 h Frequency	VAS 24 h Frequency
0	802 (77.6 %)	737 (71.3 %)	167 (16.2 %)	19 (1.8 %)
1	173 (16.7 %)	194 (18.8 %)	451 (43.6 %)	95 (9.2 %)
2	58 (5.6 %)	93 (9 %)	196 (19 %)	37 (3.6 %)
3	0	3 (0.4 %)	44 (4.3 %)	23 (2.2 %)
4	1 (0.1 %)	4 (0.4 %)	19 (1.8 %)	39 (3.8 %)
5	0	0	1 (0.1 %)	2 (0.2 %)
6	0	0	0	4 (0.4 %)
7	0	0	0	1 (0.1)

be undertaken with the same outcomes and similar complications as encountered in more developed countries.

The variation in the hernioplasty technique in spite of the low number of surgeons was due to the variability in the treated hernias. In many cases, the size of the repaired hernias made it necessary to perform the Rutkow–Robbins technique using two meshes. The protocol for deciding the technique to use in each type of hernia was previously established. The senior surgeon took the decision as to which type of technique would be used.

There is sufficient evidence of the safety and effectiveness of local anesthesia in the elective repair of primary inguinal hernia [41, 42]. Our percentage use of local anesthesia was 7.2 %, well below the level recommended by the European Hernia Society and well below the levels normally used in Africa [43], at around 15.6 %. As Kingsnorth, we think that in this type of hernia repair without tension, local anesthesia has enough benefits to be the gold standard in most cases [44]. However, our group has mostly used spinal anesthesia in combination with intrathecal morphine, because we consider it to be a safe procedure [45] that has allowed us excellent postoperative pain control, with over 80 % of patients being without pain 24 h after surgery with a very low incidence of side effects, which allowed for the early mobilization of patients and early discharge. In addition to this, it has enabled better collaboration from those patients in which it was difficult to communicate with because of the language barrier.

Our complication rate was low; below the normal range [46, 47], and when these occurred, they were always minor. Our rate of postoperative hematomas decreased markedly from the first year in which three patients required reoperation for the treatment of hematoma. In successive campaigns, we increased hemostasis care, and compression dressings were placed on the patients in the first hours after surgery, primarily because few people were available for postoperative control. Fall et al. reported poor results of surgery for uncomplicated inguinal hernia in adults in Senegal using the Bassini and MacVay techniques [17]. They report a rate of postoperative complications in their series of 21 % including serious complications. Our rates of wound or prosthesis infection were very low and did not require removal of the prosthesis in any of the cases. Ramvil described an overall rate of wound infection 7.79 % in Nigeria [16].

The long-term monitoring by the surgical team itself at 12 months was limited (31 %), although another 28 % of the patients were reviewed by local health workers, who did not report any case of recurrence. Our recurrence rate was 2.8 % which seems quite adequate.

The average stay of 19 h 10 min:10 h (18.58–19.63) is below other European series [39] and well below the figures described in Africa, of 4 days in elective cases and 7 days after emergency surgery [16].

The expected incidence of mortality of 0.07–0.2 % [48, 49] was pleasantly improved, having no case of death in the series, which is a strong indicator of the effectiveness of the surgery carried out. Although satisfaction with the care received could not be obtained in many cases because of language barriers, we can be almost completely sure it was high throughout the series.

Another important aspect in hernia repair in Africa is its cost-effectiveness. Mock et al. have defined the inguinal hernia as a "priority surgical condition" because it represents a global public health burden but can be treated with a simple cost-effective surgical treatment [50]. In fact, recent estimates suggest that the repair of inguinal hernia with mosquito mesh is as cost-effective as a vaccine [8] because inguinal hernia repair can prevent serious and costly complications such as obstruction, strangulation, and death, allowing patients reintegrate into their functional status and productive activity.

Currently, the cost-effectiveness of treatment is often measured in terms of avoided disability and mortality (DALY). Africa has the highest proportion of DALYs due to surgical conditions per 1000 people than any other region in the world [51] (Table 8), and this burden is likely to increase rapidly [52]. Initial estimates indicate that surgery could decrease the DALYs occurring in Africa to 7 % [51].

There is no unanimity in quantifying the number of DALYs attributed to inguinal hernia per 100,000 inhabitants (425 in Tanzania). It seems that the results provided by the GBD study are very understated and well below the real figures [53].

Shillcutt calculated the life years lived with disability (DALY) together with the costs involved in hernia repair in Ghana [27]. He estimated that hernia repairs prevent an average of 9.32 DALYs per patient, with a ratio of cost-effectiveness of $ 12.88 per averted DALY, and believes that these results are sufficiently robust to remain profitable

Table 8 Estimated surgical DALYs by region

Region	Total DALYs (millions)	Estimated surgical DALYs (millions)	Estimated surgical DALYs as a percentage of total DALYs	Estimated surgical DALYs per 1000 population
World	1468	164	11	27
Africa	358	25	7	38
Americas	145	18	12	21
Eastern Mediterranean	137	15	11	30
Europe	151	22	15	25
Southeast Asia	419	48	12	31
Western Pacific	258	37	15	22

Disease control priorities in developing countries. 2nd edition [34]

even if only 2 % of DALYs or just a fifth of a DALY is avoided by patient. These data are even more important considering the large amount of H3 or H4 hernias that are most likely to cause strangulation, and death if untreated. In another similar study in Ecuador, 6.39 DALYs per patient were prevented [34]. The authors conclude that hernia repair by stress free techniques is a cost-effective procedure, which is carried out by international cooperative associations in rural district hospitals, for every patient, except those over 58 years with H1 hernias. The health benefits of these programs can be significant, both in terms of avoided disability and mortality, at costs that are affordable for patients and health systems, and the model is applicable in similar countries. Our estimate of avoided DALYs, although below these figures (Table 5), still remains high in terms of avoiding disability and contributing to a reduction in the number of hernias that need repair in Africa. The estimate of the cost-effectiveness was not done because the material used came from donations, attendance was done by volunteers, and patients in most cases belonged to very disadvantaged ethnic groups without economic means, which meant that they did not have to pay for the assistance received.

A change is necessary in healthcare policy in most African countries so that the Bassini technique for hernia repair can be replaced by mesh repair. The recently published studies on the cost-effectiveness of hernia repair in disadvantaged countries [15, 24, 27, 34] may represent a solution for the health policy of these countries when choosing the most cost-effective procedure for hernia repair.

International Cooperation in surgery, based on individualized patient care series, is not enough. Cooperation must also prove its "usefulness," and provide collaboration in the training of staff for continued care, as in conducting studies that could make a change in healthcare policy.

In this new approach to the treatment of hernia, much of the responsibility will be assumed by governments but some will have to be taken by African surgeons, allowing and encouraging collaboration with other countries [54] and creating the necessary platforms to interact with politicians to raise the profile of hernia disease as a public health problem. This is in accordance with the views of Weiser et al. [55] and Bickler et al. [56], who claim that there is currently insufficient infrastructure, human resources, and financial capacity available for the effective delivery of services [19].

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