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A Pilot Program of Mass Surgery Weeks for Treatment of Hydrocele Due to Lymphatic Filariasis in Central Nigeria

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Abstract. In a pilot program of mass surgery weeks (MSW) to provide hydrocelectomy services to men with filarial scrotal hydrocele, local general practitioners performed 425 surgical repairs in 301 men in five MSW in three rural Nigerian community hospitals between 2002 and 2005. The most common (94%) procedure used was the eversion technique, which was most familiar to the practitioners. Postoperative complications included hematoma (3.7%) and infection (3%), and there was one death from infection in an elderly man with previously unrecognized diabetes. In 115 patients (38%) followed for 1 to 3 years, the hydrocele recurrence rate was 7%. The eversion technique gives an acceptable outcome, and MSW are safe and effective if strict attention is paid to preoperative screening of candidates and asepsis.

INTRODUCTION

Lymphatic filariasis (LF), caused by the mosquito–born parasites *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori*, infects over 120 million people in at least 80 countries. Lymphatic filariasis is a leading cause of permanent disability,[1] with the worms causing lymphatic system dysfunction and subsequent swelling and in males scrotal hydrocele: a fluid filled enlargement of the tunica vaginalis sac around the testes.[2] Over 27 million men are thought to suffer from filarial hydrocele.[3] The economic, physical, and psychosocial impact of this disease can be devastating—not only for the individual, but for the family and the community.

In 1997, the World Health Organization (WHO) recommended that LF transmission could be interrupted by annual mass drug administration (MDA) with a single dose of albendazole-diethylcarbamazine or albendazole-ivermectin.[1,4] Whether MDA treatment results in improvement in patients with extremity or genital swelling is controversial. Lymphatic filariasis programs therefore are urged to include disability alleviation services, and for men with hydrocele, hydrocelectomy surgical programs are encouraged.[5–7] Unfortunately, compared with substantial progress toward MDA goals, relatively little progress has been made toward broadly establishing LF disability alleviation programs.[4] We report herein our experience in meeting this challenge through a pilot program to provide hydrocele surgical services through "Mass Surgery Weeks" as part of a larger LF elimination effort based on MDA in central Nigeria.

METHODS

This pilot surgical program was conducted in Plateau and Nasarawa States of central Nigeria, where there has been a collaborative effort since 2000 by the State ministries, the Nigerian Federal Ministry of Health (FMOH), and The Carter Center to eliminate LF.[8–11] The elimination program is based on statewide annual MDA treatment with ivermectin-albendazole combination, and with health education. In 1999–2000 a survey assessment for hydrocele among adult men took place in 144 villages in the two counties (called local government areas-LGAs) of Pankshin (in Plateau State) and Akwanga (in Nasarawa State), where the MDA program was first launched. Hydroceles were diagnosed in 531 individuals (12.9%) of 4,120 examined, with prevalence reaching > 20% in men reporting their ages to be 50 years of age and above.[8] That same study found the prevalence of LF antigenemia in this group of 4,120 to be 22.5%, and it was assumed that all hydroceles observed were of filarial etiology. After this survey, we offered hydrocelectomy to men in those two LGAs. There was no charge for the procedure (although patients bore the cost of transport to and from the hospital and for follow-up). The approach to providing these services served as an opportunity to pilot how a larger hydrocelectomy program might function in Plateau and Nasarawa States.

Health care in Nigeria is provided by both private and public health units. The public health system is administered by the FMOH, individual states, and LGAs. Primary health care is provided in local clinics, which may serve one or more villages, and are staffed by community health care workers. Secondary hospitals, called State or General Hospitals, are where routine uncomplicated surgical services, such as hydrocele operations, are performed by general practitioner physicians. Tertiary hospitals are considered Federal and "Specialist" centers. These include University hospitals involved in teaching medical students and doctors in training. Only complicated or specialist surgical cases are referred here. Patients can self refer to any treatment center, private or mission hospital.

Our approach was to organize "mass surgery weeks" (MSW) at the general hospital level. The MSW were held over a 3- to 5-day period (typically a work week) to allow a large number of patients to have their hydrocele repaired at once, have on hand expert urological consultation for difficult cases, assure the presence of all necessary materials, promote follow-up (especially for suture removal and postoperative infection monitoring), and allow for standardized data collection. In 2002, the Nigerian Ministry of Health selected Pankshin General Hospital in Plateau State, as the location for the first pilot MSW (with the surgical cohort, which will be subsequently called Pankshin 2002). After the first MSW, a consultant surgeon (GT) went to Nigeria to review the experience and make recommendations for future MSW. She concluded

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that a more rigorous approach to evaluation of preoperative, intraoperative, and postoperative processes, and patient outcome (especially infection and recurrence data) was needed. Therefore, a more formal data collection form was devised, in addition to procedural changes implemented in structuring and running the actual MSW. The operating surgeons (local general practitioners) were responsible for completing the data form in all subsequent MSW. In 2003, the Nigerian Ministry of Health and the Carter Center conducted its second and third MSW at Akwanga General Hospital (Akwanga 2003) and Langtang General Hospital (Langtang 2003). In 2004 and 2005, the fourth and the fifth MSW were performed at Pankshin General Hospital (Pankshin 2004 and Pankshin 2005).

Preoperative screening. Pre-op screening was performed one to two days before the actual surgery. All patients had a general physical examination by a physician to evaluate for systemic or chronic illness, hypertension, respiratory infection, diabetes, and skin infection in the groin. The presence of a clinical hydrocele was confirmed, based on the finding of a discrete, nontender mass around the testes, not explained by an inguinal hernia or scrotal lymphedema. Vital signs were recorded and laboratory tests performed to include hemoglobin (which had to be > 10 g/dL) and urinalysis (which had to be negative for glucose). Patients, cleared for surgery, had the hydrocelectomy surgical procedure and postoperative follow-up (particularly the need for suture removal) explained to them (usually in their native language or Hausa) and any questions answered. They were instructed not to eat or to drink after their dinner on the evening before surgery. On the morning of the procedure, they were admitted to the hospital to a specially assigned ward (the "hydrocele ward"), where it was confirmed that they had not eaten or drunk overnight. The surgical procedure and postoperative follow-up were again explained to the patient in Hausa or their native language and written consent for the procedure (with signature, thumbprint, or "mark") obtained.

Operative procedures. All patients had an intravenous catheter inserted into a hand or arm vein to provide access for IV fluids, medications, and a preoperative dose of a broad-spectrum antibiotic. Patients were transported to the operating theatre where a betadine surgical skin prep was performed, and they were draped in the usual sterile manner. Anesthesia was provided by an anesthesia physician or nurse, who monitored each patient throughout the procedure. In general, the operation was performed under local anesthesia using lignocaine infiltration of the scrotal skin and nerves supplying the spermatic cord. If general anesthesia was needed, IV ketamine was administered, along with local lignocaine. No functional electronic vital sign monitoring or electrocautery (surgical diathermy–"Bovi") equipment was available at any of the hospitals, and their purchase was beyond the resources available to the program.

The hydrocelectomy procedures were performed by experienced local general practitioners. Over 94% of the surgeries were done by the "eversion technique," which was the most familiar surgical method to those practitioners. Unilateral hydroceles were repaired through an incision along the scrotal skin of the affected side. Bilateral hydroceles were repaired through a midline incision along the median raphe. First, a small nick is made into the exposed fluid-filled sac allowing for drainage into a sterile calibrated container for measurement of the hydrocele's fluid volume. The testes were visually identified and the sac longitudinally opened. The eversion technique was performed using a running, interlocking absorbable chromic suture, with care to achieve the best possible hemostatsis. No drains were used in any of the operations. The wound was closed in layers, starting with a running absorbable suture for the Dartos tunic. Interrupted non-absorbable suture was used for the skin, and a sterile pressure-type dressing applied. Patients were taken to the hydrocele ward where they were monitored during recovery.

The "excision technique" involved a nearly complete (e.g., subtotal) resection of the excessive sac wall of the tunica vaginalis, removing the redundant tissue and leaving only about a one-centimeter rim around the testis and epididymis. Hemostatis was achieved using a running absorbable suture. A consultant urologist from the Jos University Teaching Hospital (ND) was present to guide in difficult cases and to provide direct assistance by scrubbing in when necessary.

Postoperative care. Patients received oral analgesics and a 7-day course of oral antibiotics. Most patients were discharged on postoperative day 1 or 2. However, if a patient had very large hydroceles repaired and/or lived in a remote village (with difficult transportation), he was kept in the hospital for 5–7 days. All patients, and families if present, received discharge instructions regarding wound care and a schedule for resumption of normal activity, suture removal, and follow-up. If a patient lived near the hospital, patients were instructed to return to the hospital clinic on the seventh day after surgery to have sutures removed. Patients who lived in distant locations were instructed to have their sutures removed at 7 days at a local clinic or by the village health care worker.

Data collection. Preoperative information recorded included personal and demographic information (age, occupation, village location). The physical exam information also included preoperative diagnosis, vital signs, hemoglobin, and urinalysis. Intraoperative data included the type of surgery performed, duration of the operation, estimated blood loss, type of anesthesia, hydrocele volume, and any intra-operative complications. Hydroceles with a volume under 200 mL were considered "small," and over 500 mL were considered "large." Post operative information included length of hospital stay, discharge medications, date and location of suture removal. The immediate postoperative complication rate (hematoma) was relatively easy to collect, but postoperative infection and recurrence rate were more difficult to determine after patients were discharged from the hydrocele ward and the MSW focus ended.

A convenience sample of patients was selected from among the MSW occurring from 2002 to 2004; these patients was examined in 2005 for recurrent hydrocele (defined as hydrocele on the same side as the surgery) or new hydrocele (findings on the contralateral side). All were examined by the same observer (GT), who estimated the volume of recurrent or new hydroceles based on her clinical/surgical volumetric experience gained during the MSW. The condition of the scrotal skin was also carefully evaluated during this physical examination.

RESULTS

A total of 373 patients underwent a surgical procedure during the five MSW (Table 1). Three hundred-one of these patients underwent hydrocele surgical repair (81%), with the

TABLE 1
Patients by surgical week cohort

Cohort	Hydrocele patients*	PCT	Hydrocele and hernia patients	PCT
2002	63	21%	82	22%
Akwanga 2003	70	23%	73	20%
Langtang 2003	35	12%	51	14%
Pankshin				
Pankshin 2004	69	23%	83	22%
Pankshin 2005	64	21%	84	23%
TOTAL	301	100%	373	100%

*Ten patients also had inguinal hernia.

rest (72) having only hernia repair; 10 of the hydrocele patients required simultaneous hernia repair. The greatest experience with MSW was in Pankshin General Hospital where over 65% of patients were treated. Local anesthesia was used in 71% of patients; ketamine general anesthesia was used in 29% and reserved for the more complicated cases (large hydrocele, bilateral hydrocele, simultaneous hydrocele/hernia). The age distribution of patients (Table 2).showed 86% being ≥ 30 years of age and a remarkable 11% reported their ages as 70 years or older.

Of the 301 patients undergoing a hydrocelectomy procedure, a total of 425 hydrocelectomy surgeries were performed (counting each bilateral as 2 procedures); 94% had the procedure performed using the eversion technique. Thirty-seven percent of the 301 patients had hydroceles on the right, 22% on the left, and 41% were bilateral. Only 19 patients (6.3%) had their hydroceles repaired using the excision technique. Orchiectomy was required in 17 patients or 5.6% when the testis was found to be necrotic or infected at the time of surgery. The necrotic testis could not be diagnosed in this series before opening the sac. As the patients were usually awake during the procedure, the surgeon was able to inform the patient of this finding and the need for the orchiectomy. Fortunately, no bilateral orchiectomy was required.

During the first MSW in Pankshin 2002 little operative information was systematically recorded, so the most detailed data available were from records collected on the subsequent four MSW. Estimated blood loss (EBL), recorded in 275 cases, was < 50 mL in 74% of the cases, and < 100 mL in all cases. The duration of the surgical procedures was recorded in 281 cases. Seventy-three percent took less than 30 minutes, and 98% were completed in one hour or less (Figure 1). Individual hydrocele volume (e.g., excluding those bilateral hydrocele cases where volumes were measured together) for 216 hydroceles, by patient age, is shown in Table 3). Older patients (≥ 60 years of age) were nearly twice as likely to have hydroceles of 1 L or more (15 of 73, or 21%) compared with younger patients (16 of 143, or 11%) This difference approached

TABLE 2
Age distribution of all surgical patients (N = 363)

Age	Total	PCT
< 20	19	5%
20–29	33	9%
30–39	64	18%
40–49	80	22%
50–59	74	20%
60–69	53	15%
≥ 70	40	11%
Total	363	100%

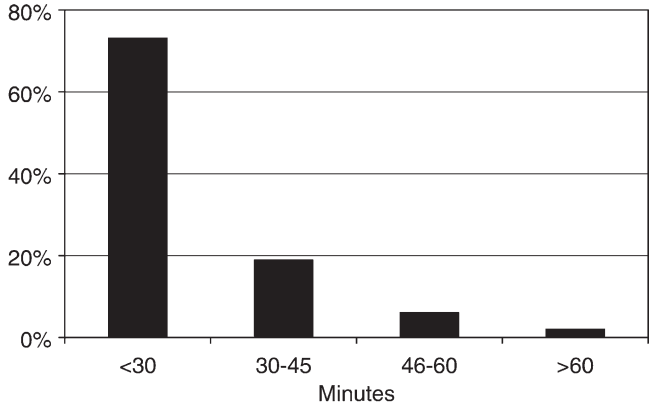

FIGURE 1. Duration of hydrocele surgeries (N = 281).

statistical significance (chi square 3.4, P = 0.06). No chyloceles were observed, but necrotic testes that had to be removed often were associated with hemorrhagic or cloudy hydrocele fluid.

The most common immediate postoperative complication was scrotal hematoma (11 patients-3.7%), which was generally treated conservatively, although 2 patients had to be returned to the theater for evacuation. Wound infections/breakdowns were documented in 9 patients (3%). One elderly (> 60 years of age) patient from Akwanga died 36 days after surgery from a large hydrocele. He had unrecognized diabetes and presented to the hospital with a large scrotal abscess and clinical septicemia. He was admitted to the hospital, the abscess was drained, and he was treated unsuccessfully with broad spectrum antibiotics and insulin. Preoperative screening with urine dipsticks that would have detected his condition (and excluded him as a surgical candidate) had not yet been instituted for that MSW.

A convenience sample of 115 patients selected from among all the MSW were examined for hydrocele recurrence in 2005, including a three year follow-up of Pankshin 2002 patients (Table 4). This sample represented 48.5% of the original surgical cohort. Overall, 8 patients (7%) had recurrences (defined as a hydrocele occurring on the same side as the procedure was performed). Recurrence rates ranged among the different surgical cohorts from 0% to 14.3%. A total of 159 repairs had been performed in this group, resulting in an overall 5.0% recurrence rate per individual hydrocele repair. Four new hydroceles (3.5%) were noted in this follow-up group. All hydroceles observed were small and estimated by GT to have a volume of < 200 mL. Those without hydrocele had, for the most part, a normal exam: there was no evidence on palpation of scrotal swelling or a bulging spermatic cord. Redundant skin was often present, although equally as often it had shrunk and returned to normal size. Scrotal skin was normal and scars were remarkably well healed and often not even visible, and we observed no cases of lymphscrotum.

DISCUSSION

Hydrocele is the most common clinical manifestation of LF,[1–3] causing considerable pain and suffering in up to 40% of men actively or previously infected with *W. bancrofti*. In LF endemic regions of northern Ghana and coastal Kenya, hydrocelectomy accounts for 25% of all surgery.[12,13] Nigeria is thought to have the highest disease burden of LF in sub-Saharan

TABLE 3
Patient hydrocele volume, by age group ($N = 216$)

	Hydrocele volume (mLs)							
Age (years)	< 200	201–500	501–999	1,000–1,500	1,501–2,000	> 2,000	Total patients	PCT total
< 20	4						4	2%
20–29	12	5	1		1		19	9%
30–39	6	17	4	5			32	15%
40–49	13	24	5	3	2		47	22%
50–59	11	12	13	3	1	1	41	19%
60–69	10	20	4	5	3	1	43	20%
≥ 70	6	14	4	3	2	1	30	14%
Total	62	92	31	19	9	3	216	100%
PCT	29%	43%	14%	9%	4%	1%	100%	

Africa, being the third most endemic country in the world after India and Indonesia.[14,15] On the basis of these estimates and our studies in Plateau and Nasarawa States[8,11] we estimate that tens of thousands of Nigerian men suffer from hydrocele. Simple surgery can be life-transforming and progress must be made to safely provide surgical hydrocelectomy services to this backlog of suffering.

Hydrocele surgery in Nigeria is usually performed by general practitioners on an individual patient basis, when and if the patient is able to pay for the procedure. As an alternative approach, MSW seem to be the best way to safely provide surgery to a large number of patients in a coordinated fashion that allows for monitoring and evaluation of pre-, intra-, and to some extent postoperative care. Costs were shared with patients who financed their travel to the hospital, local government authorities and the Nigerian Ministry of Health who provided a dedicated hospital hydrocele ward, beds, and surgical operating rooms, and The Carter Center, which provided funds for the surgeons, urological oversight, medicines, and materials. At Pankshin General Hospital, the same health team has now worked together three times, which has contributed to a progressively well coordinated and smooth program. The word has spread about MSW, and the demand for this popular surgery currently outstrips our ability to provide the service, which we continue to provide once or twice per year.

The technical skill of the general practitioners, as judged by GT and ND, was very good. The estimated blood loss was minimal, and the operative times were very compatible with any surgery times in a Western operating room, despite the lack of electrocautery equipment. However, as very little is known regarding post-repair hydrocele recurrence rates in LF endemic areas, it is difficult for us to judge if our follow-up recurrence rates of 7% (and ranging up to over 14% in one cohort) are acceptable. It is interesting to note that the contralateral side (i.e, the side opposite from the procedure) had a hydrocele incidence rate of 3.5%, so it is indeed difficult to know what fraction of our observations are related to surgical failure, and what fraction are due to new onset as part of the natural history of the lymphatic dysfunction that is a part of the overall pathogenesis of LF. Also of interest is that there were no errors made in the preoperative diagnosis of hydrocele or inguinal hernia; all were confirmed at surgery. This excellent clinical/surgical correlation may have been a result of the availability of a trained urologist for consultation during the preoperative examinations.

Orchiectomy was performed in a relatively large number (17, or 5.6%) of patients. Questioning these patients in the hospital and during visits to villages, we learned that many sought hydrocele drainage from village traditional medicine practitioners. Unfortunately, this usually means tapping into the hydrocele with an unsterile needle. Because the fluid quickly reaccumulates, some patients have this drainage procedure done multiple times. The testis may become damaged as a result of bacterial infection from these procedures (not to mention the risk of viral infections, such as hepatitis and human immunodeficiency virus [HIV]).

The 3% postoperative infection rate reported here is likely to be an underestimate because of the difficulty of follow-up and follow-up documentation of patients after their discharge from the hospital. For example, 36 out of 70 (51%) of the patients from the Akwanga 2003 cohort were examined by GT 6 weeks after surgery, and 10 (28%) were found to have superficial wound infections. A significant contributing factor to this infection rate was the failure of patients to have their sutures removed. Fortunately, none of those with infection had a breakdown at the incision site and none of these men had their daily activities hindered or required hospitalization. Another member of this same Akwanga 2003 cohort was the elderly diabetic

TABLE 4
Patient follow-up: recurrent and new hydroceles, by surgical group ($N = 115$)

Surgical group (original total number in group)	Post-op hydrocele patients examined in 2005	Years of follow-up	PCT follow-up of original group	Recurrent hydrocele	PCT recurrence	New hydrocele on opposite side	PCT new hydrocele
Pankshin 2002 ($N = 63$)	38	3	60.3%	0	0.0%	1	2.6%
Akwanga 2003 ($N = 70$)	48	2	68.6%	4	8.3%	3	6.3%
Langtang 2003 ($N = 35$)	15	2	42.9%	2	13.3%	0	0.0%
Pankshin 2004 ($N = 69$)	14	1	20.3%	2	14.3%	0	0.0%
Total ($N = 237$)	115	1–3	48.5%	8	7.0%	4	3.5%

patient who developed a scrotal abscess and died 1 month (36 days) postoperatively. His death was a wakeup call to the program that candidates for this elective surgery must be carefully screened and medically fit for the procedure. This in particular, given the large percentage of elderly men who are often in relatively poor health and yet can have the largest large hydroceles. Being selective about the surgical candidates required considerable fortitude on the part of the medical and surgical team, because refusing these men this popular operation was upsetting to them, and at times led to arguments in the halls of the hospitals. Men who are denied hydrocele surgery are likely to continue to have their hydroceles drained in their villages, which can lead to infection and testicular damage.

In 2002, WHO published a guideline manual entitled "Surgical Approaches to the Urogenital Manifestations of Lymphatic Filariasis."[5,6] These guidelines recommended a campaign style approach to providing hydrocelectomy to affected patients, similar to our MSW approach. However, the manual made some recommendations that are concerning to us based on our experience in Nigeria. 1) The manual "requires" the presence of pulse oximetry and "recommends" electrocautery, both of which were unavailable in the LGA level hospitals where we worked. 2) It recommends that hydrocelectomy involve the "complete excision of the sac"[6] (e.g., the excision technique) as opposed to the eversion, which our general practitioners most commonly used in their routine practice. We take issue with the recommendation for sole use of the excision technique for a number of reasons. 1) Excision requires more meticulous hemostasis (best obtained with electrocautery)[16] and would perhaps prolong surgery when electrocautery is not available. 2) We are unaware of any published studies that compare the outcomes of the two surgical techniques, or that we could compare with our 7% hydrocele recurrence rate. 3) In our group of 115 patients followed for 1–3 years, we did not observe a complication of lymph scrotum, nor uncomfortable scrotal swelling resulting from the eversion technique, even though this is suggested to be more common after eversion procedures.[16] Our opinion is that LF hydrocele programs should follow a contradictory recommendation made in a subsequent WER publication on the subject[7]: "Because there are different recommended methods of hydrocelectomy, the choice of method will largely depend on the practice adopted by the surgical service of the district" (page 382).

The challenge is not new techniques or new equipment, but safe scale-up of the provision of these surgical services to reach more patients. Our hydrocele MSW project, which incorporates many of the WHO guidelines, provides one model for other LF surgical programs to follow in Nigeria. MSW provide focus for strict attention to detail, use of familiar techniques, commitment to patient safety, maximal attention to sterility, and coordination of all involved personnel. Implementing rigorous preoperative screening guidelines to select the best candidates, with review of these forms by the medical team before the surgical procedures, will help to maximize patient safety and surgical outcome. Approaches to achieve better suture removal in the week after MSW remain to be fully addressed. One option is to provide prepackaged sterile, disposable suture removal kits to the patients upon discharge from the hydrocele ward. This may improve frequency and sterility of suture removal practices.

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