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## **Impact of Hydrocoele Surgeries on Quality of Life for Persons Living in Lymphatic Filariasis Endemic Communities in Toro, North-Eastern Nigeria.**

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### **Abstract**

Lymphatic filariasis (LF) is a dreadful parasitic disease that currently threatens 863 million people across 72 countries, with hydrocoele as the most common clinical condition among affected men. This study investigates the impact of hydrocoele surgeries on the quality of life (QoL) of individuals living in an LF-endemic district in Nigeria. A total of 137 participants with hydrocoele were included in the study, and data on demographics, clinical conditions, barriers to surgery, post-surgery symptoms, and QoL indicators were collected before and after the surgeries. Most participants had unilateral hydrocoele (95.3%), and there was limited knowledge about the causes of hydrocoele (0.9%) and lymphatic filariasis (15.1%) among the participants. Before the surgeries, the overall QoL score was 4.06, with self-care being the lowest domain score (2.95) and pain being the highest (6.83), after the surgeries, there was a significant improvement in QoL, with a score of 0.6. The domain scores also showed improvements, with economic and psychological health having the lowest scores (0.07) and pain having the highest (0.39). The QoL scores for household members also improved significantly after the surgeries (2.19 vs. 0.07), with domain scores ranging from mobility (1.44 vs. 0.03) and psychological health (2.70 vs. 0.01) to social issues and economic aspects. The participants reported a substantial increase in their working hours and productivity (>100%) after the surgeries, allowing them to engage in social activities, maintain friendships, and fulfil their marital duties. These findings highlight the significant improvements in the QoL of individuals following hydrocoele surgeries. It is important to allocate more resources and investments to interventions that focus on providing accessible and inclusive surgical services to individuals affected by hydrocoele. By doing so, progress can be made towards achieving the 2030 elimination targets for LF and enhancing the overall well-being of the affected individuals.

**Keywords:** Hydrocoele, Surgery, Lymphatic Filariasis, Quality of Life, Nigeria

## Introduction

Lymphatic filariasis (LF) is one of the most important neglected tropical and mosquito-borne parasitic diseases affecting people living in areas associated with poverty [1]. The disease is endemic across 72 countries predominantly in Africa, some parts of America, Eastern Mediterranean, South-East Asia, and West Pacific [1]. About 51.4 million people were affected by LF in 2018, and over 859 million live in endemic settings throughout the tropics and subtropics [1]. In Sub-Saharan Africa alone, over 50 million people are affected and about 29 million of these cases reside in Nigeria, making the country the third most endemic country for LF in the world [2]. These damages may manifest as lymphoedema (tissue swelling) or elephantiasis (skin/tissue thickening) of limbs and hydrocele (scrotal swelling) [1]. In 2020, about 25 million men and 15 million people were with hydrocele and lymphoedema respectively. Those affected were not only physically disabled, but suffered mental, social, and financial losses contributing to stigma and poverty [1].

WHO established the Global Program to Eliminate Lymphatic Filariasis (GPELF) in 2000, to stop the transmission of infection through preventive chemotherapy, and alleviate the burden of LF through morbidity management and disability prevention (MMDP) approaches [1,3]. Preventive chemotherapy for LF involves the large-scale and periodic administration of ivermectin in combination with albendazole to those living in endemic settings, with a target threshold of treating at least 65% of the total population for at least 5–7 consecutive years [4–6]. These treatments are aimed at interrupting transmission to eliminate lymphatic filariasis as a public health problem [4–6]. On the other hand, MMDP involves the provision of the essential package of care and compassion, including but not limited to access to improved water, sanitation, and hygiene (WASH) services for those affected with lymphoedema, and surgeries for persons with hydrocoele. Following the recently published neglected tropical diseases road map (2021–2030) [5], about 58 endemic countries are targeted to eliminate LF as a public health problem, through the combination of preventive chemotherapy and provision of essential packages of care in all areas with known patients.

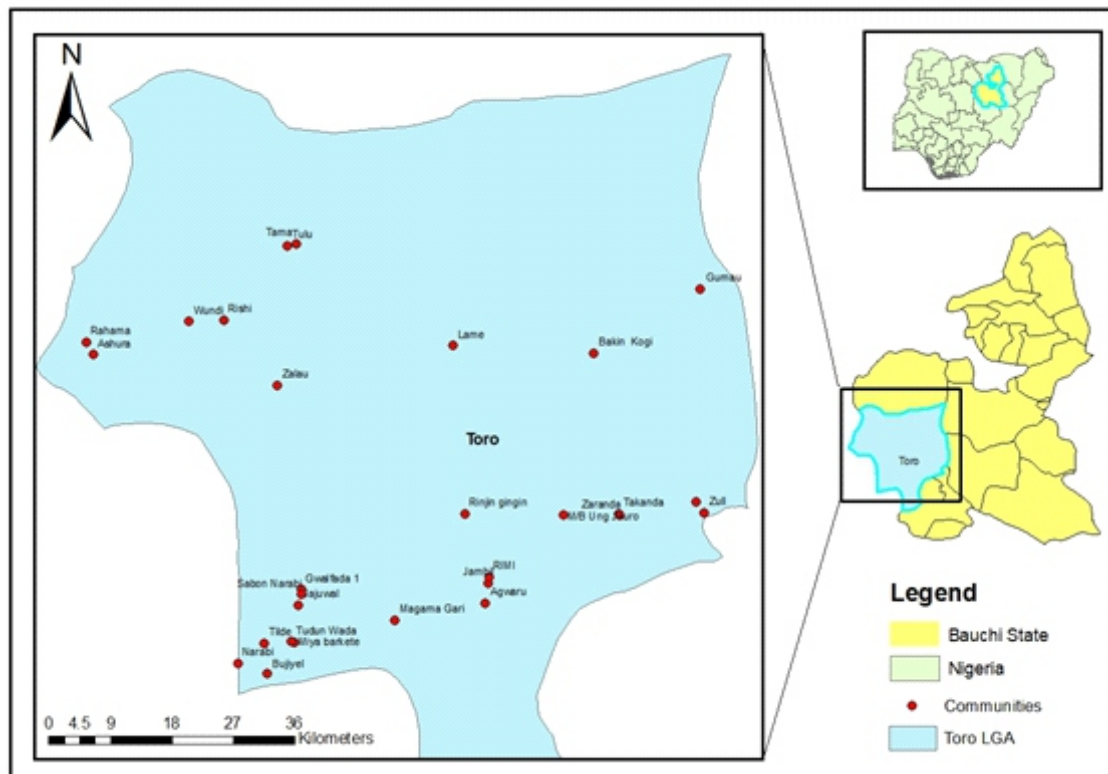
In 1997, the National Lymphatic Filariasis

Elimination Programme (NLFEP) was established in Nigeria and later merged with the National Onchocerciasis Control Programme (NOCP) in 2007 to harmonize the implementation of MDA with combined delivery of albendazole and ivermectin in co-endemic areas [7]. In 2016, the Expanded Special Project for Elimination of Neglected Tropical Diseases (ESPEN) was established to integrate elimination approaches across the other neglected tropical diseases in Africa [8,9]. Bauchi, one of the states in the north-eastern part of Nigeria, was classified to be hyper-endemic and a priority area for LF-MDA intervention (FMOH, 2015). The state has benefitted from several rounds of MDA, with limited provision of essential care packages to LF-affected persons [10]. It is therefore important to prioritize actions that ensure equitable and inclusive care is provided to people living with lymphoedema and hydrocoele [1,3]. Such actions require strengthening of health systems and achieving universal health coverage through increased investments, capacity reinforcement and collaborations [1,3]. We, therefore, hypothesize that a better understanding of patients' experiences and the impact of hydrocoele surgeries would be a significant tool in calling for increased local investments and collaborations. This study therefore reports on the impact of hydrocoele surgeries on the quality of life (QoL) of persons living in Toro, a hyperendemic implementation unit for LF in Nigeria.

## Materials and Methods

### *Study Area and Design*

Toro local government area (LGA) is situated in the North-Eastern part of Nigeria and is one of the 20 LGAs within Bauchi State (Fig 1). This region is known to be endemic for lymphatic filariasis (LF), with a high prevalence of individuals suffering from hydrocoele [10]. To investigate the impact of hydrocoele surgeries on the quality of life (QoL), this study utilized a prospective sampling design. The approach involved community mobilization for a screening camp, and surgical operations for hydrocoele patients, followed by 3-month follow-up visits. Standardized questionnaires were administered to assess the impact of surgeries on the patient's QoL. Additionally, interviews were conducted with household members living with hydrocoele patients to understand their experiences, particularly in relation to their own QoL.



**Fig 1: Map of Toro LGA showing the study communities with Nigeria as inset.**

#### *Mobilization and Recruitment of Study Participants*

We conducted community sensitization and advocacy visits to community leaders and stakeholders regarding the planned surgical intervention. Individuals with swollen scrotal sacs were encouraged to participate in the screening process, which involved attending a clinical camp held at Toro General Hospital. At the camp, a team of surgeons and medical officers conducted the screening in a private room. The screening process included a physical examination of the male genitalia to confirm the presence of hydrocoele. Only participants with confirmed hydrocoele were selected for the surgical operation.

#### *Sample Size Estimations*

Out of the 216 individuals who attended the screening camp from 49 communities, 137 of them (63.4%) were confirmed to have hydrocoele and were selected for surgical operations. Additionally, the recruited participants were invited to take part in an impact evaluation study. Those who provided their

consent completed an informed consent form, which outlined the details of the scheduled follow-up visit at 3 months after the surgery. During this follow-up visit, participants and one other member of their household were administered a questionnaire to assess the impact of the surgery on their quality of life.

#### *Surgical Operation of Hydrocoele and Follow-Up Visits*

Before surgical procedures, participants underwent pre-examinations to assess their anaemia status, blood glucose levels, Hepatitis B infection, Respiratory Syncytial Virus infection, and blood pressure. The diagnostic results were recorded in each participant's record form, which served as a reference for the medical team in case of any surgical emergencies. Before the surgeries, consent was obtained again from each study participant. The surgeries were performed by 10 medical professionals, organized into 5 pairs, with each pair consisting of one surgeon and one assistant surgeon.

Standard hydrocelectomy procedures were followed, and either local or spinal anaesthesia was administered. After the surgery, participants were advised to rest in bed and were accompanied by a close relative. They were discharged from the hospital one or two days after the surgery, along with prescribed analgesia for pain management. Azithromycin, an oral antibiotic, was prescribed for 7-14 days post-surgery. Participants were instructed to return to the hospital after the 7th day for suture removal and to report any post-operative symptoms. Follow-up visits at 3 months post-surgery were scheduled for routine medical check-ups. In addition, radio jingles were used to remind participants about their follow-up appointments.

#### *Data Collection and Tools*

The data collection tool used during this study was adopted from [11]. Data collected included demographic characteristics, clinical condition of participants, barriers to surgery, knowledge about hydrocoele and LF, and QoL before and after the surgery. All interviews were conducted 3 months after the surgery to facilitate recall and minimize the effect of loss to follow-up. Questionnaires were re-designed into electronic forms and administered by trained field research officers to all consenting beneficiaries of the surgical interventions. The majority of the participants were visited in their households, while a few subsets who were unavoidably absent during repeated rounds of household visitations, were invited to the Toro General Hospital at their most convenient time. Responses were obtained by proxy, from guardians of minor participants who couldn't respond to our questionnaires. Data were collected by two teams, each comprising an interviewer, a field assistant, and a local guide. Interviewers were recruited based on their expertise in field-based surveys, ability to use electronic data collection tools and knowledge of Hausa and English languages. All data collection tools were primarily designed in English language and subsequently translated into Hausa language. The tools were pre-tested at the Toro General Hospital among a group of healthcare workers to ensure that questions were properly phrased, and the main message was not lost in translation. All interviews were conducted in the native Hausa language and held in a private space within/around the household or hospital respectively.

#### *Study Indicators*

Demographic information of participants including

age, place of residence, marital status, household size, educational status and occupational status were documented. In addition, retrospective clinical information about the hydrocoele was obtained using the criteria described by Capuano and Capuano [12]. Associated data on post-operative symptoms and complications were also obtained by asking participants if they experienced swelling, bleeding, infection and/or pain/discomfort around the incision site, and what type of treatment they received [11]. The impact of hydrocoele surgery on the QoL of the study participant was assessed using an adapted Lymphatic Filariasis Quality of Life Questionnaire (LFSQQ) [13, 14] that was previously used by Betts et al [11]. This tool included seven predefined domains: pain, mobility, usual activities, self-care, social issues, psychological health, and economics. Each QoL domain consisted of three to six questions (30 questions in total) with men's answers coded in four levels to assess and score the level of problem the hydrocoele (pre-surgery) or groin area (post-surgery) caused to their QoL. The four levels and associated scores included no problem = 0, mild problem = 1, moderate problem = 2, severe problem = 3. The individual scores were used to calculate an overall QoL score, which ranged between 0 (no problems recorded in all 30 questions) and 90 (severe problems recorded in all 30 questions), and a mean QoL score for each domain. In addition to the QoL tool, the average number of hours/day (when applicable) used by participants at work before and after the surgery, and their associated income were also documented. Under each of the pre-identified domains, participants were allowed to freely express themselves after responding to the structured questionnaire. All expressions were captured with an audio-recorder, transcribed and analysed based on emerging themes to support already collected data. Factors limiting participation in MDA and surgical interventions were also documented using the tool described here [11].

Similarly, the indirect impact of hydrocoele on the QoL of those living with study participants was assessed using an adapted tool comprising six predefined domains: pain, mobility, usual activities, social issues, psychological health and economic. Each QoL domain consisted of one to four questions (15 questions in total) with answers coded in four levels to assess and score the level of problem the hydrocoele (pre-surgery) or groin area (post-surgery) caused to their QoL. The four levels and associated scores included no problem = 0, mild problem = 1,

moderate problem = 2, severe problem = 3. The individual scores were used to calculate an overall QoL score, which ranged between 0 (no problems recorded in all 15 questions) and 45 (severe problems recorded in all 15 questions) and a mean QoL score for each domain. Higher QoL scores reflect more difficulties.

#### *Data Management and Analysis*

Data collected were imported into SPSS 20.0 statistical software (SPSS, USA) for analysis. Descriptive statistics such as frequencies, proportions and means were used to summarize and present the proportions on socio-demographic characteristics and questionnaire data collected from the participants. Chi-square tests were used to examine differences between age groups. Frequency, proportions, and mean scores were used to summarize variables in the QoL questionnaire. Paired student t-tests were used to compare responses obtained pre-surgery and post-surgery. The significant level was set at 95%. For qualitative data, vernacular audio recordings were transcribed verbatim and translated into English. Transcripts were coded and analysed thematically to support quantitative data.

### **Results**

#### *Recruitment profile and demographic characteristics of the study participants*

A total of 137 males across 47 communities benefitted from hydrocelectomy in Toro LGA of Bauchi State. In the 3-month follow-up survey, only a subset of 107 (78.1%) beneficiaries across 29 communities and 88 households were available and recruited. The mean age of the study participants was 30.84 years (SD = 23.95), and the majority were minors below 17 years (41.1%), followed by adults between ages 16 and 65 (22.4%) (Table 2). About 54% of the participants were single, with the most common educational achievement being primary school education (n=47, 43.9%), followed by those with no formal education (n=32, 29.9%). By occupation, the majority of the participants were engaged in farming (n=29, 27.1%), family support activities (n=25, 23.4%), business (n=25, 23.4%), schooling (n=10, 9.3%) and other forms of paid employment (n=5, 4.7%). A total of 15 (14.0%) were unemployed during the period of this survey (Table 1).

#### *Clinical Conditions of Hydrocoele before Surgical Interventions*

The assessment and summary of the pre-surgery hydrocoele conditions among the study participants are shown in Table 2. Most participants (n = 102, 95.3%) had unilateral hydroceles, indicating that the swelling was present on one side only. The type of hydroceles did not show a significant difference across different age categories (p = 0.862). Regarding the stage of hydrocoele, most participants in all age categories had the earliest stage (n = 78, 72.9%), followed by stage 2 (n = 22, 20.6%). Stage 3 and 4 hydroceles were less common, accounting for 5.6% and 0.9% of cases, respectively. It is worth noting that stage 4 hydroceles were found only among the oldest participants above 66 years of age (n = 1, 9.1%). There was no significant difference in the size of hydroceles across age categories (p = 0.385). Penis burial, which refers to the degree to which the penis is covered by the hydrocoele sac, was less common among the study participants. The majority (n = 84, 78.5%) had no burial, indicating that the penis was not covered by the hydrocoele sac. Among those who had penis burial (n = 14, 13.1%), most had partial burial where a visible part of the penis extended beyond 2cm. There was only one case of total burial observed among the minor participants (0.9%). The grades of penis burial did not show a significant difference across age categories (p = 0.736).

**Table 1: Demographic characteristics of the study participants**

	Frequency or mean	% or SD
Number of persons recruited	107	100
Age of participants (in years)	30.84	23.95
Number of persons per household	12.36	7.89
Number of rooms per household	4.75	3.00
Number of wives per household	1.0	1.006
Number of children per household	5.47	6.115
<b>Age category (in years)</b>		
5-16	44	41.1
17-25	14	13.1
26-45	14	13.1
46-65	24	22.4
>66	11	10.3
<b>Marital status</b>		
Single	58	54.2
Married	49	45.8
<b>Educational status</b>		
No formal education	32	29.9
Primary education	47	43.9
Secondary education	18	16.8
Post-secondary education	10	9.3
<b>Occupational status</b>		
Student	10	9.3
Paid employment	5	4.7
Self-employed/Business	25	23.4
Farming	29	27.1
Family support	25	23.4
Not employed	15	14.0

SD: Standard Deviation of Means

**Table 2: Clinical conditions of hydrocoele before surgical interventions**

	Age category (in years)					Total	
	5-16	17-25	25-45	46-65	> 65		
<b>Type of hydrocoele</b>							
Unilateral-Left Side	11(25.0)	6(42.9)	5(35.7)	6(25.0)	4(36.4)	32(29.9)	$X^2 = 3.943$
Unilateral-Right Side	31(70.5)	7(50.0)	9(64.3)	17(70.8)	6(54.5)	70 (65.4)	$p = 0.862$
Bilateral	2 (4.5)	1 (7.1)	0 (0)	1(4.2)	1 (9.1)	5 (4.7)	
Total	44 (41.1)	14 (13.1)	14 (13.1)	24 (22.4)	11(10.3)	107(100)	
<b>Size of hydrocoele</b>							
Stage 1	32 (72.7)	11 (78.6)	12 (85.7)	15 (62.5)	8 (72.7)	78 (72.9)	$X^2 = 12.786$
Stage 2	9 (20.5)	2 (14.3)	2 (14.3)	7 (29.2)	2 (18.2)	22 (20.6)	$p = 0.385$
Stage 3	3 (6.8)	1 (7.1)	0 (0)	2 (8.3)	0 (0)	6 (5.6)	
Stage 4	0 (0)	0 (0)	0 (0)	0 (0)	1 (9.1)	1 (0.9)	
Total	44 (41.1)	14 (13.1)	14 (13.1)	24 (22.4)	11(10.3)	107(100)	
<b>Penis burial</b>							
Grade 0	32 (72.2)	12(85.7)	14 (100)	18 (75.0)	8 (72.7)	84 (78.5)	$X^2 = 12.122$
Grade 1	7 (15.9)	0(0)	0(0)	4 (16.7)	3 (27.3)	14 (13.1)	$p = 0.736$
Grade 2	3 (6.8)	1(7.1)	0 (0)	1 (4.2)	0 (0)	5 (4.7)	
Grade 3	1(2.3)	1 (7.1)	0 (0)	1 (4.2)	0 (0)	3 (2.8)	
Grade 4	1 (2.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.9)	
Total	44 (41.1)	14 (13.1)	14 (13.1)	24 (22.4)	11(10.3)	107(100)	

$X^2$ : Chi-square value;  $p$ :  $p$ -value is significant at 0.05; The size of the hydrocoele- stage I: scrotum size of a tennis ball, stage II: greater than a tennis ball, stage III: reaches mid-thigh, stage IV: reaches the knee, stage V: reaches between the knee and lower mid-leg, and stage VI: reaches between lower mid-leg and ankle); Penis burial - grade 0: no burial, grade 1:

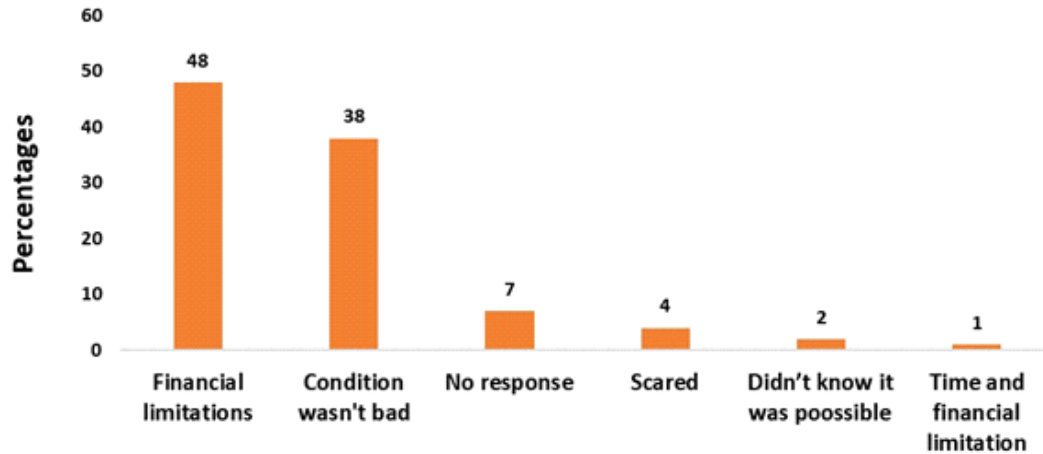
partial burial with the visible part of the penis more than 2cm, grade 2: partial burial with the visible part of the penis below 2cm, grade 3: total burial with glans penis visible, and grade 4: total burial with glans penis invisible.



*Barriers Towards Surgical Interventions among Study Participants*

The main barrier towards hydrocoele surgery was the inability to pay for the cost of surgery (n=51, 48%), followed by the perception that the condition was not

too serious to be attended to (n=41, 38%). Other barriers included being scared (n=4, 4%), and not knowing the surgical operation is possible (n=2, 2%) (Fig 2).



**Fig 2: Barriers towards surgical interventions among study participants**

*Knowledge about Hydrocoele and Lymphatic Filariasis among Study Participants*

Most participants (n=106, 99.1%) did not know the causes of hydrocoele (Table 3), while a small percentage (n=1, 2.3%) attributed it to sexual

intercourse. There were no significant differences in the knowledge about the causes of hydrocoele across the different age categories (p=0.836). Regarding the knowledge about what transmits lymphatic filariasis, the majority of participants (n=90, 84.1%) did not

**Table 3: Knowledge about hydrocoele and lymphatic filariasis among study participants**

	Age category (in years)					Total	
	5-16	17-25	25-45	46-65	>65		
<b>What do you know causes hydrocoele</b>							
Don't know	43 (97.7)	14 (100)	14 (100)	24 (100)	11 (100)	106 (99.1)	$X^2 = 1.445$ p = 0.836
Sexual intercourse	1 (2.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Total	44 (41.1)	14 (13.1)	14 (13.1)	24 (22.4)	11(10.3)	107(100)	
<b>What do you know transmits lymphatic filariasis</b>							
Don't know	36 (81.8)	13 (92.9)	11 (78.6)	21 (87.5)	9 (81.8)	90 (84.1)	$X^2 = 4.724$ p = 0.787
Mosquitoes	7 (15.9)	1 (7.1)	3 (21.4)	2 (8.3)	1 (9.1)	14 (13.1)	
No idea	1 (2.3)	0 (0)	0 (0)	1 (4.2)	1 (9.1)	3 (2.8)	
Total	44 (41.1)	14 (13.1)	14 (13.1)	24 (22.4)	11(10.3)	107(100)	

$X^2$ : Chi-square value; p: p-value is significant at 0.05

know about it. However, about 13.1% of participants (n=14) knew that mosquitoes were responsible for transmitting lymphatic filariasis. Among those who knew, the majority (n=3, 21.4%) were between the ages of 25 and 45 years. There were no significant differences in the knowledge about what transmits lymphatic filariasis across the age categories (p=0.787).

Self-reported postoperative symptoms and complications at 3 months post-surgery  
In Table 4, it is shown that the majority of participants (n=87, 81.3%) reported no post-operative symptoms or complications after the surgeries. However, a total of 20 participants (18.7%) reported experiencing post-operative symptoms. Among those who

reported symptoms, the majority were in the age group of 17 to 25 years. There were significant differences in the proportion of participants reporting post-operative symptoms across the different age groups (p=0.002). The most common post-operative complication reported by participants was pain and discomfort, which was experienced by 12 participants (60%). Swelling was the second most common complication, reported by 10 participants (50%), followed by bleeding, which was reported by only 1 participant (5%). None of the participants experienced infection at the site of the incision. There were no significant differences in the types of complications experienced across the different age groups (p > 0.05).

**Table 4: Self-reported post-operative symptoms and complications at 3 months post-surgery**

	Age category (in years)					Total	
	5-16	17-25	25-45	46-65	>65		
<b>Were there post-operative complications</b>							
Yes	4(9.1)	7 (50.0)	0 (0)	7 (29.2)	2 (18.2)	20 (18.7)	$X^2 = 16.651$ p = 0.002
No	40 (90.9)	7 (50.0)	14 (100)	17 (70.8)	9 (81.8)	87 (81.3)	
Total	44 (41.1)	14 (13.1)	14 (13.1)	24 (22.4)	11(10.3)	107(100)	
<b>Post-operative complication [Swelling]</b>							
Yes	3 (75.0)	2 (28.6)	0 (0)	5 (71.4)	0 (0)	10 (50)	$X^2 = 5.571$ p = 0.134
No	1 (25.0)	5 (71.4)	0 (0)	2 (28.6)	2 (20.0)	10 (50)	
Total	4 (20.0)	7 (35.0)	0 (0)	7 (35.0)	2 (10.0)	20 (100)	
<b>Post-operative complication [Bleeding]</b>							
Yes	0 (0)	0 (0)	0 (0)	1 (14.3)	0 (0)	1 (5.0)	$X^2 = 1.955$ p = 0.582
No	4 (100)	7 (100)	0 (0)	6 (85.7)	2 (100)	19 (95.0)	
Total	4 (20.0)	7 (35.0)	0 (0)	7 (35.0)	2 (10.0)	20 (100)	
<b>Post-operative complication [Infection]</b>							
Yes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	$X^2 = NA$ p = NA
No	4 (100)	7 (100)	0 (0)	7 (100)	2 (100)	20 (100)	
Total	4 (20.0)	7 (35.0)	0 (0)	7 (35.0)	2 (10.0)	20 (100)	
<b>Post-operative complication [Pain or discomfort]</b>							
Yes	2 (50.0)	5 (71.4)	0 (0)	3 (42.9)	2 (100)	12 (60.0)	$X^2 = 2.738$ p = 0.434
No	2 (50.0)	3 (42.9)	0 (0)	4 (57.1)	0 (0)	8 (40.0)	
Total	4 (20.0)	7 (35.0)	0 (0)	7 (35.0)	2 (10.0)	20 (100)	

NA: Not applicable;  $X^2$ : Chi-square value; p: p value is significant at 0.05

*Participants' Quality of Life before the Surgery and 3-months Post-surgery*

Before the surgery, participants expressed how they felt within the households and the society. Some of the selected participants' quotes reflect emotional, social, and practical challenges faced by participants before undergoing surgery:

“...always thinking of the situation and feeling shameful despite the fact that lots did not know”- Participant ID 29, Age 45 years.

“...It restrained my social interaction”- Participant ID 32, Age 55 years.

“...It really affects me that I even missed exams during school and my other daily activities” - Participant ID 36, Age 18 years.

“I used to be ashamed because my friends even make jest of me”- Participant ID 61, Age 18 years.

“Friends and family members were not aware of my conditions and now I'm better” - Participant ID 106, Age 50 years.

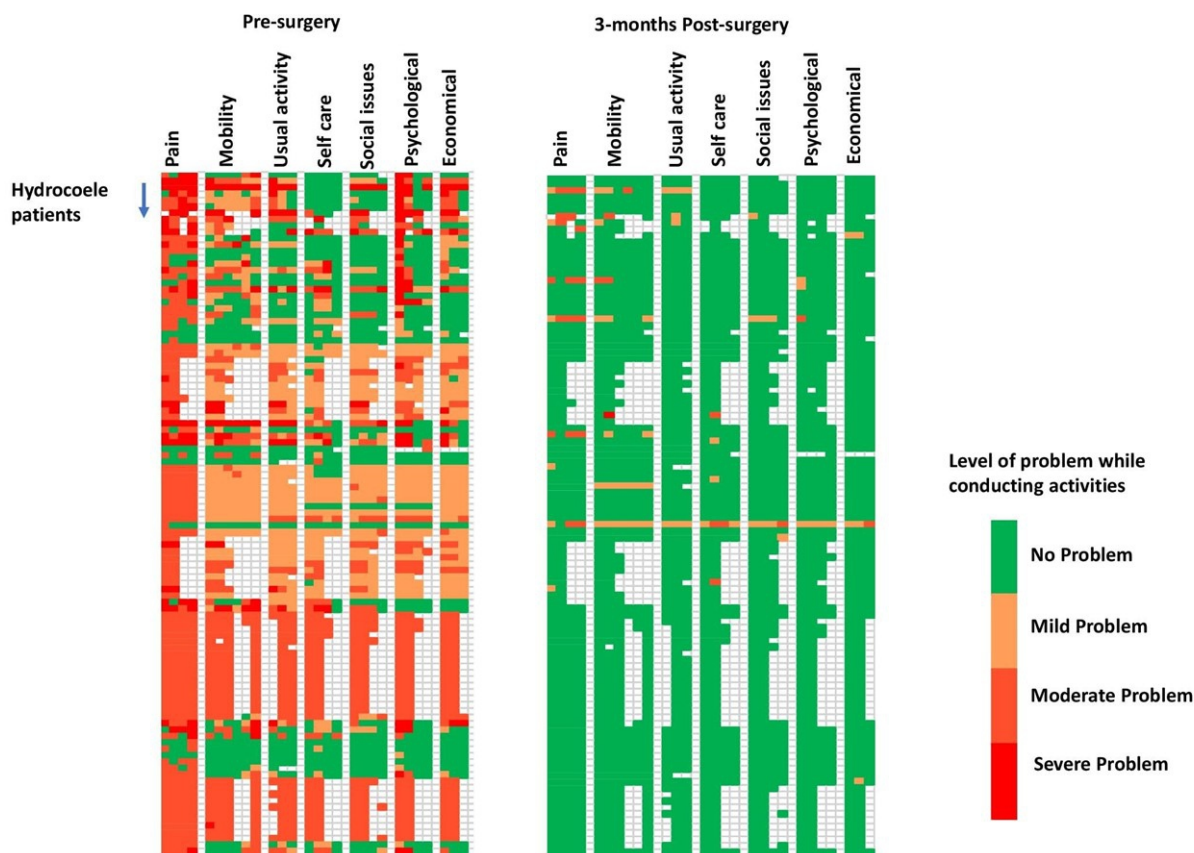
“I am not depressed but having issues when having

fun [intercourse] with my sexual ability” - Participant ID 32, Age 55 years.

“Affected my business and was unable to perform my marital right” - Participant ID 85, Age 43 years

“Unable to farm as I used to and also unable to carry out my marital right at home” - Participant ID 97, Age 65 years.

Figure 3 displays the color-coded scores representing each question across the seven domains for the interviewed participants (n=107). The colours visually illustrate the notable improvements in post-surgery problems compared to the pre-surgery stage. Previously, many problems were categorized as severe (red) or moderate (light orange), but after the surgery, most problems were classified as mild (deep orange) or non-existent (green). This indicates a significant enhancement in the participants' quality of life.



**Fig 3: Quality of life responses for hydrocoele patients across seven domains colour-coded by the level of problem during pre-surgery and 3 months post-surgery.**

The overall mean score for quality of life before surgery was 4.06 (SD = 2.92), with domain mean scores ranging from 2.95 to 6.83 (Table 5). However, at the 3-month post-surgery mark, the overall mean score for quality of life was 0.6 (SD = 1.56), with individual domain mean scores ranging from 0.07 to 0.39 (Table 5). There were significant differences in the mean quality of life scores before and after the surgery ( $p = 0.000$ ). Participants reported higher mean scores for the domains of pain (6.83), mobility (5.79), and psychological health (3.92) compared to

other domains. The self-care domain had the lowest mean score (2.78), indicating that participants faced more difficulties in that area. However, three months after the surgery, the mean scores significantly decreased, ranging from 0.07 to 0.39, indicating substantial improvements and the absence of difficulties. There were significant differences in the mean quality of life scores before and after the surgery for each assessed domain ( $p = 0.000$ ) (Table 5).

**Table 5: Summary of pre-surgery and post-surgery quality of life scores for hydrocoele patients across the domains**

Domain	Pre-surgery		3-months post-surgery			
	Mean QoL	SD	Mean QoL	SD	T-test	p-value
Pain	6.83	2.61	0.39	1.41	23.192	0.000
Mobility	5.79	3.60	0.29	1.07	15.71	0.000
Usual-activities	3.14	2.28	0.07	0.43	14.563	0.000
Self-care	2.78	2.09	0.11	0.65	13.374	0.000
Social issue	3.05	2.53	0.09	0.57	12.406	0.000
Psychological	3.92	2.19	0.07	0.45	18.400	0.000
Economical	2.95	2.05	0.07	0.44	14.552	0.000
Overall	4.06	2.92	0.60	1.56	30.776	0.000

For each of the domains, responses provided were graded on a four-point Likert scale, in which 0 corresponded to “no problem”, 1 to “mild problem”, 2 to “moderate problem”, 3 to “severe problem”. Questions related to sexual life were excluded for both children and adults considering the context of the study area. The individual scores were used to calculate an overall QoL score, which ranged between 0 (no problems recorded in all 28 questions) and 84 (severe problems recorded in all 28 questions). The mean QoL score for each domain ranged between 0 to 18 for mobility (6 questions), between 0 and 12 for pain, self-care, social issues, and psychological (6 questions each) and 0 and 9 for usual activities and economic domains (3 questions

each); p-value significant at 0.05; SD: Standard Deviation

#### *Impact Of Surgery On The Economic Life Of Participants During Pre-surgery And 3 Months Post-surgery.*

Table 6 illustrates the impact of hydrocoele surgery on the economic lives of the study participants, specifically in terms of their working hours. Before the surgical interventions, a significant portion of the participants were either unemployed (26, 24.3%) or worked for 1-4 hours per day (26, 24.3%), while others engaged in occasional work (23, 21.5%). However, three months after the surgery, most of the participants (46, 43.0%) were able to work for 5-8

hours per day, and (31, 29.0%) reported working for more than 8 hours. This represents a substantial increase of approximately 141% and 211% respectively in the proportion of participants with extended working hours. Additionally, there was a notable decline of 23% to 86% in the proportion of participants who were either unemployed or engaged in occasional work. Furthermore, when asked about

their income, most participants expressed how their earnings had doubled [Participants 4 & 7], while others mentioned a doubling of their farm outputs over the three months [Participants 1, 3, and 6]. Participants 2, 5, and 7 also highlighted their inability to work or generate income due to the pain experienced before the surgery (Table 7).

**Table 6: Working hours of participants during pre-surgery and 3 months post-surgery.**

Working hours (n=107)	Pre-surgery	3-months post-surgery	% Difference
	N (%)	N (%)	
No work	26(24.3)	20(18.7)	-23.0453
Retired	3(2.8)	1(0.9)	-67.8571
Seasonal	23(21.5)	3(2.8)	-86.9767
1-4 hours per day	26(24.3)	6(5.6)	-76.9547
5-8 hours per day	19(17.8)	46(43.0)	141.573
>8 hours per day	10(9.3)	31(29.0)	211.828

N: Number of respondents

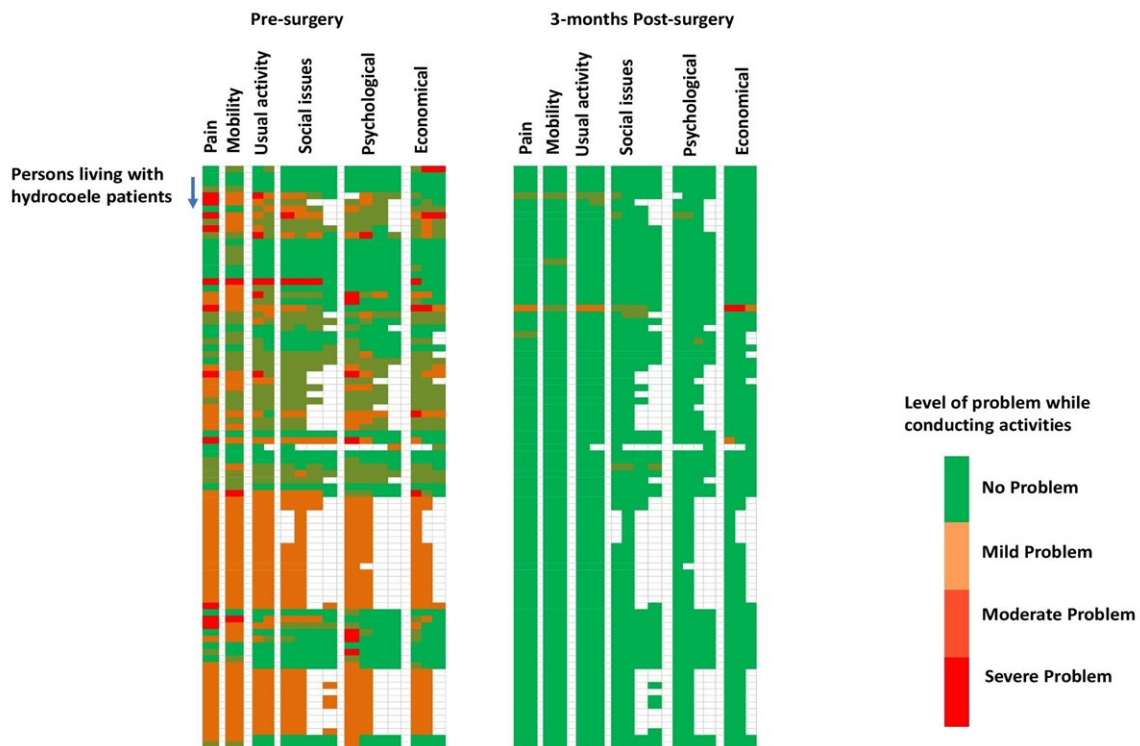
**Table 7: Some participants quote about their income before and 3 months post-surgery.**

Participant ID	Age	How much were you earning before the surgery	How much were you earning 3-months after the surgery
4	54	"I wasn't cultivating crops for commercial purposes because of the pain"	"Now I cleared a large piece of land for farming because I'm better now."
19	23	"I wasn't making any gain because whenever I go to the market I come with loss due to the pain..."	"After the surgery, I now earn about 6000 naira in a month."
106	50	"Before the surgery I farm 15 to 20 bags of maize ..."	"After the surgery, I can farm 25 to 30 bags of maize ..."
86	33	"Before the surgery I was making 500 to 1000 naira (\$2) per day..."	"After the surgery, I make up to 2000 naira (\$4) per day..."
87	60	"Before the surgery I was at home for 6 months due to pain..."	"After the surgery, I have started farming..."
8	70	"Before the surgery I was not able to cultivate up to a bag of maize?"	"After the surgery, I cultivate up to 5 bags of maize ..."
5	70	"I was lying at home before the surgery due to the pain..."	"Now I make up to 5000 naira in the days sales are bad..."

*Quality of Life before the Surgery and 3 Months Post-surgery among those Living with Hydrocoele Patients*

Fig 4 displays the colour-coded scores for each question across the six domains for individuals living with hydrocoele patients (n = 88). The colour-coded representation highlights the significant improvements observed from pre-surgery problems, where many problems were categorized as severe (red) and moderate (deep orange), to post-surgery, where most problems were classified as mild (light orange) or no problem (green). The overall mean quality of life (QoL) score before surgery was 2.19 (SD = 1.77), with mean domain scores ranging from 1.44 to 2.70 (Table 8). However, after three months post-surgery, the overall mean QoL score decreased significantly to 0.07 (SD = 0.49), with individual

mean domain scores ranging from 0.03 to 0.11 (Table 8). These differences in mean scores before and after surgery were statistically significant (p = 0.000). Individuals living with hydrocoele patients reported higher difficulties in the social (2.70), psychosocial health (2.68), and economic (2.51) domains compared to the domains of usual activity (2.38), pain (1.44), and mobility (1.44). However, after surgery, the mean scores decreased to a range between 0.03 and 0.11, indicating significant improvements and the absence of difficulties in these domains. Significant differences in mean QoL scores were observed between the pre-surgery and post-surgery stages for each assessed domain (p = 0.000) (Table 8). These findings highlight the positive impact of the surgery on the quality of life of individuals living with hydrocoele patients.



**Fig 4: Quality of life responses across six domains colour-coded by the level of problem during pre-surgery and 3 months post-surgery for those living with hydrocoele patients.**

**Table 8: Summary of pre-surgery and post-surgery quality of life scores across the domains for people living with hydrocoele patients**

Domain	Pre-surgery		3-months post-surgery			
	Mean QoL	SD	Mean QoL	SD	T-test	p-value
Pain	1.44	1.01	0.05	0.26	12.958	0.000
Mobility	1.44	0.81	0.03	0.18	16.014	0.000
Usual activities	2.38	1.72	0.08	0.48	12.595	0.000
Social issue	2.70	2.29	0.11	0.51	10.625	0.000
Psychological	2.26	1.82	0.03	0.24	13.464	0.000
Economical	2.51	1.98	0.11	0.88	11.672	0.000
Overall	2.19	1.77	0.07	0.49	27.817	0.000

### Discussion

The World Health Organization's recently published NTDs roadmap for 2021-2030 underscores the urgency of bolstering capacity for morbidity management and disability prevention (MMDP), a crucial step towards realizing the objectives of Sustainable Development Goal (SDG) 3 [15,16]. This present study therefore builds on ongoing investments in MMDP activities in Toro, one of the hyperendemic IUs in Nigeria. This is probably the first cohort study from the region, and it builds on a recent prospective study in Malawi [11], to quantify the clinical burden, knowledge, and barriers to surgery, in addition to the physical, social, psychological, and economic well-being of hydrocoele patients and their household members before the survey and at 3-months post-surgery.

Foremost, our findings revealed that less than 1% of the patients with hydrocoele had severe hydrocoele, compared to the 10% reported by Bett et al [11] in Malawi. The majority (about 40%) of those affected were minors, with unilateral hydrocoele, mostly in the first stage and without penis burial. The consequence of this condition on children's wellbeing was clearly expressed during qualitative interviews, as the majority were absent from school because of the pain they experienced. Without

appropriate care, children are likely to live with this condition till adulthood, hence impeding their chances of securing job opportunities, seeking partners, or having a quality life. These consequences have been extensively discussed by other authors [17,18] and hence require urgent attention.

Furthermore, like most other rural areas in the northeastern part of Nigeria, Toro is agrarian and the majority of those who were screened with hydrocoele were either farmers, self-employed or minors who rely on family support for survival. The impact of the hydrocoele on productivity of participants, were significant, as mean quality of life scores were higher in the pain, mobility, psychosocial and economic domain. Participants reported significant incapacitation to work for longer hours which impacted their productivity and directly resulted in poor income. This is in line with several other reports [11,17,18,19,20]. In addition, participants experienced shame and social exclusion as they could neither perform marital rights with their partners nor engage in social activities with their friends and members of the larger society [18,20,21]. The psychosocial impact and economic consequences of hydrocoele are potentially huge and quite debilitating as shown with other NTDs [20,21,22,23].

Our study has thus shown a significant improvement in the quality-of-life following hydrocoele surgeries across all domains examined for both hydrocoele patients and their household members within 3-6 months, with over a hundred percentage increase in working hours and productivity, coupled with the ability to socialize with friends and perform marital rights. These findings are important as very little is known about the impact of the disease and ongoing surgical interventions in the IUs [11, 24]. However, there are a limited number of implementation activities focusing on providing essential care to LF-affected persons, especially surgical services to those with hydrocoele in Nigeria. It is therefore imperative to prioritize access and delivery of equitable, inclusive, and compassionate surgical services to people with hydrocoele in line with the 2030 elimination targets for LF [3, 25, 26].

On the other hand, our study also identified the perceived cost of surgeries as a major limitation for seeking surgical care among study participants. This finding is in line with previous reports from [11,12] who highlighted cost and access to transport as a significant barrier to surgical health care especially among patients who live very far from the operation centres. It is therefore necessary that national and regional programs continue to provide financial support to patients who desire surgical care to ensure equitable coverage and access. MITOSATH is one of the indigenous non-governmental developmental organizations providing free hydrocoele surgeries in Nigeria. In Toro, the average cost of hydrocoele surgery was estimated at US\$68 per person. This is inclusive of surgical supplies, support to surgical teams, patient transport, food, and accommodation. Considering the resultant economic impact of the surgeries in the IUs, as observed via reduced pain, increased mobility, improved social interactions and increased productivity. It is therefore important to increase investments and coverage of these interventions to more affected persons.

This study has some limitations. Foremost, the surgical interventions that preceded our survey employed a community-wide sensitization approach to mobilize residents with swollen scrotum to a health screening camp. This method has its inherent limitation of low turnout, especially with patients who fear surgeries or have been previously stigmatized to have hydrocoele [28]. It is therefore vital to invest in more inclusive social mobilization strategies that reduce stigma and increase uptake and

demand for quality surgical services [11, 26]. In addition, the participant's lack of knowledge about what causes both hydrocoele and lymphatic filariasis was appalling and may likely impact awareness and participation in prevention, treatment, and care interventions. Incorporating health educational messages on prevention, treatment, and care options for lymphatic filariasis in social mobilization campaigns, especially on regular and widely aired radio programs would be an important addition towards improving the uptake and demand of surgical services [29,30].

### **Conclusion**

Our study sheds light on the notable enhancement in the quality of life experienced by persons who underwent hydrocoele surgeries. These improvements were observed across various domains and were consistent for both the hydrocoele patients themselves and their household members. The findings of our study are particularly significant due to the limited existing knowledge regarding the impact of ongoing surgical interventions in the implementation units. Therefore, it is crucial to increase investments in interventions that prioritize accessibility and the equitable delivery of surgical services to individuals affected by hydrocoele. By doing so, we can align with the 2030 elimination targets for lymphatic filariasis and ensure that these interventions are inclusive and compassionate.

### *Limitations of this study*

The study focused on assessing the impact of hydrocoele surgeries on the quality of life of individuals residing in an LF-endemic area. It is important to note that hydrocoele among young participants in this study was likely not LF-related but congenital. This distinction is crucial in understanding the specific context of the condition. Furthermore, the community-wide sensitization approach employed in this study aimed to mobilize residents with swollen scrotum to attend a health screening camp. However, it is acknowledged that this method may have limited the turnout of participants, particularly those who may have been apprehensive about undergoing surgeries or have previously experienced stigmatization due to their condition. The low participation rate of individuals with hydrocoele might introduce a selection bias and could impact the generalizability of the findings. Another limitation of the study is that participants were not screened for hernia and mental health status before surgical intervention. These factors could



potentially influence patient recovery and outcomes, and their omission should be considered when interpreting the study results. These limitations should be duly acknowledged and addressed in future surveys and research endeavours. By incorporating a more comprehensive assessment of medical conditions and considering alternative recruitment strategies, such as addressing patient concerns and stigma associated with the condition. Future studies can also provide a more comprehensive understanding of the impact of hydrocoele surgeries on the quality of life among beneficiaries (cases) and controls.

#### Declarations

##### Ethics Approval and Informed Consent

This study received ethical approval from the ethical review board of the Bauchi State Government (SPHCDA/GEN/066V). Permission and consent were also obtained from the NTD control units in Bauchi and Toro LGA. Consent was sought from the community leaders across the selected communities before data collection. Written informed consent was obtained from study participants above 16 years of age. However, for children below 16 years, an assent form was administered, and additional written consent was obtained from their parent or guardian. Unique identifiers and a password-protected database was also used to ensure anonymity and confidentiality through the study procedures.

##### Authors' Contributions

OFO, MHO conceptualized the study. MHO prepared the protocol, while OFO, OOJ, MD, AI, AH, MR, AH, OF improved the protocol. ME, OS, TE participated in field surveys and data collection. MD, NHB supervised field surveys. MHO performed all statistical analyses and prepared the first draft of the manuscript. All authors contributed to the development of the final manuscript and approved its submission.

##### Disclosure of Conflicts of Interests

The authors declare that they have no competing interest

##### Disclosure of Funding Source(s)

Not applicable

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