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ORIGINAL ARTICLE

# Polyester mosquito net mesh for inguinal hernia repair: A feasible option in resource limited settings in Cameroon?

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## KEYWORDS

Inguinal hernia;  
Developing countries;  
Mosquito mesh;  
Indigents

## Summary

**Background:** In developing countries, most inguinal hernia repairs are performed using Bassini or Shouldice techniques resulting in higher recurrence rates than with mesh placement. Our study aimed to evaluate the postoperative course and quality of life of patients undergoing inguinal hernia repair with a polyester mosquito net meshes during non-governmental organization health campaigns in Cameroon.

**Methods:** Patients were prospectively included from January to November 2013. Meshes were made from a polyester non-impregnated mosquito net purchased at a local market in Yaounde and sterilized on site.

**Results:** The total cost of a mesh was 0.21 USD. Among the 41 patients included in the study, 33 (80.5%) were men, 30 (72%) were farmers and the median age was 52 (21–80) years. The time between the onset of symptoms and surgery was 24 (3–240) months. Eleven (26.8%) patients had a previous history of hernia repair: 4 (9.7%) had been operated on the contralateral side and 7 (17.1%) had a recurrence. No intraoperative event related to the meshes was recorded. Three patients (7.2%) had a postoperative uninfected scrotal seroma, and 1 patient (2.4%) experienced a superficial skin infection that was treated using local care and oral antibiotics. No allergic rejection or deep infection was observed.

**Conclusions:** Meshes made from sterilized mosquito nets are safe and effective and provide a cost-effective alternative to commercially available meshes in countries with limited resources especially during non-governmental organization health campaigns.

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## Introduction

Inguinal hernia repair is one of the most frequently performed procedures worldwide, but raises specific problems in developing countries [1–3]. As an example, the prevalence of inguinal hernias is estimated to be 3% with an incidence of 210/100,000 inhabitants per year in the Ghanaian population, with an inguinal repair rate of only 30/100,000 each year [4]. In developing country with limited resources, a mesh is used in less than 5% of patients [1], mainly because these expensive devices (between 60 and 100 euros [5,6]) are neither affordable nor available [2]. Therefore, most inguinal hernia repairs are performed using Bassini or Shouldice techniques [7–9], resulting in higher recurrence rates, especially for large hernias, compared with the use of mesh [10]. In view of the high incidence of hernia disease in sub-Saharan Africa and the detrimental medical and social consequences that can occur if hernias are left untreated, hernia repair with mesh placement should be viewed as a public health issue [11].

Several teams have used various cheap materials, such as polyester or nylon from mosquito nets [5,6,12–14] as a replacement for traditional meshes. However, these meshes were often manufactured in Europe, and the sterilization program was not clearly detailed [15].

Recently, a randomized controlled trial showed that rates of hernia recurrence and postoperative complications were not significantly different between patients treated by a mosquito mesh or a commercial one [16].

The feasibility of such procedures has not been evaluated in rural conditions, especially during health campaigns of a non-governmental organization (NGO).

The present study aimed to evaluate the feasibility, post-operative course and quality of life of patients undergoing inguinal hernia repair with placement of locally manufactured polyester mosquito net meshes in Cameroonian's rural area during NGO health campaigns.

## Patients and methods

### Patient selection

This study was approved by the Ethics Committee of the Biomedical Sciences University of Yaounde. Patients were prospectively included during health campaigns conducted by the non-governmental organization (NGO): "Association des competences pour une vie meilleure" (ASCOVIME) according to Cameroon national legislation [17]. Inclusion criteria were: patients over 18 years of age with unstrangulated inguinal or inguino-scrotal hernias. Exclusion criteria were: patients under 18 years of age and/or undergoing another surgery during the same operative procedure. Each patient received an oral explanation of the purpose of the study in French, English or local dialect and signed the consent form.

### Mesh production and analysis

Meshes were made from a polyester non-impregnated mosquito net purchased at a local market in Yaounde. The net was initially designed for a "classical" mosquito-protective use. For the purpose of surgery, meshes were cut into rectangles of 10 × 16 cm (Fig. 1, pan A), folded in half lengthwise, packaged in two sealed plastic bags (Fig. 1, pan B) and then sterilized on site at the Yaoundé Central

Hospital using an autoclave at a temperature of 130 °C for 18 minutes, with a 30 minute warm-up cycle and a 30 minute post-treatment cycle (Fig. 1, pan C) [18]. Sterilization was verified using a quality control color indicator. The meshes were used within an arbitrary three-week period and were no longer considered sterile beyond this time period.

The physical, mechanical and chemical characteristics of the meshes were analyzed in a biomaterial laboratory in France and compared to commercially available meshes. The studied characteristics of the meshes included density, cell seeding and proliferation, resistance to uni-axial tensile test, tear propagation resistance and burst strength. These characteristics were measured using previously reported techniques [19].

### Characteristics of the meshes

The non-impregnated polyester mosquito net purchased at the local market costed 2500 FCFA [3.80 euros/4.31 US dollars (USD)]. It allowed for designing and cutting 100 rectangle meshes. The gross cost of a single mesh was 25 FCFA (0.038 euro/0.043 USD). The cost of the sealed plastic used for the packaging was 100 FCFA (0.15 euro/0.17 USD). Sterilization was considered free of charge because the meshes were sterilized along with surgical instruments. Overall, the manufacturing cost of one mesh was 125 FCFA (0.19 euro/0.21 USD).

The macroscopic structure of the implant was not affected by the sterilization. The implants were made of polyester polyethylene terephthalate (PET) knitted in multifilament. The pore size varied from 2 to 2.3 mm. The mesh was non-cytotoxic with good cell proliferation (less than 19% cell death at day 4 and less than 12% cell death at day 6) after cell seeding. The meshes weighted 34g/m<sup>2</sup>. The tensile strength in the uni-axial tensile test was 200 Newtons (N) in the direction of the manufacture of the material and 65N in the transverse direction. The tear propagation resistance was 15 N. The tensile stress was 20 N/cm. Table 1 shows the comparison of the polyester mosquito net mesh with a commercially available Mersilene<sup>®</sup> mesh.

### Surgery

Ambulatory surgery was performed for all patients during a one-day surgery campaign, usually located in a local school temporarily transformed into a medical facility [17]. Prior to surgery, the patients were shaved in the pubic region up to the umbilicus. Skin disinfection included soap, 90% alcohol and dermal iodized polyvidone. All procedures were performed under local, spinal or general anesthesia, depending on the availability of the products, the general condition of the patients and the presentation of the hernia. The hernia repair was conducted using the Lichtenstein technique as previously reported [20]. The mesh was fixed with a 00 non-absorbable monofilament suture (Fig. 1, pan D). The skin was closed with non-absorbable separated sutures. Routine antibioprophyllaxis included intravenous or intramuscular injection (ceftriaxone 1g) of a third-generation cephalosporin one hour before skin incision followed by five days of oral amoxicillin (1g, 3 times daily) and metronidazole (500mg, 3 times daily) [8,12]. Postoperative analgesia included a non-steroidal anti-inflammatory (ibuprofen 200mg/day) along with a gastroprotective treatment and an analgesic medication for five days. After discharge, the patients were seen by a nurse every two days to check the scar. Cutaneous sutures were

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