Original Article

Resterilized Polypropylene Mesh for Inguinal Hernia Repair

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Abstract

Purpose: The use of prosthetic biomaterials for reconstructing and reinforcing the posterior wall of the inguinal canal reduces the incidence of hernia recurrence. Cost, availability of mesh, and perhaps reluctance to adopt a new technique are factors which prevent widespread practice of hernioplasty in low-resource settings. Use of resterilized mesh significantly reduces the cost of hernioplasty and is safe. **Patients and Methods:** Sheets of 30 cm × 30 cm polypropylene mesh were cut into 16 cm × 8 cm to produce mesh strips which were repackaged into SELFSEAL® (Medical Action Industries Inc., USA) sterilizing pouches measuring 90 mm × 230 mm and autoclaved. At repair, the strips are shaped to fit the anatomy of the posterior wall of the inguinal canal, a slit created at one end and applied in Lichtenstein repair of inguinal hernias. Patients were monitored for seroma collection and wound infection up to 2 weeks postoperative period. **Results:** Sixty inguinal hernia repairs were done in 58 patients using the resterilized mesh; two cases being bilateral. One patient (1.7%) had seroma collection at 2 weeks which was aseptically aspirated. We did not record any case of wound infection. **Conclusion:** The use of sterilized polypropylene mesh for the repair of inguinal hernias is safe and reduced the cost of hernioplasty by reducing the cost of polypropylene mesh. This technique is recommended in low-resource settings.

Keywords: *Inguinal hernia, Lichtenstein repair, low-cost, sterilized mesh*

Introduction

Inguinal hernia repair constitutes a significant part of the workload of the general surgeon worldwide.[1,2] West Africa is known to have a high prevalence of inguinal hernia which makes the disease a major public health concern.[3] However, hernia repair rate in the region is very low compared to the rate in Caucasians, resulting in a higher tendency for patients in Sub-Saharan Africa to present for the first time with obstructed or strangulated hernias, either of which heightens the associated morbidity or mortality.[4,5]

The Bassini repair, its modifications or other suture repairs are still commonly practiced by many hernia surgeons in Sub-Saharan African countries.[6] Most suture repairs for inguinal hernia are done under tension with implications for tissue ischemia, poor healing, and subsequent recurrence which contrast with current practice by colleagues in Europe and North America who routinely practice the Lichtenstein or other tension-free repairs with a lower recurrence rate and incidence of postoperative pain.

Current best practice for inguinal hernia repair recommends the use of prosthetic biomaterials for reconstructing and reinforcing the posterior wall of the inguinal canal to reduce the incidence of hernia recurrence.[7] Polypropylene is the most common biomaterial employed in tension-free hernia repair but newer materials such as poliglecaprone and polytetrafluoroethylene have been introduced into hernia repair, and recent fabric designs tend toward a large pore weave and/or a composite of absorbable and nonabsorbable materials to reduce the tissue–mesh

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interface and lower the quantum of tissue inflammatory response post insertion.

Cost, availability of mesh, and perhaps reluctance to adopt a new technique are specific factors which combine to prevent widespread adoption of bioprosthesis for hernia repair in low-resource settings. Few workers have used sterilized nylon nettings to repair inguinal hernias in Africans and report favorable outcome at very low cost.[6,8] Flat mesh is much readily available and cheaper in our practice when compared to designed mesh for inguinal hernia repair. The use of sterilized flat mesh meant for incisional hernia repair is an alternative which we have been practicing in our center since we introduced the Lichtenstein repair 10 years ago, and in our opinion, it significantly reduces the cost of hernioplasty using commercial mesh specifically designed for inguinal hernia repair.

The immediate concern for resterilizing mesh is the risk of postoperative surgical site infection which may warrant mesh excision postoperatively. This study looks at the risk of postoperative infection, the tendency of the sterilized mesh to grow microbes *in vitro*.

Setting

This study was conducted in the General Surgery and Microbiology units of a University Teaching Hospital.

Study type

A prospective, observational study done over an 18-month period.

Ethical approval

The approval was obtained from the Institutional Health Ethical Review Committee.

Inclusion criteria

Patients 18–65 years old in the American Society of Anesthesiologist I and II presenting with simple unilateral or bilateral inguinal hernia residing <1 h drive from the hospital and have a functional mobile phone contact.

Exclusion criteria

Patients presenting with obstructed or strangulated inguinal hernias, those having severe comorbidities that warrant admission, those residing >1 h drive from the hospital, and those without a functional mobile phone contact.

Patients and Methods

Sheets of 30 cm × 30 cm polypropylene mesh (Premilene® mesh, BBRAUN Aesculap, 82 g/m^2) were cut into strips which were repackaged into SELFSEAL® (Medical Action Industries Inc.) sterilizing pouches [Figures 1 and 2] measuring

Figure 1: SELFSEAL sterilizing pouch showing sterilization indicator

Figure 2: Mesh inside sterilizing pouch

90 mm × 230 mm and steam sterilized at 121°C for 25 min. Random samples of the sterilized mesh were sent for bacteriological studies at day 7 and 60 poststerilization. Each mesh was cut into two parts under aseptic conditions, labeled, and inoculated into brain–heart infusion (oxoid) and thioglycolate (oxoid) broths and incubated at 37°C for 48 h. These were subsequently subcultured into MacConckey, blood and chocolate agars, and incubated aerobically with 5% carbon dioxide and anaerobically for 5–7 days. The plates were examined for the growth of microorganisms and such growths characterized and identified.

The patients who were considered fit for inclusion into the study had a minimum of full blood count and urine analysis done and were informed of sterilized heavyweight polypropylene mesh for the hernia repair under an ambulatory setting and given the option of withdrawing from the study at any stage. Written consent for repair was obtained from each patient and the operations scheduled for the next day case list.

The repair was done by consultant general surgeons as ambulatory procedures under ilioinguinal nerve block with 20–30 ml of 0.5%–1.0% xylocaine (0.5% is used when additional agent is required intraoperatively). At hernia repair, each patient received 1gm of intravenous

Ceftriaxone. We routinely use an oblique inguinal incision and only plicate the transversalis fascia if it is widely stretched. A strip of sterilized mesh was taken out of the pouch, shaped to fit the anatomy of the posterior wall of the inguinal canal, a slit created at the lateral end of the mesh and applied over the posterior inguinal wall and fixed with Prolene® 2/0 to the inguinal ligament below and the external oblique aponeurosis above. Oral extended release ketoprofen and paracetamol were given for postoperative analgesia. All patients were assessed at 1 week in clinic for evidence of pain, erythema, swelling, or discharge of pus from the surgical site.

Data obtained included patient age, sex, evidence of wound infection (erythema or discharge of pus from operation site), and seroma collection (swelling) at day 7 and 14 postprocedure. The type of microbes cultured from the mesh was recorded.

Data analysis

The data were analyzed using SPSS for Windows version 17 (SPSS Inc. Chicago, IL, USA) and presented as percentages and tables.

Results

Sixty inguinal hernia repairs were done in 58 patients; 51 males and 7 females [Table 1]. No organism was cultured from the first batch of mesh samples sent for microbial culture at 1 week of sterilization. One mesh sample from the second batch at 1 week of sterilization grew *Bacillus cereus*. The 6 weeks mesh batched specimen grew no organisms [Table 2].

Table 1: The characteristics of patients studied

Patient characteristics	Frequency (%)
Gender	
Male	51 (88)
Female	7 (12)
Complication	
Surgical site infection	0
Seroma collection	1 (1.7)

Table 2: Microbial profile of cultured polypropylene mesh per duration of storage before use

Number in batch	Storage time (days)	Incubation (days)	Number growing organisms	Organism isolated
3	7	7	0	None
3	7	7	1	*Bacillus cereus*
3	60	7	0	None
3	60	7	0	None

Discussion

The unmet surgical needs in much of Africa are huge[9-11] and the persisting low socioeconomic indices, especially in the rural communities, contribute to the unmet needs. Most common surgical pathologies in the region such as abdominal wall hernias are amenable to simple, inexpensive procedures, but these conditions remain as important causes of morbidity and mortality. Managing surgical diseases in these resource-poor settings which lack basic infrastructure and medical insurance calls for ingenious acts not considered harmful to the patients. We consider the provision of resterilized mesh for inguinal hernia repair as an important intervention; this disease presents often with preventable complications of obstruction and strangulation. An effective elective repair of abdominal wall hernia prevents these complications and improves the quality of life.

The use of prosthesis to overlay the hernia defect and reinforce the posterior inguinal wall has supplanted most other known techniques of inguinal hernia repair in Europe and North America. The prosthesis induces a foreign body reaction resulting in laying down scar tissue, which forms a new and stronger posterior wall of the canal. Clinical evidence ascribes the popularity of prosthetic repair to the absence of tension and low incidence of recurrence. The Lichtenstein technique is the most commonly practiced because of its ease of execution.

In much of Sub-Saharan Africa, the Bassini repair is still commonly practiced. The cost and availability of pre-shaped prosthesis for inguinal hernia repair have been adduced as reasons for the very low application of these biomaterials for hernia repair.[12] Few hernia surgeons in the region have advanced the use of sterilized meshed window nettings as a cheap alternative to mesh for inguinal hernia repair and have done studies with same which produced results comparable to mesh for hernia repair.[8,13,14] Our primary concerns on the use of this alternative to mesh bother not only on the absence of long-term efficacy and safety profile of this material but most importantly that this device is not designed for use in humans and does not meet the requirements of an ideal mesh.[15]

Sheets of polypropylene mesh designed for ventral hernia repair are cheap and readily available in our practice. This is unlike preshaped mesh for inguinal hernia repair which is still very scarce in the West African subregion. We routinely improvize mesh for repairing inguinal hernias by cutting 30 cm × 30 cm sheets of polypropylene mesh into strips of 16 by 8 cm and autoclaving same along with other surgical supplies. The approximate cost per sterilized mesh is $n = 2700$. This compares against $N = 51{,}334$ for a pack of 3

(6 cm × 11 cm) polypropylene mesh or N = 89,648 for a composite of prolene and monocryl for a pack of 3 (6 cm × 11 cm). We have practised resterilizing of polypropylene mesh since we adopted the Lichtenstein repair in our institution >10 years ago, and find this practice to be cost-effective and reliable in providing us with a constant supply of mesh for inguinal hernia repair.

Maintaining a high-level of sterility of the mesh is critical to preventing postoperative surgical site infection which potentially increases the cost of care, especially if it warrants excision of the mesh. To minimize this risk, we ensure that the process of preparing and sterilizing the mesh is handled by a single individual. We routinely employ antibiotic prophylaxis in all patients and have not recorded in 10 years of practice an incident of wound infection. *In vitro* bacteriological studies of randomly selected samples of the sterilized mesh grew *B. cereus* in only one mesh at 1 week of sterilization in this study. This single positive culture was, however, considered to be from contamination of the specimen; the organism is known to be a common contaminant in our laboratory.

Seroma collection is an inflammatory response[16,17] which intensity depends on the mesh-tissue area of contact; it is minimal with inguinal hernioplasty because the implanted mesh dimension is small and tissue dissection is minimal. Much of the seroma gets absorbed and does not require intraoperative placement of a drain but in the event of its occurrence postoperatively can be adequately treated by aseptic aspiration.

We consider our technique of providing sterilized mesh for inguinal hernia repair to be safe though not ideal. It has improved our capacity to practice the Lichtenstein repair and proven its low recurrence rates, and we recommend same to colleagues who are challenged with sourcing mesh for hernia repair at affordable cost. Attention to details in sterilizing the mesh should be emphasized to prevent surgical site infection.

A major limitation of this study was our inability to perform anaerobic cultures on the sterilized mesh because of cost; we may have missed anaerobic pathogens if such were present. We also could not also assess the effects of heat of autoclaving on the physical structure of the sterilized polypropylene mesh. A tensile strength test was planned as a part of this study but could not be done because we lacked the relevant instruments in our immediate environment.

Conclusion

Inguinal hernia is a major public health issue in much of Africa which requires urgent attention. The use of sterilized polypropylene mesh for the repair of inguinal hernias is safe and does not significantly add to the cost of hernia repair. Use of resterilized polypropylene mesh for the Lichtenstein hernioplasty is recommended in low-resource settings.

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Conflicts of interest

There are no conflicts of interest.

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