The Use of Mosquito Nets in Hernia Repair

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Introduction

Global surgery is a rapidly-growing field of study, and as investment in this area increases, it will be necessary to expand efficiently. With resources being stretched to their limits, low-cost surgical innovations are crucial in ensuring that all countries are able to provide the highest standard of treatment with the available materials. Hernia repair operations are the most common surgical procedure undertaken globally, but the exorbitant import fees of commercial mesh required for effective repair often render this prohibitively expensive in low- and middle-income countries (LMICs). Hernias can, therefore, become extremely debilitating to residents in LMICs if left untreated, limiting their capacity to work. In these countries, mosquito nets are often so heavily subsidised and widely distributed that they are repurposed, e.g. as fishing nets[1]. RR Tongaonkar was the first to recognise these nets' potential as replacements for commercial mesh, and has demonstrated this in hundreds of different cases over a number of years[2,3]. Since his seminal 2003 paper, there have been many studies documenting the effectiveness of these nets, but they have not yet been implemented on a wide-scale. In this poster, I make a case in favour of the use of simple mosquito nets in place of commercial mesh in tension-free hernia repair, by describing their favourable properties.

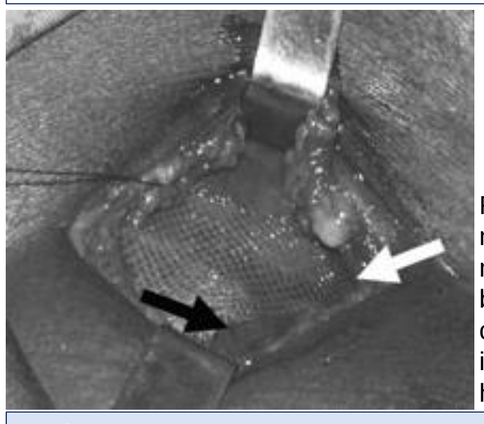

Figure 1. A nylon mosquito net being used to correct a right inguinal hernia[4].

Literature Search

Study (Author, Year) Types of Mesh	Number Inserted	Complications/Recurrences (%)
Freudenberg *et al.* 2006		
Mosquito net (nylon)	18	0/0
Ultrapro® (polypropylene)	18	0/0
Clarke *et al.* 2008		
Mosquito net (polyester)	106	7 (6.6)/0
Löfgren *et al.* 2016		
Mosquito net (polyethylene)	143	44 (30.8)/1 (0.7)
Polypropylene	148	44 (29.7)/0
Rouet *et al.* 2017		
Mosquito net (polyester)	41	4 (9.8)/0

Table 1. Literature review comparing the rate of complications and recurrences in the use of mosquito nets and commercial mesh in hernia repair[4-7].

	Total inserted	Complications (%)	Recurrence (%)
Mosquito net	308	17.8	0.3
Commercial mesh	166	26.5	0

Table 2. Collated data from Table 1.

•Tables 1 and 2 show that mosquito nets are effective replacements for commercial mesh, with just one recurrence, and a lower complication rate than the mesh.

- The smaller sample size of the commercial mesh may give a more extreme value for complications, but the efficacy of the mosquito nets is undeniable.
- Complications' include seromas, haematomas, and surgical site infections.

•PubMed search: (Hernia [mesh]) AND (mosquito net OR mosquito nets OR mosquito OR (mosquito AND polyethylene)).

- Inclusion criteria: 25 results, only analysed primary research papers written in English, in which the primary outcomes were complications/recurrence, and raw numerical data were included.
- Left with just 4 papers.

Necessary Considerations

Wound Healing

Complication and recurrence rates are comparable to those in commercial mesh operations, but it can be difficult to predict long-term consequences of using mosquito nets in hernia repair, as this is a relatively new technique. In 2003, Sharma *et al.* compared the in-vitro effects of using a polyethylene mosquito net and commercial polypropylene mesh histologically in rats, and found that while the mesh induced a greater inflammatory response, collagen fibre deposition was much closer to the commercial alternative. Professor Sharma suggests that this is a favourable indication of wound healing[8].

Mechanical Properties

Any material used in hernia repair must be strong enough to prevent recurrence, and have minimal variation in tensile strength relative to orientation (anisotropy). In 2013, Sanders *et al.* compared polyethylene mosquito nets with two brands of commercial polypropylene mesh. They showed that the 'bursting force' of mosquito nets was far greater than for the commercial meshes, and these had less anisotropy, indicating orientation in the patient is less important[9]. Data from other labs indicates polyester may be less efficacious, but polypropylene mesh is a suitable alternative[10].

Sterilisation

The major obstacle to the use of mosquito nets is the necessity to sterilise them, as effective sterilisation techniques, such as the use of ethylene oxide, can be expensive. Many hospitals in LMICs have steam autoclaves, a low-cost sterilisation method; 134℃ is the required temperature in the UK, but this can damage the mosquito nets' structure. There is evidence that steam sterilisation at 121℃ is sufficient to prevent wound sepsis while maintaining mesh structural integrity, a compromise which may solve this problem[11]. However, some meshes may still be damaged at this temperature, so more work is needed[12].

Conclusion

Mosquito nets are a suitable alternative to commercial mesh with regard to their efficacy (comparative recurrence and complication rates), wound healing (pro-fibrotic nature), and mechanical properties (high bursting force and low anisotropy). Some refinement is necessary in their sterilisation, but the major task which remains to be done is to raise awareness about this frugal answer to a global question.

References

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