The Use of Mosquito Nets in Hernia Repair Kamath A, Khundkar R, Sharma D, Lakhoo K

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 nets¹. 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.

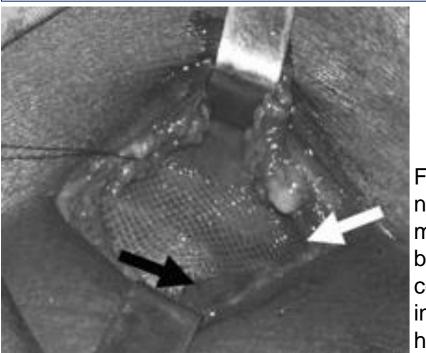


Figure 1. A nylon mosquito net being used to correct a right inguinal hernia⁴.

iterature Search				Necessary Considerations	
Study (Author, Year) Types of Mesh		Number Inserted	Complications/Rec urrences (%)	Wound Healing Complication and recurrence	Mechanical Properties Any material used in hernia repair
Freudenberg <i>et al.</i> 2006 Mosquito net (nylon) Ultrapro® (polypropylene)		18 18	0/0 0/0	commercial mesh operations, but recurrence, and have it can be difficult to predict long- variation in tensile	
Clarke <i>et al.</i> 2008 Mosquito net (polyester)		106	7 (6.6)/0	mosquito nets in hernia repair, as this is a relatively new technique. In 2003, Sharma <i>et al.</i> compared the in-vitro effects of using a polyethylene mosquito net and commercial polypropylene mesh histologically in rats, and found	
Löfgren <i>et al.</i> 2016 Mosquito net (polyethylene) Polypropylene		143 148	44 (30.8)/1 (0.7) 44 (29.7)/0		
Rouet <i>et al.</i> 2017 Mosquito net (polyester)		41	4 (9.8)/0	that while the mesh induced a greater inflammatory response, indicating orientation collagen fibre deposition was much closer to the commercial labs indicates polyealternative. Professor Sharma less efficacion	and these had less anisotropy, indicating orientation in the patient
			,		
	Total inserted	Complications (%	%) Recurrence (%)	indication of wound healing ⁸ .	polypropylene mesh is a suitable alternative ¹⁰ .
Mosquito net	308	17.8	0.3	Sterili	sation
Commercial mesh	166	26.5	0		mosquito nets is the necessity to
Table 2. Collated data fr	rom Table 1.		sterilise them, as effective sterilisation techniques, such as the use of ethylene oxide, can be expensive. Many hospitals in LMICs have steam		
commercial mesh, with	•		autoclaves, a low-cost sterilisation method; 134°C is the required temperature in the UK, but this can damage the mosquito nets' structure. There is evidence that steam sterilisation at 121°C 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 .		
The smaller extreme value	ue for complication				
Complication infections.	ns' include serc	mas, haematoma	Conclusion		
			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.		
 Inclusion cri written in complication 	teria: 25 results, English, in v ns/recurrence, and	only analysed prin which the prima			
	Study (Author, Year) Types of Mesh Freudenberg et al. 200 Mosquito net (I Ultrapro® (poly Clarke et al. 2008 Mosquito net (I Löfgren et al. 2016 Mosquito net (I Rouet et al. 2017 Mosquito net (I Table 1. Literature revie the use of mosquito net Mosquito net Commercial mesh Table 2. Collated data fr •Tables 1 and 2 sho commercial mesh, with the mesh. > The smaller extreme valu is undeniabl > Complication infections. •PubMed search: (Hern mosquito OR (mosquito > Inclusion cri written in complication	Types of Mesh Freudenberg et al. 2006 Mosquito net (nylon) Ultrapro® (polypropylene) Clarke et al. 2008 Mosquito net (polyester) Löfgren et al. 2016 Mosquito net (polyethylene) Polypropylene Rouet et al. 2017 Mosquito net (polyester) Table 1. Literature review comparing the the use of mosquito nets and commercia Mosquito net al. 308 Commercial mesh Collated data from Table 1. * Tables 1 and 2 show that mosquito commercial mesh, with just one recurrent the mesh. > The smaller sample size of extreme value for complication is undeniable. > Complications' include sero infections. • PubMed search: (Hernia [mesh]) AND mosquito OR (mosquito AND polyethyler > Inclusion criteria: 25 results, written in English, in v	Study (Author, Year) Types of Mesh Number Inserted Freudenberg et al. 2006 Mosquito net (nylon) Ultrapro® (polypropylene) 18 Clarke et al. 2008 Mosquito net (polyester) 106 Löfgren et al. 2016 Mosquito net (polyethylene) Polypropylene 143 148 Rouet et al. 2017 Mosquito net (polyester) 41 Table 1. Literature review comparing the rate of complicatio the use of mosquito nets and commercial mesh in hernia report Mosquito net 308 Mosquito net 308 17.8 Commercial mesh 166 26.5 Table 2. Collated data from Table 1. • •Tables 1 and 2 show that mosquito nets are effectit commercial mesh, with just one recurrence, and a lower of the mesh. > •The smaller sample size of the commercial mesh extreme value for complications, but the efficacy is undeniable. > •Complications' include seromas, haematomas infections. • •PubMed search: (Hernia [mesh]) AND (mosquito net Of mosquito OR (mosquito AND polyethylene)). > • Inclusion criteria: 25 results, only analysed prin written in English, in which the prima complications/recurrence, and raw numerical data	Study (Author, Year) Types of Mesh Number Inserted Complications/Rec urrences (%) Freudenberg et al. 2006 Mosquito net (nylon) Ultrapro® (polypropylene) 18 0/0 Clarke et al. 2008 Mosquito net (polyester) 18 0/0 Löfgren et al. 2016 Mosquito net (polyester) 106 7 (6.6)/0 Löfgren et al. 2017 Mosquito net (polyester) 143 44 (30.8)/1 (0.7) 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)). > Inclusio nriteria: 25 resu	Study (Author, Year) Types of Mesh Number Inserted Complications/Rec urrences (%) Freudenberg et al. 2006 Mosquito net (nylon) Ultrapro® (polypropylene) 18 0/0 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 net (polyester) Löfgren et al. 2016 Mosquito net (polyester) 106 7 (6.6)/0 mosquito net (polyester) 143 44 (30.8)/1 (0.7) 44 (29.7)/0 Table 1. Literature review comparing the rate of complications and recurrences the use of mosquito nets and commercial mesh in hernia repair ^{1-7,} . Total inserted Complications (%) Recurrence (%) Recurrence (%) Mosquito net used mash, with just one recurrence, and a lower complication rate that the mesh. Total inserted Complications (%) Recurrence (%) Recurrence (%) Table 2. Collated data from Table 1. Total inserted Complications (%) 26.5 Recurrence (%) * Table 3. and 2 show that mosquito nets are effective replacements is underiable. Total inserted infections, butch loser ch that set infections. Sterili The major obstacle to the use of sterilise them, as effective sterilisation torperature in the UK, but this structure. There is evidence that steri prevent wound sepsis while mais structure in the is vidence that steri infections. * Total inserted Complication steri alable 2. Collated data from Table 1. Th

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/ 5 /	Löfgren <i>et al.</i> 2016 Mosquito net (polyethylene) Polypropylene		143 148	44 (30.8)/1 (0.7) 44 (29.7)/0	the in-vitro effects of using a polypropylene mesh. polyethylene mosquito net and commercial polypropylene mesh histologically in rats, and found that while the mesh induced a greater inflammatory response, indicating orientation in the	showed that the 'bursting force' of mosquito nets was far greater
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s) r	able 1. Literature review comparing the rate of complications and recurrences in ne use of mosquito nets and commercial mesh in hernia repair ⁴⁻⁷ .				alternative. Professor Sharma	is less important ⁹ . Data from other labs indicates polyester may be less efficacious, but
f		Total inserted	Complications (%	%) Recurrence (%)	suggests that this is a favourable indication of wound healing ⁸ .	polypropylene mesh is a suitable alternative ¹⁰ .
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