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INVITED COMMENTARY

Worldwide hernia repair: variations in the treatment of primary unilateral inguinal hernias in adults in the United Kingdom and in low- and middle-income countries

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Abstract

Introduction In this invited commentary, we aim to quantify and explain the variation between, and also within, developed healthcare systems (using the UK as an example) and low- to middle-income countries (LMICs). Rather than including complex cases, we have looked only at 'uncomplicated' primary unilateral inguinal hernias, an area where limited variation may be identified.

Methods Data were obtained from Hospital Episode Statistics and structured surveys in the United Kingdom and in low- and middle-income countries.

Conclusion There is widespread variation in the repair of 'uncomplicated' primary inguinal hernias worldwide and within developed healthcare systems.

Keywords Variations in Parctice · Hernia (inguinal) · Surgical technique

Introduction

Of the 20-plus million Inguinal Hernia (IH) repairs carried out annually, a competent general surgeon should be able to perform a simple, cost-effective, durable and low-complication operation [1]. In developed healthcare systems, during the last 30–40 years, there has been a shift from suture/tissue repairs to open and laparoscopic mesh repair, and more recently in advanced healthcare systems, an emerging era of robotics. Synthetic mesh repairs have become the norm and are now the preferred technique in high-resource settings. They have demonstrated superiority over most conventional non-mesh procedures, due to their lower recurrence rates [2–4]. More recently, concerns about mesh inguinodynia have stimulated debate over whether there should be a more prominent role for pure tissue repairs such as the Shouldice operation, which unlike many suture repair techniques, has excellent outcomes in a cohort study [5]. Furthermore, we have seen in some countries the emergence of specialist hernia centres, where tailored treatment may be offered [6].

Epidemiology on inguinal hernia is limited, from both the developed world and particularly from low- to middle-income countries (LMICs). Inguinal hernia incidence (measure of probability of inguinal hernia occurrence in a population within a specified time) is difficult to firmly establish although it seems unlikely that incidence varies much between countries. In contradiction, inguinal hernia prevalence (population proportion with inguinal hernia at a given time) appears to be significantly higher in countries with poor access to healthcare [7–9]. The assumption is that most cases go untreated in resource-poor settings. The discrepancy in incidence versus repair rate results in high prevalence. This in turn has a huge economic impact on countries least able to shoulder that burden [10]

A 1996 United Kingdom (UK) study found a lifetime risk of inguinal hernia repair of 27% for men and 3% for women, an immense inguinal hernia disease burden [1]. Data from

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sub-Saharan Africa paint a very different clinical picture. A 1978 study of rural Ghanaian men estimated that 7.7% had an inguinal hernia [11]. However, a 1969 study showed that the prevalence of inguinal hernia was as high as 30% on Pemba Island in East Africa [12]. A prospective cohort study compared inguinal hernias in Ghana and the UK, and revealed that two-thirds of Ghanaian hernias extended into the scrotum [13]. This was the case in only 7% of UK inguinal hernias. The majority of these were longstanding right-sided indirect hernias. Ghanaian subjects had an average age of 34 years versus 62 years in the UK cohort. Inguinal hernias, occurring in the young, have a major impact on fragile economies. In the Ghanaian study, 64% of subjects experienced daily activity limitations and 16.3% of these individuals were unable to work.

Despite such a high volume of disease and frequency of repair, there remains global disparity in the management of inguinal hernias.

In low-resource settings, where out-of-pocket expenditures are significant and families often cope by borrowing money or selling assets to pay for surgery, mesh is often either unavailable or unaffordable. Most inguinal hernias in these settings are still repaired with the Bassini method (and many modifications) because of the high cost of mesh and the lack of training in mesh repair or pure tissue repair with the Shouldice operation [14, 15].

In this invited commentary, we aim to quantify and explain the variation between, and also within, developed healthcare systems (using the UK as an example) and LMICs. Rather than including complex cases, we have looked only at 'uncomplicated' primary unilateral inguinal hernias, an area where limited variation may be identified.

Methods

This is not a comprehensive or an evidence-based study; however, to highlight variation, we explored practice in the United Kingdom using data from Hospital Episode Statistics and also a questionnaire to the Board of the British Hernia Society. Similarly, for rural areas of LMICs, a questionnaire was sent to 100 specialist hernia surgeons, who have worked in 37 low-income countries as volunteer members of 'Hernia International'.

United Kingdom data (England and Wales only)

Hospital episode statistics (HES) is a database of all hospital admissions, clinic appointments and Emergency Department attendances at NHS hospitals in England. These data were searched using the online database Surgical Workforce Outcome Audit Database (SWORD), which is run by the Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland (AUGIS) and the Association of Laparoscopic Surgeons of Great Britain and Ireland (ALS).

Data were extracted for the financial year 2017/2018 and was limited to:

- total number of surgeries for primary inguinal hernias,
- number of tissue repairs, synthetic mesh or natural mesh repairs,
- number of laparoscopic and open repairs.

In addition, a short survey was sent to the eight consultant members of the Board of the British Hernia Society (BHS). The aim was to determine the preferred practice of expert hernia surgeons. See Table 1.

Table 1 Questionnaire sent to BHS board members

1. What technique do you use for the majority (51+ %) of primary, unilateral, uncomplicated, inguinal hernia repairs?
2. In what percentage of patients do you operate under local anaesthesia?
3. Do you ever perform a pure tissue repair?

Table 2 Questionnaire sent to volunteer members of Hernia International

(Name of the low-income country)
1. Presence of a resident surgeon in the District Hospital (Y/N)
2. Technique used for repair by local surgeons (suture/mesh)
3. Availability of general anaesthesia (Y/N)
4. Availability of nurse anaesthetist (Y/N)
5. Technique used in city/university hospital (mesh/suture)—if known

LMICs

A questionnaire was sent to 100 specialist hernia surgeons who had worked as volunteer members of 'Hernia International'. In total, these consultants have worked in 37 low and middle-income countries (LMICs) worldwide. Questions (see Table 2) were related to the practice of resident (if applicable) surgeons in rural district hospitals in LMICs, in the absence of overseas surgeons.

Results

HES data

In the year 2017/2018, a total of 59,755 primary inguinal hernia repairs were carried out. Synthetic mesh repairs account for 97.6% and suture repairs for only 1.3%. Laparoscopic or endoscopic approaches were used in 23% of repairs, see Table 3.

Table 3 HES data from England and Wales 2017/2018 for primary unilateral inguinal hernia

	n	%
Suture repairs	777	1.30
Synthetic mesh repairs	58,333	97.6
Natural mesh repairs	132	0.2
Other	513	0.8
Open repairs	46,115	77.2
Laparoscopic repairs	13,640	12.8

British Hernia Society Board Survey

Responses were obtained from all eight BHS Board members. One of these responses is excluded because the respondent does not perform any inguinal hernia repairs.

Preferred technique varies between surgeons (Table 4): 37.5% favour the endoscopic totally extraperitoneal (TEP) repair. The majority (5/7) use local anaesthetic only rarely; however, the range is large with one surgeon using local anaesthetic techniques for > 40% of inguinal hernia repairs.

LMICs

One hundred surgeons were surveyed with a 72% response rate. Overall, experience from 37 LIMCs is recorded and results have been interpreted in their nine different regions.

Local resident surgeons in rural district hospitals were rare in all the LMICs surveyed (range 5–50%). This was least frequent in African regions with a range of 5–15% and more frequent in South America and Central Asia (25–50%). Results are shown in Table 5.

Mesh is being used for 0–50% of inguinal hernia repairs, with lowest usage in Africa and the highest in South America. Results are shown in Table 6. In all regions, usage of mesh was higher in the city or university hospital. Laparoscopic techniques are also being used in India, Asia and South America.

Ketamine is available for general anaesthesia in 90% of hospitals in all regions. Gaseous anaesthetic availability is more varied, with a range of 5–50%, and results are shown in Table 7.

Nurse anaesthetists are most common in African Regions, with 25–50% of hospitals using them. In contrast, this is relatively uncommon in India and Asia (0–5%).

Table 4 Survey results of BHS Board members

	N	%
Preferred technique (51% plus of cases)		
Laparoscopic TEP	3	37.5
Laparoscopic TAPP	1	12.5
Open flat mesh (Lichtenstein)	2	25.0
Plug and patch	1	25.0
% of cases performed under LA		
< 5	3	37.5
5–20	2	25.0
20–40	1	12.5
> 40	1	12.5
Do you perform suture tissue repairs		
Yes	1	25.0
Rarely	2	12.5
No	3	37.5

TEP totally extraperitoneal, *TAPP* trans-abdominal pre-peritoneal, *LA* local anaesthesia

Discussion

Our surveys have provided a snapshot of clinical practice in the UK and in rural areas of some LMICs. It demonstrates wide variation in the management of simple unilateral inguinal hernias. Whilst a wide variation might have been expected between LMICs and developed health care systems such as the UK, the variation within each setting is perhaps surprising.

In LMICs, the majority of inguinal hernia repairs are performed using suture repairs under local anaesthetic. In the UK, the vast majority of inguinal hernia repairs utilise mesh. In fact, only 1.3% are performed as a pure tissue repair. Looking at Hospital Episode Statistics data, 77.2% of operations are performed open and 12.8% are performed laparoscopically. Interestingly, the survey of the Board of the British Hernia Society showed wide variation in preferred technique. This variation included the use of open flat mesh, plug and patch, laparoscopic TEP and TAPP. This variation is probably reflects practice in many developed healthcare systems. Swedish data for 2017 report that only 0.8% of all inguinal hernia repairs are tissue repairs without mesh and a total of 33% of inguinal hernia repairs are performed

Table 5 Local resident surgeon presence in district hospital by region

West Africa	5–10%
East Africa	10–25%
Middle and Southern Africa	5–15%
Indian subcontinent	10–30%
Southeast Asia	5–30%
Central Asia	25–50%
South America	25–50%
Central America	10–30%
Caribbean	15–25%

Table 6 Mesh repair usage

	Mesh repair (%)	Technique in city/university hospital
West Africa	0–5	Mesh 5–25%
East Africa	0–5	Mesh 10–50%
Middle and Southern Africa	0–5	5–20% mesh
Indian subcontinent	10–30	Mesh 75–100%, some laparoscopic
Southeast Asia	10–30	Mesh 25–50%, some lap
Central Asia	5–25	Mesh 25–50%, some lap
South America	25–50	Mesh 50–75%, some lap
Central America	10–25	Mesh 25–50%
Caribbean	10–25	Mesh 25–50%

Table 7 Anaesthetic practice

	Gaseous anaesthetic available (%)	Nurse anaesthetist available (%)
West Africa	5–10	25–50
East Africa	10–20	25–50
Middle and Southern Africa	5–10	25–50
Indian subcontinent	10–50	0–5
Southeast Asia	5–30	0–5
Central Asia	25–50	0–5
South America	25–50	5–25
Central America	15–25	5–25
Caribbean	15–25	10–25

laparoscopically (28% TEP and 5% TAPP). The Danish National Database from 2016 states that more than 95% of inguinal hernia repairs utilised mesh. Laparo-endoscopic surgery use varies from 0 to a maximum of approximately 55% in some high-resource countries. The average use in high-resource countries is largely unknown except for some examples such as Australia (55%) [16], Switzerland (40%) [17], the Netherlands (45%) and Sweden (28%) [18]. Sweden has a national registry with complete coverage. Interesting are the following percentages for the year 2015: Lichtenstein 64%, TEP 25%, TAPP 3%, open pre-peritoneal mesh 3.3%, combined open and pre-peritoneal 2.7%, and tissue repair in 0.8%. The German Herniamed registry which contains data on about 200,000 patients (not complete national coverage, so possibly biased) and contains interesting information confirming that a wide variety of techniques are in use. The percentages over the period 2009–2016 were: TAPP 39%, TEP 25%, Lichtenstein 24%, Plug 3%, Shouldice 2.6%, Gilbert PHS 2.5% and Bassini 0.2%.

Why do we observe such widespread variation? Selecting the optimal technique for inguinal hernia repair is challenging, and influencing factors are both operator and patient specific. The ideal technique should be low risk, and relatively easy to learn. Causes for variation are multifactorial, and training in laparoscopic and endoscopic techniques is time consuming and relies upon availability. Case load needs to be sufficient to maintain competence, so surgeons carrying out smaller volumes may not access such training. In addition, resources for training and equipment are varied, and pressure towards efficiency savings may prohibit the use of laparoscopic techniques.

The fact that so many different repairs are now done strongly suggests that a "best repair method" does not exist. Additionally, large variations in treatments result from cultural differences amongst surgeons, different reimbursement systems and differences in resources and logistical capabilities. Surgeons searching for "best" treatment strategies are challenged by a vast diverse scientific literature, much of which is difficult to interpret and apply to one's local practice environment.

In LMICs, many inguinal hernias are repaired with open suture repair. Despite good evidence that mesh repairs give lower recurrence rates, LMICs continue to perform significantly more suture repairs [7, 19]. It is notable that surgical interventions have not been prioritised by health budgets. This means that funding is limited. In addition to this general lack of resource, the cost of any mesh used is covered by the patient in most LMICs. Therefore, the decision for mesh or suture repair rests with the patient and decisions are influenced by low incomes and hernia-related difficulty in working. It is notable that in larger city or university hospitals in LMICs, mesh is more frequently used, even when costs are borne by the patient. This may reflect higher incomes in these areas as well as a more evidence-based approach to surgical choice. In some of the higher income areas, laparoscopic techniques are also being used, although not as the inguinal hernia repair technique of choice.

In the UK, most inguinal hernia repairs are performed under general anaesthesia with a minority surgeons operating under local anaesthesia. Use of Ketamine for general anaesthesia is not used in the UK. In contrast, Ketamine is extremely popular in LMICs, with all regions included in the study reporting its availability at 90%. It is probable that economics play a part in this decision. Ketamine is low

cost and easily available. It does not necessitate a consultant anaesthetist to be present, allowing the use of nurse anaesthetists, who are more readily available.

Conclusions

There is widespread variation in the repair of 'uncomplicated' primary inguinal hernias worldwide and within developed healthcare systems. In LMICs, suture repair is much more prevalent in rural communities and most operations are performed under local anaesthesia. Conversely in developed healthcare systems, there is predominance of mesh repairs under general anaesthesia but there is significant variation in the technique used. We need to strive towards more robust outcome reporting to help identify the optimal techniques and to guide our own practice. As Kirk stated more than 35 years ago, "It is not a particular method of Inguinal Hernia repair that brings success, but the enthusiasm for perfection and the painstaking skill with which is it accomplished" [20]. The technique used is only one factor that affects the overall outcome.

Compliance with ethical standards

Conflict of interest The authors declare no conflict of interest.

Ethical approval The study has been performed in accordance with the ethical standards of the Declaration of Helsinki.

Human and animal rights This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent For this study, formal consent was not required.

References

1. Kingsnorth A, LeBlanc K (2003) Hernias: inguinal and incisional. Lancet 362(9395):1561–1571
2. Bay-Nielsen M et al (2001) Quality assessment of 26,304 herniorrhaphies in Denmark: a prospective nationwide study. Lancet 358(9288):1124–1128
3. HerniaSurge G (2018) International guidelines for groin hernia management. Hernia 22(1):1–165
4. Bisgaard T, Bay-Nielsen M, Kehlet H (2008) Re-recurrence after operation for recurrent inguinal hernia. A nationwide 8-year follow-up study on the role of type of repair. Ann Surg 247(4):707–711
5. Shouldice EB (2003) The Shouldice repair for groin hernias. Surg Clin N Am 83(5):1163–1187 **(vii)**
6. Kockerling F, Berger D, Jost JO (2014) What is a certified hernia center? The example of the german hernia society and german society of general and visceral surgery. Front Surg 1:26
7. Primatesta P, Goldacre MJ (1996) Inguinal hernia repair: incidence of elective and emergency surgery, readmission and mortality. Int J Epidemiol 25(4):835–839
8. Laxminarayan R et al (2006) Advancement of global health: key messages from the disease control priorities project. Lancet 367(9517):1193–1208
9. Nordberg EM (1984) Incidence and estimated need of caesarean section, inguinal hernia repair, and operation for strangulated hernia in rural Africa. Br Med J (Clin Res Ed) 289(6437):92–93
10. Fente B, Ukoima H (2013) Incarcerated external anterior abdominal wall hernias. A 5 years experience in Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State of Nigeria. Afr J Med Surg 1(1):001–005
11. Gul M et al (2012) Factors affecting morbidity and mortality in patients who underwent emergency operation for incarcerated abdominal wall hernia. Int Surg 97(4):305–309
12. Yordanov YS, Stoyanov SK (1969) The incidence of hernia on the island of Pemba. East Afr Med J 46(12):687–691
13. Sanders DL et al (2008) A prospective cohort study comparing the African and European hernia. Hernia 12(5):527–529
14. Ohene-Yeboah M, Abantanga FA (2011) Inguinal hernia disease in Africa: a common but neglected surgical condition. West Afr J Med 30(2):77–83
15. Leive A, Xu K (2008) Coping with out-of-pocket health payments: empirical evidence from 15 African countries. Bull World Health Organ 86(11):849–856
16. Tran H et al (2015) Single-incision laparoscopic inguinal herniorraphy with telescopic extraperitoneal dissection: technical aspects and potential benefits. Hernia 19(3):407–416
17. Tschuor C et al (2015) Inguinal hernia repair in Switzerland. Hernia 19(5):741–745
18. Swedish Hernia Registry (2016) https://www.svensktbrackregister.se/images/stories/doc/verksamhetsberattelser/rapport16_170508.pdf.
19. Rutkow IM (2003) Demographic and socioeconomic aspects of hernia repair in the United States in 2003. Surg Clin N Am 83(5):1045–1051 **(v–vi)**
20. Kirk RM (1983) Which inguinal hernia repair? Br Med J (Clin Res Ed) 287(6384):4–5